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Risk Perceptions of Adults in the Town of Unicoi, Tennessee, Regarding the Possible Building of a Uranium Enrichment Plant.

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ABSTRACT

Risk Perceptions of Adults in the Town of Unicoi, Tennessee,
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A prolonged siting controversy for a uranium enrichment facility has occurred in the Town of Unicoi, Tennessee. One hundred-seventy residents of Unicoi were interviewed using a questionnaire regarding the building of a proposed uranium enrichment facility for Unicoi. The questionnaire sought to determine relationships between residents' risk perceptions and 18 variables. When the Fisher's exact procedure was applied at $\alpha < 0.05$, the results indicated several associations. Odds ratio measured the strength of association. Results are reported as crude measures of association. Risk perceptions were influenced by the choice of possible locations for the facility [p=0.0003; OR=32.6]. Residents' risk perceptions were associated with a history of working with nuclear materials [p=0.0476; OR=3.2]. Finally, risk perceptions were associated with residents' beliefs that the nuclear facility would affect their health [p=0.0001; OR=18.8]. These results are discussed in light of risk perception and communication theories.

DEDICATION

I dedicate this thesis to J. Kevin and Nanette M. Sellards. My parents contributed their time, talent, and support through my education and career endeavors.

ACKNOWLEDGMENTS

I thank God for giving me the strength to persevere in completing this thesis. I thank my father, J. Kevin Sellards (died May 2, 2003), for his love. I appreciate my mother, Nanette Sellards, for her kindness.

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INTRODUCTION

Background

Uranium occurs naturally as a ubiquitous metal in the United States (Appendix A). The Atomic Energy Commission, succeeded by the Department of Energy (DOE), constructed three uranium enrichment plants: K-25 at the Oak Ridge Reservation in Tennessee, during World War II; and plants at Piketon, Ohio and Paducah, Kentucky in the 1950s. Subsequently, the Oak Ridge uranium enrichment plant was permanently shut down in 1987, and Piketon stopped enriching uranium commercially in 2001. By 2003, the last remaining uranium enrichment plant was in Paducah. It uses the gaseous diffusion enrichment process (Yggdrasil 2003).

Uranium Enrichment Technology

In the beginning of the nuclear fuel cycle (Figure 1), natural uranium is mined and milled to produce "yellow cake" (uranium oxide powder) that is then converted into uranium hexaflouride (UF_6). The converted uranium is modified into useable forms of uranium isotopes, such as U-235.

Nuclear Fuel Cycle

1. Ore Deposit
⇓
2. Conversion or Processing
⇓
3. Enrichment or Refining
⇓
4. Fuel Fabrication
⇓
5. Research / Power Reactor/ Health and Medicine/Electricity/Food and Agriculture
⇓
6. Waste Disposal
⇓
7. Waste Storage

Figure 1 Nuclear fuel cycle (U.S. Nuclear Regulatory Commission 2003)

U-235 undergoes fission to produce nuclear energy. The fuel for nuclear reactors must have a higher concentration of U-235 than exists in the natural uranium ore which contains 99% U-238 and 0.7% U-235 by weight (U.S. Nuclear Regulatory Commission 2003). So, natural uranium must be enriched to increase the concentration of the U-235 isotope to between 3 % and 5%. At that level, it can be used to operate light water nuclear power plants. Nuclear weapons are fabricated with the enriched uranium containing more than 90% of U-235 isotope (U.S. Nuclear Regulatory Commission 2003).

Two types of uranium enrichment processes are used to increase the concentration of the U-235 isotope: gaseous diffusion has been used for 50 years in the U.S., and gaseous centrifugation has been used for 30 years in Europe (Figure 2). During the gaseous diffusion enrichment process, the UF_6 is filtered through molecular effusion, or the flow of gas through small holes (U.S. Nuclear Regulatory Commission 2003). In this process, the walls of a vessel are semi-permeable, which allows the lighter U-235 to pass through the small openings in the vessel walls while restricting the heavier U-238.

In contrast, the second type of uranium enrichment process or gaseous centrifugation separates UF_6 in large, fast-rotating cylinders. The heavier U-238 is separated through centrifugal force from the lighter U-235 (U.S. Nuclear Regulatory Commission 2003).

Uranium Enrichment Process

1. (UF_6) Autoclave in transport container
⇓
2. Pressure reduction
⇓
3. Diffusion or centrifuge enrichment
⇓
4. Enriched or depleted (UF_6)
⇓
5. Compressed (U-235)
⇓
6. Cooled (U-235) ready for transport

Figure 2 Uranium enrichment process (U.S. Nuclear Regulatory Commission 2003)

Uranium Enrichment Hazards

Uranium is converted into “yellowcake” (uranium oxide) powder, which can be easily

inhaled. In addition, this conversion process involves chemicals that are toxic, corrosive, flammable, and explosive. The two main hazards in gaseous diffusion plants are the potential for the UF_6 to be released during the enrichment process and potential mishandling of enriched uranium, which can result in a criticality accident (U.S. Nuclear Regulatory Commission 2003).

Both uranium enrichment processes entail human health and safety concerns. Uranium, embedded in the earth's crust, is a hazard when milled, mined, or fabricated. Due to the presence of radium-226 in uranium ores, radon gas is released. Radon is a radiological hazard because it emits alpha particles which have minimal penetrating power. When people inhale radon, their chance of developing lung cancer is increased (U.S. EPA Website 2004).

The half-life of uranium is the amount of time it takes for half of the atoms to decay. The half-life distinguishes one radioactive substance from another and can be used to measure the level of radioactivity. Uranium's half-life is 4.5 billion years (Figure 3). Radon's is only 3.8 days. As described above, both substances pose a health threat to the public (Devine et al. 2000).

Uranium Decay for U-238

Element	Half-Life	Element	Half-Life
1. Uranium (U238)	4.5 billion years	9. Lead (214)	27 minutes
⇓		⇓	
2. Thorium (234)	24.1days	10. Bismuth (214)	20 minutes
⇓		⇓	
3. Protactinium (234)	1 minute	11.Polonium (214)	180 microsecs
⇓		⇓	
4. Uranium (234)	245,000 years	12. Lead (210)	22 years
⇓		⇓	
5. Thorium (230)	76000 years	13. Bismuth (210)	5 days
⇓		⇓	
6. Radium (226)	1800 years	14. Polonium (210)	138 days
⇓		⇓	
7. Radon (222)	3.8 days	15. Lead (206) stable	
⇓			
8. Polonium (218)	3 minutes		

Figure 3 Uranium decay for U-238 (Devine et al. 2000)

Radiological Exposure

Other health threats have been studied at various locations where releases of radioactive materials occurred through a criticality (when a nuclear chain reaction occurs unintentionally) or some other kind of accident. Among locations studied for the release of radioactive material or other harmful chemicals were the Feed Materials Production Center located in Fernald, Ohio; the Paducah, Kentucky gaseous diffusion plant; a Japanese fuels plant in Tokai-mura; the Three Mile Island accident of 1979; and the Chernobyl accident in 1986.

The Feed Materials Production Center has been studied by the Centers for Disease Control to evaluate the health impacts of the release of radionuclides into the environment from 1951 until 1988. The purposes of the Feed Materials Production Center included: "converting uranium feed materials such as uranium concentrates, uranium compounds recycled from other stages of nuclear weapons productions and some uranium ores to uranium metal ingots for machining" (Meyer et al. 1996). The Fernald Dosimetry Reconstruction Project was undertaken to assess the human health risks of exposure to radioactive materials.

The project has assessed the health risks of human exposure to uranium, thorium, radium, and other radionuclides. The largest releases were atmospheric, with small amounts released to surface water. Furthermore, inhalation was the most important exposure pathway, and radon decay products contributed most of the radiation dose (Reed et al. 2003). The community that lived closest to the facility was exposed to radon released from K-65 silos which placed them at an increased risk of developing cancer. Exposure to other substances such as neptunium, plutonium, and uranium accounted for the remaining contribution to cancer risk (Reed et al. 2003).

At the Paducah, Kentucky Gaseous Diffusion Plant workers were sometimes deliberately deceived regarding exposure to neptunium, plutonium, and uranium. A Congressional hearing was held on September 22, 1999 where the committee reviewed the Department of Energy's oversight and mismanagement of this facility for over 40 years. Workers at the facility were not made aware of the possible dangers of working with certain hazardous materials. In addition, the Paducah facility has been named a Superfund site because of contaminants found in the groundwater and soil (DeGarady

and Halbrook 2003). Trichloroethylene (TCE), persistent organic pollutants, polychlorinated biphenyls (PCB's), and other organic contaminants were discovered at the Paducah site (Holton 1999).

On September 30, 1999, a criticality accident occurred at a Japanese fuels plant in Tokai-mura, located 100-km northeast of Tokyo. The company responsible for this accident, named JCO Co., converts enriched uranium oxide into fuel assemblies used in nuclear power plants. A large amount of enriched uranyl nitrate solution was being loaded into a tank. A chain reaction occurred, which lasted 20 hours. Two workers died as a result of this accident. An additional 667 workers and 56 off-site people were exposed to radiation (Endo and Yamaguchi 2003). Criminal charges were brought against the company as a result of this accident.

Another nuclear accident resulted in a partial meltdown of the Three Mile Island Unit 2 (TMI-2). This accident caused no immediate fatalities, but 200,000 people were ordered to be evacuated 100 miles away from the source of the accident. The partial meltdown resulted in damage to the reactor core with small offsite releases of radioactivity (U.S. Nuclear Regulatory Commission 2003). The massive negative public attention caused a shutdown of nuclear plants worldwide, contributed to the cessation of nuclear plant construction in the U.S. in the 1970s, and eroded public confidence in nuclear industry (Yim and Vaganov 2003).

The Chernobyl accident in 1986 further eroded public confidence in nuclear energy. The main health effects of Chernobyl were acute radiation deaths in "liquidators" while extinguishing a major fire in the reactor core and a sharp increase of thyroid cancer in children. The 600,000 "liquidators" were farmers, factory workers, miners, soldiers, or professionals who were conscripted to cleanup the accident (Havennar et al. 2003). By far, the Chernobyl accident created the most public health concern over nuclear energy (Havennar et al. 2003).

Nuclear accidents are only one source of public concern for human health. Prolonged public radiation exposure has raised concern for radiological protection in specific situations. These situations include natural radiation sources such as radon, fallout after nuclear accidents and testing, and the global marketing of products containing radioactive substances (U.S. Nuclear Regulatory Commission 2003). It is important that the public

knows more about acceptable radiation doses to decrease the perception of possible threats to human health.

The exposure allotment that any regulatory organization deems acceptable is based on various factors such as the particular radionuclide involved, its chemical form, exposure pathways, duration of exposure, type of energy, radiation emitted, and bioavailability. Since the start of nuclear power in the 1950s, the allowable level of radiation exposure has changed because of improved technology, refined epidemiologic studies, and the ability to detect smaller doses of toxic and radioactive substances in the environment and human tissues (Rucker et al. 2001). Furthermore, increased awareness of the negative health and safety risks associated with radiation exposure from nuclear accidents has resulted in negative public perceptions.

Present Unicoi Study

The proposed building of a gaseous centrifugation uranium enrichment plant in Unicoi, Tennessee provided an opportunity to measure risk perceptions of residents who lived in Unicoi. The community was not initially involved in the site selection decision-making process for the nuclear facility. As a result, the present study was designed to evaluate Unicoi residents' risk perceptions about a possible nuclear enrichment plant.

Objective

The objective of this study was to determine if adult residents' risk perceptions about a uranium enrichment plant being considered for the town of Unicoi were affected by their demographic characteristics, prior experiences, and backgrounds.

Two hypotheses were tested:

1. Unicoi residents favored a possible uranium enrichment plant because of birth place, type of work, level of education, and having children.
2. Unicoi residents are more likely to support the uranium enrichment plant when they have certain prior experiences and backgrounds with respect to the media, scientific knowledge, economic values, and health concerns.

An exploratory analysis was performed to determine whether crude associations existed among the variables of interest:

- place of birth and time lived in Unicoi
- type of work; worked or family worked with nuclear materials
- parents who had children (below the age of 18)
- level of education
- initial source of information about the proposed plant
- sought to obtain more information about uranium enrichment
- actual knowledge about uranium enrichment process
- risk perception assuming that health might change
- risk perception assuming that personal wealth and community wealth might change
- risk perception based on factual statements versus personal feelings
- risk perception in 2002 compared to 2003
- risk perception if the plant were built in a town such as Bluff City, Tennessee
- risk perception of residents who engaged in an activity involving risk

A sizable body of published literature on risk perception was available to inform the development of a survey instrument to study the relationships among these variables. This literature is reviewed in Chapter 2.

CHAPTER 2
LITERATURE REVIEW

Values, Attitudes, and Behavior

The World Book Dictionary explains values in sociological terms as the "established ideals of life; objects, customs, ways of acting and the like, that the members of a given society regard as desirable." Value judgments, on the other hand, assess to what extent a person, place, or thing possesses good or bad attributes. Some scientists disagree with the definition of value because of its abstract and subjective nature (Maio and Olson 1995).

Sometimes the way a scientist defines value is by identifying what it is not. Karl Popper asserted that science is never proven but only refuted or confirmed through experiments (Zalta 1999). Experiments and trials can refute "scientific" statements. Beliefs and values are those statements that cannot be refuted through experimentation (Zalta 1999).

Attitudes, not values, are more likely to be altered because attitudes are dependent on three interactive transitory variables and have four psychological functions. The three interactive components include the affective component or feelings, the cognitive component or knowledge held by the person, and a behavioral component or the intention to act (Olson and Zanna 1993). If one of these components changes then it is possible for the associated attitude to change.

Attitudes are classified into four common types of psychological functions in a person's life: utilitarian, ego-defensive, value-expressive, and knowledge functions (Maio and Olson 1995). The utilitarian function pertains to maximizing rewards and minimizing punishments obtained from the environment. The ego-defensive function is found in attitudes that protect the ego from unacceptable impulses that cause fear. The knowledge function is found in attitudes that give meaning to the self and its relation to the environment. Finally, the value-expressive function exists in attitudes that are used to express central values (Maio and Olson 1995). Social scientists have tried to predict behavior through measuring these attitudes and various others.

Stronger intentions and greater perceived control over a behavior are associated with a greater likelihood that a behavior will be performed. Intentions to perform a behavior

are best predicted by attitudes toward behavior, subjective norms (peer pressure), and perceived control over the behavior. However, predicting behavior intentions may be independent of values because sometimes values reflect a sense of moral obligation rather than intentions (Olson and Zanna 1993).

Public Risk Perceptions

Perception is the selection and organization of external stimuli to provide meaningful experiences when people use some or all of their senses (Zalta 1999). Perception or selective processing of internal and external factors will eventually lead to a response. The response may occur as actions or feelings by experts or the public. For example, there is often conflict between expert and public views about the risks of exposure to environmental pollution (Tesh 1999).

For a scientist, social science may appear trivial. Even though social science is abstract and often misunderstood, real world decisions do not exclude public risk perceptions. People with opposing views participate in environmental policy making (Tesh 1999). As long as people are involved in making decisions, facts, values, and blind spots should be recognized because people are affected by and affect their environment (Freudenburg and Alario 1999).

Certain institutions have the potential for recreancy, defined as the failure of institutions to enthusiastically carry out their responsibilities. This lack of enthusiasm leads the public away from trusting the institution, even though the public is a part of the institution (Freudenberg 1993).

Another situation that can lead the public away from trusting an institution is through the “asymmetry principle.” The "asymmetry principle" describes situations in which an institution tries to build its credibility and trust with the public for years and with one mistake, trust is lost (Freudenberg 1996). This lack of trust may interfere with risk communication leading to oppositional relations between scientists and the public.

Freudenburg and Alario claim that social science is valuable to ensure good public relations especially during the decision making process. More importantly, however, this article emphasizes that scientific credibility plays an important role when technical scientists communicate risk to the public (Freudenburg and Alario 1999).

Scientists do not always filter out their opinions on science-related issues. Unfiltered opinions have led to the perception that science has been reduced in its credibility, but not its prestige (Shrader-Frechette 1996). As a result of the decrease in credibility of science an anti-science sentiment has emerged. Kristin Shrader-Frechette asserts that the public rejects scientific presentations because the information is biased. For example, the National Academy of Science reported scientists' judgments about environmental estimates of health risks as factual information rather than opinions.

Most studies conducted by risk managers have primarily focused on the characteristics of the perceivers and not on the institutions that manage risk (Freudenburg and Alario 1999). Risk managers would be wise to target institutions rather than individuals when analyzing risk perceptions (Freudenberg 1993). In certain instances, the public expresses its opinion about risks within organized groups. Individuals may reject a proposed nuclear facility because the organization the person belongs to opposes a proposed nuclear facility (Freudenburg and Alario 1999). These groups insist that experts present information about certain risks, even though experts and the public have opposing views. Experts are asked to present scientific information because the most prestigious form of knowledge in American culture is scientific information rather than opinions (Tesh 1999).

Various groups of people, especially experts and the public, have opposing views about dangers associated with exposure to environmental hazards. Paul Slovic concludes that expert and public risk perceptions differ because of differences of rationality in making decisions. Early studies of risk perception suggested that public concerns were because of ignorance. However, it is now understood that reactions to risk can be attributed to sensitivity to technical, social, and psychological qualities of hazards (Slovic 1997).

Public reactions to a technology viewed as risky, such as uranium enrichment, can be classified as either based upon a technical/rational approach or a normative/value approach. The technical/rational approach focuses on technically informed rational decision making. Those who use the technical approach form their opinion on objective, factual knowledge rather than qualitative components of risk. Members of the public

who use the value approach make their decision about risk based on feelings, values, or attitudes (Bord and O'Conner 1990).

Public Risk Perceptions of Nuclear Technology

The community level impacts of development, namely construction and expansion, have been understood through sociological studies. The social impacts of technology take place before and after the physical activities of construction, production, and expansion. The impacts can be opportunities or threats to the physical, economic, social, cultural, and psychological human systems (Freudenburg and Gramling 1992).

Another impact on public acceptance of nuclear technology is economic gain. In some locations, the public has accepted nuclear technology when benefits such as tax incentives, scholarships, or improvements to safety are offered, even when it was against certain public values, such as health. When the health risk is high (associated with cancer or death), then the technology is unacceptable to people who are financially secure. Those who are financially insecure, or who work frequently with nuclear materials, may be more likely to accept the health risks associated with nuclear technology which is directly counter to their value system (Rogers 1998). If these groups of financially insecure people do not have their basic needs met then they may overlook nuclear health risks for financial gain. This decision to pursue financial gain can be explained through Abraham Maslow's "Hierarchy of Needs (Figure 4)."

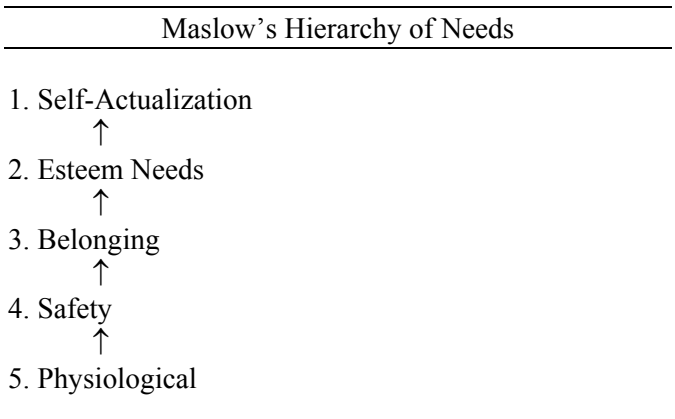

Figure 4 Maslow's hierarchy of needs (Boeree 1998)

According to the "Hierarchy of Needs" (Figure 4) the desire to satisfy human needs affects individuals' behavior. Maslow also emphasizes in the pyramid that a person can only pursue meeting needs of a higher level in the hierarchy when the level below is satisfied. At the bottom of the pyramid are physiological needs such as oxygen and nourishment, followed by safety needs, belonging and love needs, the esteem needs, and finally, at the top, the self-actualization needs (Boeree 1998). People's motivation to satisfy these needs influences their perceptions especially when making important decisions. Conversely, when people are over confident that their need is satisfied then their decision may reflect this assuming attitude.

Public opinions, especially those of organized activist groups, have influenced government decisions about siting hazardous facilities through three processes. The three processes are the electoral process (voting), the agenda setting process (using the media to voice concerns), and the policy making process (lobbying, rallying, protests, and petitions) (Tesh 1999). Government and industry have encountered all these road blocks which may have led them to site hazardous waste facilities near low-income and minority communities because they represent "paths of least resistance" (Bullard and Johnson 2000).

Opponents to a particular nuclear facility may support nuclear energy in general, but "not in my backyard" (NIMBY) because of costs, depleted property values, and environmental contamination (Bassett et al. 1996; Rogers 1998). Public opinion about building nuclear facilities may eventually lead to a situation of "build absolutely nothing anywhere near anybody or anything (BANANA)."

Those who lived near a nuclear power plant were more favorable to nuclear energy than the general population because of two factors: familiarity with the nearby facility and contributions to the local economy. A poll conducted for the Nuclear Energy Institute in July 2003 indicated that of 64% of the U.S. population surveyed favored nuclear energy (Bisconti-Stouffer 2003). However, the gap between those who favor nuclear energy and those who oppose it is greater now than it was 20 years ago. Public support for building additional nuclear power plants has decreased from 66% in 2001 to 50% in 2003 (Bisconti-Stouffer 2003).

Attitude Formation Theories

Background characteristics, experiences, and many other external factors contribute to the formation of attitudes. Various attitude formations are explained through the stimulus response theory. This theory holds that the credibility of the communicator and the effectiveness of the message influence the attitude of the recipient even though the original values are from the individual (Olson and Zanna 1993).

In previous risk perception studies, knowledge of the subject did not change people's minds, but the message characteristics caused people to change their minds. Persuasive message characteristics of the presenter could be credentials, style of presentation, facial expressions, and speech components. In addition, the message characteristics such as repetition, attention grabbers, and visual information influenced the audience's attitudes (Olson and Zanna 1993).

Part of the reason that source characteristics rather than more knowledge altered the mind-set of the public may be due to their beliefs. Certain attitude formation explanations affirm that beliefs, prior knowledge, and family values affect attitudes (Olson and Zanna 1993). When people believe a person, place, or thing possesses favorable, rather than unfavorable characteristics, their attitude is positive unless they have prior knowledge or were shaped by their family's values (Olson and Zanna 1993).

Nuclear Risk and Attitude Functions

There are four types of people who may be opposed to a nuclear facility but for very different reasons. People might be against nuclear energy in principle, but they support it because they are having trouble paying their bills. This attitude is considered utilitarian, in that it helps the holder accommodate his or her immediate financial situation (Maio and Olson 1995). A second type of person might resist a nuclear facility because of health and safety reasons or fear of out-of-state companies operating in the person's community. For such an individual, this attitude serves an ego-defensive function (Maio and Olson 1995).

The opposition to a nuclear facility for a third and fourth type of person may be because of personal philosophy or experiences. For example, a third type of person might resist a nuclear facility because the person believes that governmental activities

should be severely restricted. This attitude has a value-expressive function in that it reflects an overall philosophy. A fourth individual might oppose a nuclear plant due to familiarity with nuclear materials. Knowledge or experience determines attitude, which is a reflection of what an individual has learned in the past (Maio and Olson 1995).

Knowledge of Nuclear Technology, Personal Feelings, and Values-Influenced Risk Perceptions

A person's perception of the risks of nuclear technology is a highly complex function of the person's values, exposure to information, and feelings. Social scientists have studied the factors that contribute to the public's perceptions of high health risks in nuclear power plants (Molak 1997; Sjoberg 2000). These factors include more potential accidents with serious consequences, more personal experiences with nuclear hazards, and more publicized legal situations involving nuclear power plants. Moreover, people have immediate access to the most recent, complex, and publicized information through television, radio, and the Internet. Sometimes, the public associates the word "nuclear" with the word "dangerous" because of pre-existing information about catastrophes from nuclear accidents.

In an empirical study, Maharik and Fischhoff (1993) found that when people know more about nuclear energy, they are more favorable toward nuclear energy and perceive it as less risky, except for those who strongly support environmental protection. The perception of a less risky situation would be familiar, controlled by self, and not memorable. In contrast, more risky situations are involuntary, unfamiliar, controlled by others, and memorable (Yim and Vanganov 2003). Regardless of the level of risk in a situation, more information does not usually change the public mind-set toward nuclear energy.

Olson and Zanna (1993) claimed that "once formed, attitudes resist change" unless underlying values change. Values could be one foundation upon which people form their opinions about nuclear fuels and may influence their decision to support or oppose nuclear energy. Subsequently, obtaining more information about nuclear fuels would have a minimal affect on the prevailing opinion unless "more information" had the effect of changing their values.

Effective Risk Communication

Ambiguities permeate risk communication that may influence the credibility and trustworthiness of the communicator. Contributors to the Health and Environment Digest define risk communication as the purposeful exchange of information about the existence, nature, form, severity, or acceptability of risk (Tinker 1995). In essence, risk communication is public or private communication that informs individuals about the existence, nature, form, severity, or acceptability of environmental risks.

When experts, businesses, or governmental agencies communicate scientific information, the public makes its decision to accept or reject the information based on trust of the presenter, source of information, and pre-existing experiences and values. Often, regulators and corporate officers who want to institute a new project with adverse consequences will only inform the public after they have gained support from community officials (Clarke and Freudenberg 1993).

One role of public health agencies is to effectively communicate health risk information to the public (Tinker 1995). The risk communication process can be described as a "tangled web" of sender and receiver interactions (Krimsky and Plough 1988). Unproductive communication occurs, despite the fact that the scientific experts are responsible to help the public understand the nuclear technology. To avoid these situations, risk managers should follow six criteria for effective risk communication (Table 1).

Not only is the message important in the acceptance of a health threat, but so is the relevancy of the threat toward the subject involved. When people who identify with a certain situation are presented a non-threatening message, they would more likely form their opinion based on cognitive rather than reactionary processing (Liberman and Chaiken 1992). For example, in New Jersey, a chemical corporation called Sybron Inc. involved the community in its decision-making processes. Because the community was involved in the decision-making then the community would approach the situation proactively rather than reactively. Involving the community in this process led to less resistance from the community when the company wanted to build new technology (Clarke and Freudenberg 1993).

Table 1 Six criteria for effective risk communication

1. Risk managers should inform the public of risk through public hearings, newspapers, television, and radio.
2. Risk managers should be honest and open with the public during all parts of the planning and development of siting a nuclear facility.
3. Risk managers should carefully plan conversations with the public by being prepared for questions.
4. Risk managers should listen to the public's concerns instead of reacting, which can cause mistrust of the public.
5. Risk managers should evaluate public responses so they can calmly prepare for all types of emotions.
6. Risk managers should collaborate with other credible sources whom the public trusts to add to risk managers' trust and credibility (Molak 1997).

In a risk controversy such as siting a nuclear plant, many unexpected and uncontrollable factors may arise. These factors include unexpected social outcomes, varied information sources, and contradictory messages. These factors may have contributed to public resistance, which has thwarted the expansion of nuclear power in the United States.

In the community setting of the present study, there was already a successful nuclear fuels plant in nearby Erwin, Tennessee. Urenco may have expected to find a similar workforce in or around the Town of Unicoi. Urenco may have considered the Town of Unicoi for the siting of the uranium plant because the workforce might have been more accepting of a nuclear facility.

Present Study

The present Unicoi study was conducted as a follow-up to the public resistance to the possible building of a uranium plant in Unicoi, Tennessee (Appendix B). The Town of Unicoi has a population of 3,519 (Table 2). Some demographic characteristics of the town in 2000 were:

- 51% male, 49% female:
- 78% adults, 22% children:
- 69.9% white collar workers, 30.1% blue collar workers:

- 58.8% high school graduates and 41.5% had some college

Table 2 Town of Unicoi population characteristics

Category	Sub Category	Unicoi Town (%)	Tennessee (%)	Present Survey
Gender	Male	51.0 %	48.7 %	N/A
	Female	49.0 %	51.3 %	N/A
Age	Over 18	78.0 %	75.4%	N/A
	Under 18	22.0 %	24.6 %	N/A
Race	White	98.0%	80.2 %	N/A
	Other	2.0 %	19.8%	N/A
Education	Some high school /degree	58.5%	75.9%	53.0%
	Some college/ degree	41.5%	19.6%	47.0%
Job	White Collar	69.9%	54.8%	31.0%
	Blue Collar	30.1%	45.2%	23.0%
	Other	N/A	N/A	46.0%
Residency	< 10 years	39.1%	46.1%	29.0%
	> 10 years	60.9%	53.9%	71.0%
Poverty	N/A	13.2%	13.5%	N/A
Median Household Income	N/A	$29,483	$36,360	N/A

*Information in columns 2 through 4 taken from the 2000 U.S. Census Bureau Website

CHAPTER 3
MATERIALS AND METHODS

Resident Demographic Characteristics

The total population of the Town of Unicoi, including adults and children, was 3,519 (U.S. Census Bureau Website 2003). Of this number 2,734 (78%) were adults (Table 3). Children under the age of 18 were not included in this study.

Table 3 Unicoi population data

Population	Formulas & Sources	N=total
Total population (adults and children under 18)	U.S. Census Data	N=3,519
Total population (with phones)	U.S. Census Data	N=3,364
Adult population	Equals total population minus children under 18	N=2,734
Sample population (adults with telephone according to U.S. Census)	Equals total population with telephone	N=2,624
Actual sample population (one adult with telephone according to U.S. Census)	Sample population (divided by 2)	N=1,312
Households with listed telephones	Counted from phone book	N=1,390
Households with no telephone	U.S. Census Data	N=62

In order to determine the adult population that could be contacted by telephone the number with phones (3,364) was multiplied by the percent of adult population, resulting in 2,624 adults. The sample population (2,624) was based on who had a telephone. Because only one adult per household was interviewed, the actual sample was 1,312 (Table 3). Of the 1,312, only 709 answered the phone. If there was no answer, then a number could be dialed a maximum of four times. Of the 1,312 sample, 603 phone numbers were no answers, disconnected, or unavailable.

In May 2003, 399 people were contacted at random in Unicoi until a sample of at

least 10% of the sample of 1,312 was achieved. Achieving 10% of the sample was intended to enhance statistical power. The number of no interviews was 229, or 57.4% of total interview responses. The actual number of people interviewed was 170 or 42.6% of total interview responses (Table 4).

Table 4 Unicoi residents contacted

Residents Contacted	N=population	Percent (%)
Actual sample population	N=1,312	100%
People answered phone	N=709	54.2%
People never answered (disconnected, unavailable, no response, etc.)	N=603	45.8%
Interviews	N=170	42.6 %
Declined to be interviewed	N=229	57.4 %
Total interview responses	N=399	100%

General Procedures

The study design was a cross sectional probability design using a telephone survey. The research design procedures were divided into three categories: sampling, data, and quality categories.

Statistical Test

The statistical methods used in the data analysis were Fisher's exact test and the odds ratio. Before the residents were interviewed on the phone, a pretest survey was conducted so that any problems could be addressed before the actual survey was used (Fink and Kosecoff 1998). Furthermore, individuals were tracked by assigning a random number and their names were discarded to protect their confidentiality.

Sampling Procedures

The appropriate respondent sample size was 170 adult residents of Unicoi, which included a 7% standard error. Simple random sampling was used to assign random numbers for the randomly selected phone numbers from the 2002 Erwin/Unicoi phone book. A few other telephone numbers came from the Unicoi voter registration list obtained from the Erwin courthouse. Every seventh phone number was chosen from the phone book and was assigned a random number so that the Unicoi resident's identity was protected.

Because the phone book had the word Unicoi beside each address, this indicated a Unicoi phone number and not Erwin, Tennessee. The phone book contains all listed telephone numbers with a description of whether the person lived in Unicoi, Erwin, or Flag Pond, Tennessee. Phone numbers without addresses were verified as a Unicoi resident by the reverse lookup on the U.S. Census Bureau Website. Of the 1,312 sample, 709 numbers were dialed until 170 respondents were obtained from the Town of Unicoi. The researcher asked the respondents if they lived in Unicoi. Four attempts were made for each telephone number.

A "pretest" phone survey with a list of 320 phone numbers was conducted to test the survey on 20 randomly selected residents from the Town of Unicoi (Royse 1999). The Institutional Review Board (IRB) of East Tennessee State University (ETSU) approved Form 103, the narrative, and the script for the final survey (Appendix C). Dr. Scott Beck from the ETSU Sociology Department reviewed the pretest and suggested several revisions, which were incorporated into the final instrument (Appendix D). The final survey was different from the pretest survey because of certain changes (Appendix E).

Changes to the pretest survey included shortening the script of the survey, changing certain questions, and reorganizing the questions. The survey was changed to improve clarity of the questions, decrease the amount of time required to answer the questions, and to provide an easier way to record the responses (Fowler 1995).

Data Procedures

Data collection began on May 12, 2003, and ended on May 27, 2003, which was one year after the announcement of the possible siting of the uranium enrichment plant in

Unicoi, Tennessee. Primary nominal data were taken from the survey responses. Secondary population data for the Town of Unicoi were taken from the 2000 U.S. Census Bureau Website. Other sources of data included newspaper articles from the Erwin Record, Johnson City Press, and newspaper articles archived on the Internet.

The data were recorded as numbers and percentages in Excel © (Microsoft Corp Redmond, WA) and analyzed in Minitab © (Microsoft Corp Redmond, WA). Each response from the survey was coded as 1, 2, 3, 4, or 5. The code for very positive was 1, positive was 2, neutral was 3, negative was 4, and very negative was 5. Data were reported in a codebook that contained a number for the group, location, name, and meaning of the code, and also included all the omitted and wrong answers.

For data to be tabulated in Minitab, survey answers must be expressed numerically. Categories were numerically coded and combined after the survey data were collected. For results to be significant 100 responses were required for each question. If fewer than 100 responses were obtained, then Minitab responded with an error message indicating that the results may be invalid, which led to using the Fisher's exact method to calculate p-values.

Quality Assurance Procedures

Consistency with the 2000 U.S. Census Bureau data and complete responses were the data quality objectives. The primary survey data taken from the interview questions were compared with the 2000 U.S. Census Bureau data for Town of Unicoi to check resident data characteristics. The survey variables of education level, age, residency, and type of work were compared to the 2000 U.S. Census data.

All data were entered into an Excel spreadsheet and copied into Minitab. Data were edited because certain questions did not have complete responses, due to refusals to respond. Thus, response categories were combined to obtain enough responses for statistically significant data.

The standard confidence level was 95%, which meant that if this study were conducted again then the researcher would be 95% certain to obtain similar results. It was important to check the data and obtain similar results so as to minimize sources of error introduced during data transcription and analysis.

The Institutional Review Board of ETSU performed the survey quality check. The collected data were verified through an initial data check by to determine if responses were complete, consistent, and entered correctly.

Limitations

Certain limitations may have influenced the results of the Unicoi study. The data were limited to nominal data, which means that only associations can be deduced and not causality (Table 5). Finally, all the information is collected at one point in time from one community, which means that the Town of Unicoi was not compared to another community with similar demographic characteristics. The Town of Unicoi neighbors the Town of Erwin, Tennessee, which already has a nuclear facility.

Table 5 Limitations of present Unicoi study

1. The time of the study was about one year later than the actual possible siting of the nuclear facility, so the perceived risk may have changed or not been as fresh.
2. The data collected were only nominal data at one point in time from one community.
3. The perceived risk of siting a uranium enrichment plant in Unicoi was hypothetical because the plant was never built (Appendix F).
4. Having a nuclear facility nearby may have prevented people from responding if they worked at the facility.
5. The type of media was emphasized in the pretest but taken out because the survey took too much time to fill out.
6. Media data would be considered secondary data compared to first hand data from the present Unicoi survey.
7. Uncertainty was present in respondents' participation because residents were reluctant to answer questions.
8. Using a telephone interview limits the interviewer in viewing facial expressions.
9. The number of non-responses is high with telephone interviews because of the screening of telephone calls (Table 4).

CHAPTER 4
RESULTS

The objectives for this study were to determine associations between risk perceptions and 18 variables (Table 6). Residents were asked survey questions about their knowledge of uranium enrichment, their population characteristics, and their perceptions of a possible uranium enrichment plant proposed for Unicoi. The association between variables and risk perception about possibly building the uranium enrichment plant in Unicoi, Tennessee was measured using Fisher's exact test which was considered significant when $p < 0.05$. Fisher's exact method is used to calculate the p-value for small population sample size. The odds ratio is a measure of the strength of the associations. Other cross tabulations between questions and answers were not included because they were not objectives of this research. All results are presented graphically in Figures 5 through 21, below. The underlying numerical values along with complete test statistics are contained in Tables 7 through 17 in Appendix G.

Table 6 Variables for research objectives

- Place of birth
- Time lived in Unicoi
- Level of education
- Type of work
- Worked or family worked with nuclear materials
- Parent who had children and children's age
- Source of information
- Sought to obtain more information
- Actual knowledge about uranium enrichment
- Facts versus feelings
- 2003 risk perceptions compared to 2003
- Possible uranium enrichment plant in Bluff City, TN
- Health, personal, or community wealth changed
- Involved in risky activity

The reason there were multiple odds ratios with a single p-value is that a survey question may have more than two choices for responses, especially the risk perception question (question #10). In essence, the risk perception question (three possible

responses) was measured for associations with all other questions. Then the three possible responses were compared to all the other questions (which usually had two possible responses), thus producing as many as five odds ratios values for the variable of interest.

The hypotheses stated that these variables were related to residents' risk perceptions about the possible building of a uranium enrichment plant (Table 6). The following results were based on the numerical data, which included the total survey responses of Unicoi residents.

Of the residents who were born in Unicoi, 36.4% (20) supported the nuclear facility, 23.6% (13) had no opinion about the nuclear facility, and 40% (22) opposed the possible nuclear facility to be built in Unicoi. Of the residents who were not born in Unicoi, 28.4% (27) supported the nuclear facility, 18.9% (18) had no opinion about the nuclear facility, and 52.6% (50) opposed the possible nuclear facility to be built in Unicoi (Figure 5). There was no significant association between those born in Unicoi or born in other places and whether they supported the nuclear facility (p=0.3414).

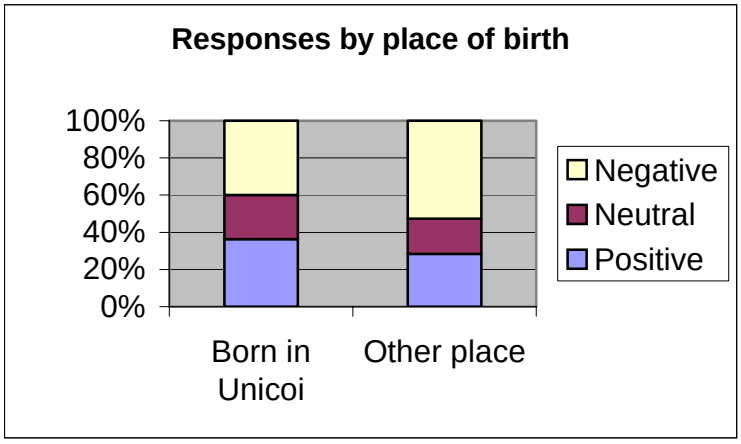

Figure 5 Response results for the question "Were you born in Unicoi?"

There was no significant association between those who lived in Unicoi under or over 10 years and whether they supported the nuclear facility (p=0.5977). Of the residents who lived in Unicoi for over 10 years, 33.0% (35) supported the nuclear facility, 21.7% (23) had no opinion, and 45.3% (48) opposed the possible nuclear facility. Of the residents who lived in Unicoi for less than 10 years, 27.3% (12) supported, 18.2% (8) had no opinion, and 54.5% (24) opposed the possible nuclear facility (Figure 6).

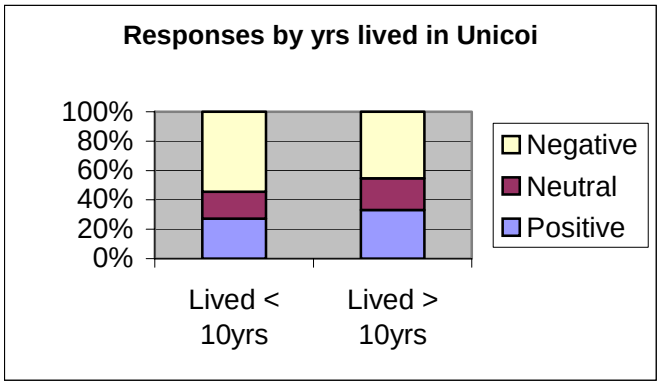

Figure 6 Response results for the question "How many years have you lived in Unicoi?"

Of respondents who had a high school education, 30% (24) supported, 20% (16) had no opinion, and 50% (40) opposed the nuclear facility. Of the respondents who had some college education ranging from a few courses to having a degree, 32.9% (23) supported, 21.4% (15) had no opinion, and 45.7% (32) opposed the possible nuclear facility (Figure 7). There was no significant association between those who had a high school education and some college and whether they supported the nuclear facility (p=0.8873).

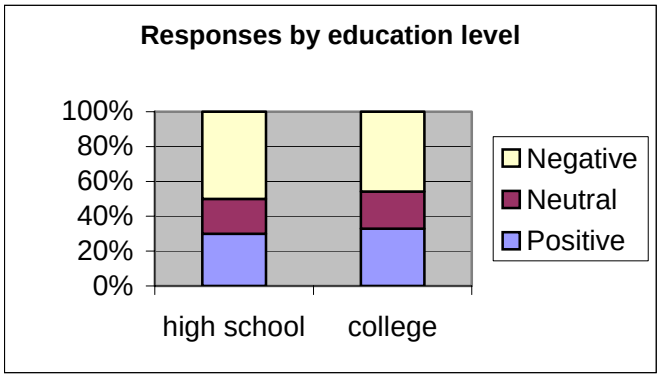

Figure 7 Response results for the question "What is the highest level education you have attained or completed?"

There was no significant association between occupations and whether they supported the nuclear facility (p=0.8091). Of the residents who worked in a white-collar job 26.1% (12) supported, 17.4% (8) had no opinion, and 56.5% (26) opposed the possible nuclear facility. Of those who worked in a blue-collar job 37.1% (13) supported, 22.9% (8) had no opinion, and 40% (14) opposed the possible nuclear facility. Of those who were not employed because they were homemakers, retired, or disabled, 31.9% (22) supported,

21.7% (15) had no opinion, and 46.4% (32) opposed the possible nuclear facility (Figure 8).

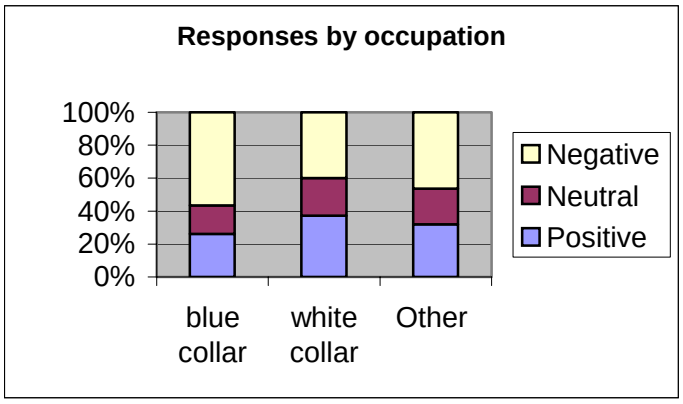

Figure 8 Response results for the question "What type of work do you do?"

Among residents who did not work with nuclear materials 27.3% (35) supported, 22.7% (29) had no opinion, and 50% (64) opposed the nuclear facility. Fifteen percent of the respondents said they worked with nuclear materials. Of those who worked with nuclear materials, 54.5% (12) supported, 9.1% (2) had no opinion, and 36.4% (8) opposed the possible nuclear facility (Figure 9). When applying the odds ratios, the residents who worked with nuclear materials were 2.7 times more likely to support than oppose the nuclear facility built in Unicoi. There was a significant association between those who worked with nuclear materials and whether they supported the nuclear facility (p=0.0410).

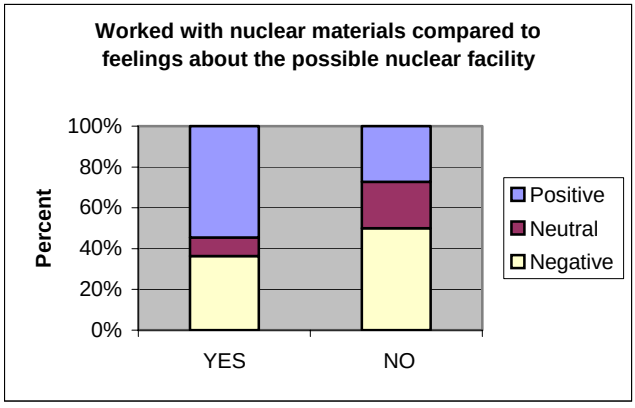

Figure 9 Response results for the question "Have you ever worked with nuclear materials?"

There was no significant association between those who had a family member who worked with nuclear materials and whether they supported the nuclear facility

(p=0.4293). Forty-four percent of respondents' extended family members worked with nuclear materials. Of the respondents whose family members worked with nuclear materials, 36.4% (24) supported, 21.2% (14) had no opinion, and 42.4% (28) opposed the possible nuclear facility. Of those who did not have family working with nuclear materials, 27.4% (23) supported, 20.2% (17) had no opinion, and 52.4% (44) opposed the nuclear facility (Figure 10).

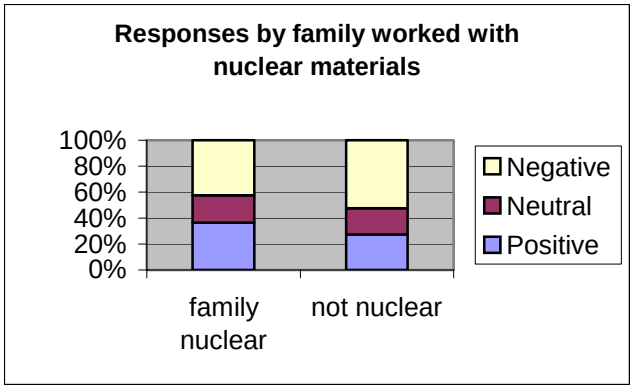

Figure 10 Response results for the question "Has a member of your family ever worked with nuclear materials?"

Eighty percent of respondents said they had children. Of those who had children, 30.8% (37) supported, 20% (24) had no opinion, and 49.2% (59) opposed the possible nuclear facility. Of those who did not have children, 33.3% (10) supported, 23.3% (7) had no opinion, and 43.3% (13) opposed the possible nuclear facility (Figure 11). There was no significant association between those who had children and whether they supported the nuclear facility (p=0.8638).

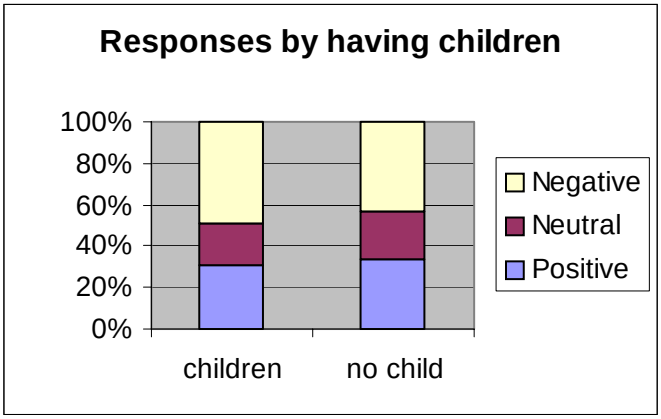

Figure 11 Response results for the question "Do you have any children?"

Of the respondents who had children, 32% of respondents had children under the age of 18 years, and 68% of respondents had adult children. Of the respondents with young children, 38.5% (15) supported, 20.5% (8) had no opinion, and 41.0% (16) opposed the possible nuclear facility. Of the respondents with adult children, 28.0% (23) supported, 19.5% (16) had no opinion, and 52.4% (43) opposed the nuclear facility (Figure 12). There was no significant association between those who had children and whether they supported the nuclear facility (p=0.4424).

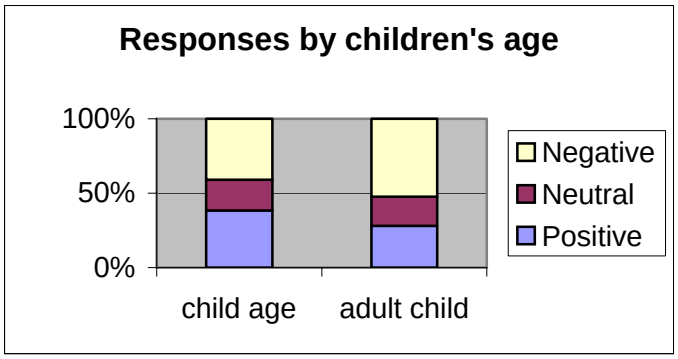

Figure 12 Response results for the question "What are your children's ages?"

There was no significant association for residents who learned from the media about the possible nuclear facility to be built in Unicoi, Tennessee and whether they supported it (p=0.5898). Seventy-seven percent of respondents said they obtained their information about the uranium facility from the media. Of this group, 33.9% (39) supported, 20% (23) had no opinion, and 46.1% (53) opposed the possible nuclear facility (Figure 13). Of those who learned about the nuclear facility by word of mouth, 23.5% (8) supported, 23.5% (8) had no opinion, and 52.9% (18) opposed it.

The pretest survey contained an additional question that asked about the type of media. There were only 20 participants who answered the specific type of media question. Of those 20 people, 75% (15) answered they learned information from the newspaper and 25% (5) said they learned information about uranium enrichment from other sources such as word of mouth or community meetings.

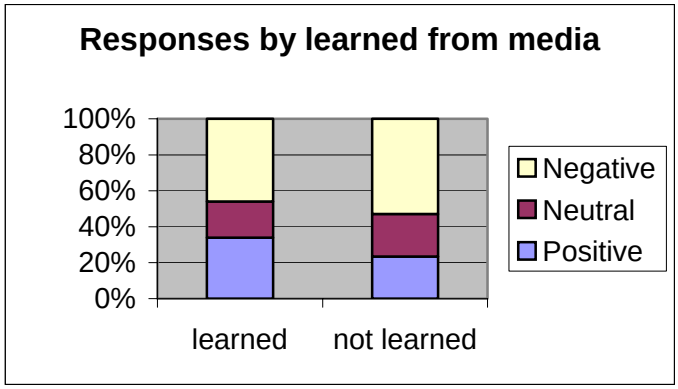

Figure 13 Response results for the question "How did you hear about it?"

There was a significant association between those who obtained more information and whether they supported the nuclear facility (p=0.0109). Of those who obtained more information from any source 38.6% (22) supported, 8.8% (5) had no opinion, and 52.6% (30) opposed it. Of those who did not obtain more information 26.1% (24) supported, 28.3% (26) had no opinion, and 45.7% (42) opposed the nuclear facility (Figure 14).

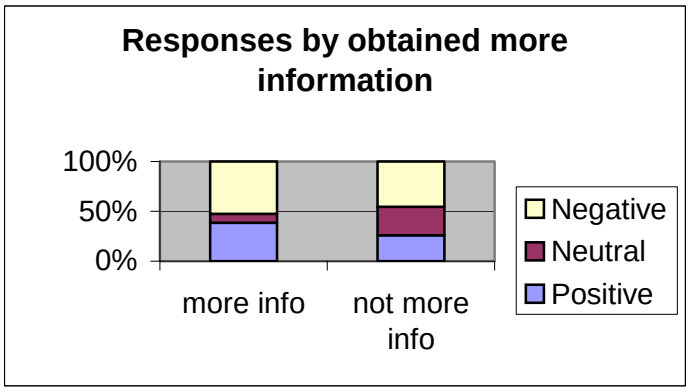

Figure 14 Response results for the question "Did you try to get more information?"

Of those who know about the technical uranium process 37.3% (31) supported, 20.5% (17) had no opinion, and 42.2% (35) opposed it. Of those who did not know about uranium enrichment 23.9% (16) supported, 20.9% (14) had no opinion, and 55.2% (37) opposed the nuclear facility. There was no association between those who knew about uranium enrichment and whether they supported the nuclear facility (p=0.1757).

Respondents who based their opinion on facts were 4.7 times more likely to support than oppose the possible nuclear facility, 3.6 times more likely to support than have no opinion, and 1.3 times more likely to have no opinion than oppose the possible nuclear facility. Of those who based their opinion on facts, 53.6% (30) supported, 16.1% (9) had

no opinion, and 30.4% (17) opposed the possible nuclear facility (Figure 15). Of those residents who based their opinion on feelings, 21.2% (14) supported, 22.7% (15) had no opinion, and 56.1% (37) opposed the possible nuclear facility. There was a significant association between those who based their opinion on factual statements, feelings, or both and whether they supported the nuclear facility (p=0.0005).

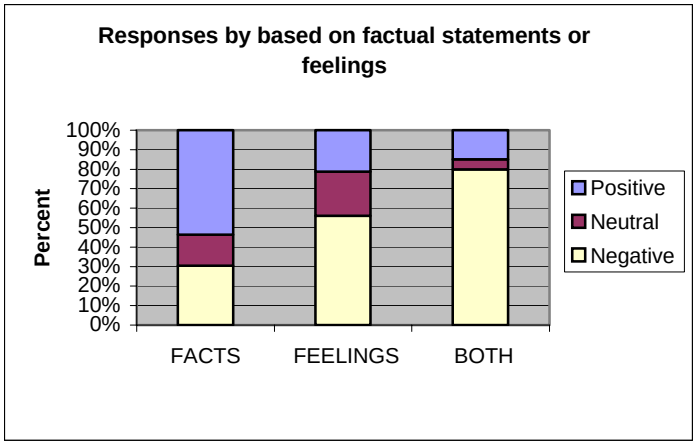

Figure 15 Response results for the question "… what was your first reaction based on?"

There was a significant association between residents' risk perceptions in 2003 compared to 2002 (p=0.0001). Of those who supported the plant, 82.4% (42) supported in 2002 and in 2003, and 77.8% (21) had no opinion in 2002 and in 2003. Of those who opposed the plant, 84.4% (65) opposed it in 2002 and in 2003 (Figure 16).

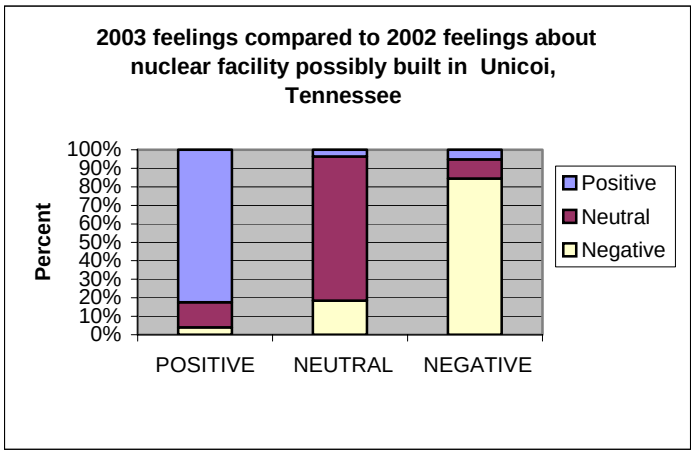

Figure 16 Response results for the question "…feel positive, negative, or neutral about having a uranium enrichment plant built in Unicoi?"

There was a significant association between those who supported the nuclear facility built in Bluff City, Tennessee and the nuclear facility in Unicoi (p=0.0003). Of the residents who responded, the odds ratio was 7.2 for supporting compared to having no opinion about the nuclear facility built in Bluff City, Tennessee. The residents responded 9.3 times more likely to support than oppose the nuclear facility to be built in Bluff City. Eighty-one percent (29) of those who supported the nuclear facility in Bluff City also supported a possible nuclear facility to be built in Unicoi.

Thirty-one percent (16) of those who opposed the possible plant in Bluff City also opposed it for Unicoi. If they opposed it for Bluff City, then 19.6% (10) supported it for Unicoi. When residents had no opinion for Bluff City, then 14.0% (8) supported it for Unicoi. If they had no opinion for Bluff City then 78.9% (45) opposed it for Unicoi (Figure 17).

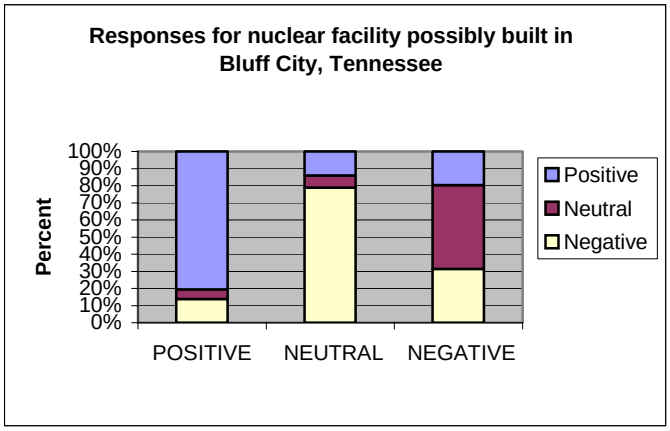

Figure 17 Response results for the question "Would you feel positive, negative, or neutral if a uranium enrichment plant was built in Bluff City, Tennessee?"

There was an association between those who thought their health might change and whether they supported the nuclear facility (p=0.0001). When residents thought their health might change, then they responded 30.0 times more likely to oppose the possible nuclear facility. Among residents who thought their health might change 6.6% (4) supported, 6.6% (4) had no opinion, and 86.9% (53) opposed the possible nuclear facility. In addition, when the residents thought their health might not change then 48.3% (43) supported, 30.3% (27) had no opinion, and 21.3% (19) opposed the possible nuclear facility (Figure 18).

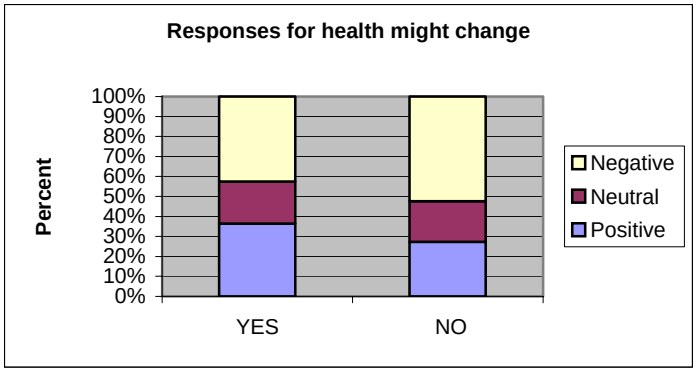

Figure 18 Response results for the question "Do you think your health would change by the uranium enrichment plant?"

When residents thought their wealth might change, then 46.2% (18) supported, 15.4% (6) had no opinion, and 38.5% (15) opposed the possible nuclear facility. Of those who thought that their wealth might not change, then 26.4% (29) supported 22.7% (25) had no opinion, and 50.9% (56) opposed the possible nuclear facility (Figure 19). There was a borderline association between those who thought their wealth might change and whether they supported the nuclear facility (p=0.0589).

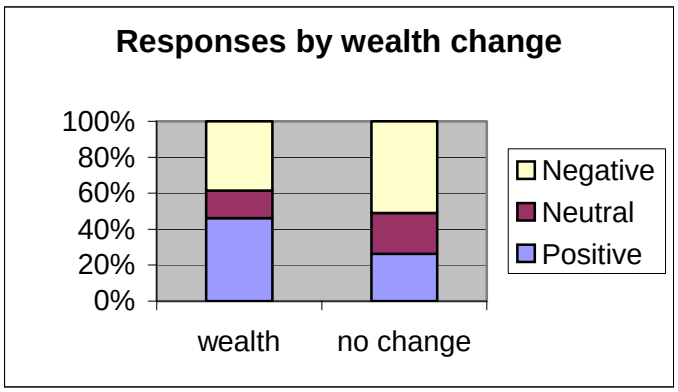

Figure 19 Response results for the question "Do you think your wealth would change if the uranium enrichment plant was built in Unicoi?"

There was an association between those who thought their community wealth might change and whether they supported the nuclear facility (p=0.0001). Of the residents who thought that the community wealth might change, 38.8% (47) supported, 20.7% (25) had no opinion, and 40.5% (49) opposed the possible nuclear facility. Of those who thought that the community wealth might not change, 0% (0) supported, 20.7% (6) had no opinion, and 79.3% (23) opposed the possible nuclear facility. The "had no opinion"

respondents were 2.0 times more likely to respond that their wealth might change if the possible nuclear facility was built in Unicoi.

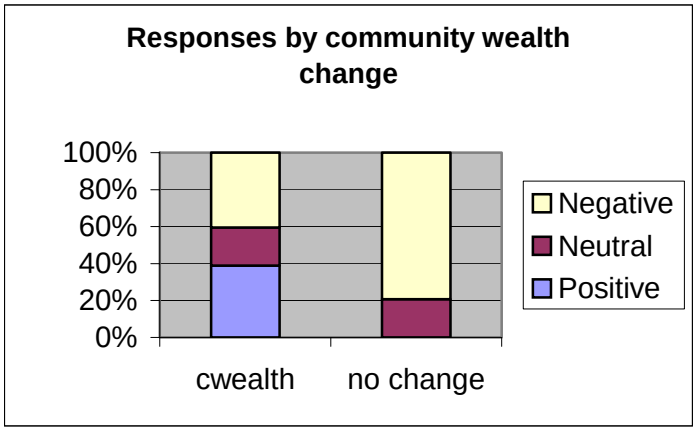

Figure 20 Response results for the question "Do you think that your community wealth would change if the uranium enrichment plant was built in Unicoi?"

Of those who were "risk takers*", 25.9% (7) supported it, 18.5% (5) had no opinion, 55.6% (15) opposed the possible nuclear facility. Of those who were not risk takers, 32.5% (40) supported, 21.1% (26) had no opinion, and 46.3% (57) opposed the possible nuclear facility (Figure 21). There was no association between those who were risk takers and whether they supported the nuclear facility (p=0.4761).

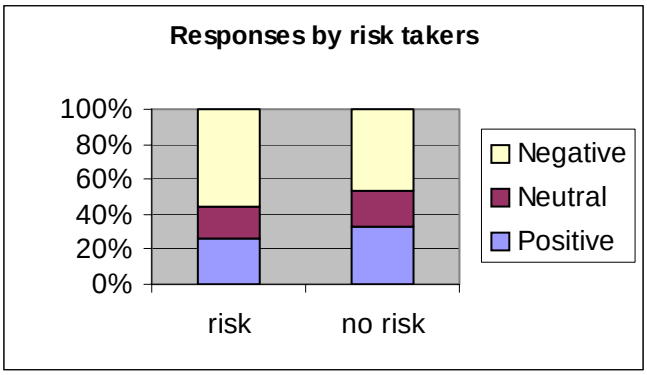

Figure 21 Response results for the question "Do you voluntarily participate in any activity that others consider a risk to your health or safety?"

*a short-hand term used herein to capture affirmative responses to question 28.

Chapter 5

DISCUSSION

Previous risk perception studies have indicated associations of risk perceptions with beliefs, attitudes and demographic variables (Mehta and Simpson 1994). The current research has sought to identify significant associations between support of or opposition to building nuclear facilities and understanding the underlying principles for those judgments. When the public values are identified as either health or wealth, risk experts can predict public opinions based on these values.

Fisher's exact test and odds ratio methods are valuable in understanding the associations between values, experiences, bases for decisions and support of or opposition to building nuclear facilities. This study examines how personal characteristics of the individual --including experiences, values, decision-making, and facts-- influenced support of or opposition to new technology such as uranium enrichment. Admittedly, this is a crude analysis, uncorrected for confounding and covariates among the numerous variables considered.

Results of this study show that support for the possible nuclear facility is associated with the following variables:

1. the person worked with nuclear materials;
2. the resident obtained more information about the nuclear facility;
3. the resident based his or her opinion on factual information rather than feelings;
4. where the nuclear facility could be located;
5. the resident perceived a change in community wealth.

As expected, residents who thought their health would be changed opposed the building of a nuclear facility in Unicoi Tennessee.

Implications of Working with Nuclear Materials

Nuclear materials workers are more likely to support the possible building of a nuclear facility in Unicoi. For adult Unicoi residents, the odds of supporting the possible building of a nuclear facility in their town are 2.7 times higher for those who worked with nuclear materials than those who had never worked with nuclear materials (Figure 9).

This research associated working with nuclear materials and risk perceptions regarding the possible building of a uranium enrichment plant in Unicoi, Tennessee.

Implications of Obtaining More Information About the Nuclear Facility

Obtaining more information about the possible nuclear facility in Unicoi is associated with support of or opposition to the facility. In addition, the behavior of obtaining more information increases the probability of an adult Unicoi resident supporting the nuclear facility. In general, obtaining more information resulted in 1.3 times more likely to support than oppose, and 4.8 times more likely to support than have no opinion about the nuclear facility in Unicoi (Figure 14). It is suspected that some of the residents with no opinion are fearful of responding definitively.

The strength of association is weak when comparing support and opposition groups who obtained more information. It is possible that the behavior of obtaining more information is because of underlying individual values rather than attitudes. The slight impact that more information had on attitudes is consistent with certain risk perception scholars' assertion that, "once formed attitudes resist change" (Olson and Zanna 1993).

Of those who obtained more information 77% (115) did so from the media and 23% (34) did so via word of mouth (Figure 14). If planners or policy makers seek to decrease opposition to building of nuclear facilities then they should provide the public with factual information. Even though the behavior of obtaining information is not significant, basing opinions on factual statements is significant in this study.

Factual Statements Rather than Gut Feelings: Decision-Making Implications

Basing opinions on facts increases the probability of favoring the building of a nuclear facility. There is a relationship between basing opinions on facts and support of or opposition to a possible nuclear facility. The adult residents who supported the nuclear facility and based their decision on facts composed of 53.6% respondents (Figure 15). If residents based their opinions on facts, then they use logic rather than gut feelings to support or oppose the nuclear facility. The odds are 4.7 times more likely for residents to base their opinion on facts and support the nuclear facility in their town of Unicoi (Figure 15). These results would motivate planners to present factual information so that the

public would more likely support the possible building of a uranium enrichment plant. Special programs should be developed to educate the public about the facts of nuclear facilities emphasizing safety precautions.

The risk perception study conducted in Unicoi about the possible uranium enrichment plant is comparable to previous findings. For example, in previous studies when people know more facts about nuclear energy they are more favorable toward it (Maharik and Fischoff 1993). This current study also demonstrated that when residents believe they know more facts about the nuclear facility they are more likely to support it.

Implications of Location for the Nuclear Facility

In this study, if the location for the possible nuclear facility is farther than the resident's immediate community then the odds for a Unicoi resident of opposing the nuclear facility is decreased. There is an association between location for the nuclear facility and support of or opposition to the possible building of the facility with 80.6% of the residents supporting the construction of the nuclear facility in Bluff City, Tennessee (Figure 17). For Unicoi residents, the odds for supporting the nuclear facility are 9.3 times more likely for Bluff City than in Unicoi (Figure 17). This finding suggests that the Unicoi residents definitely opposed the nuclear facility in their immediate community, but not in Bluff City, Tennessee.

This current research is comparable to previous attitude studies regarding the possible building of a nuclear facility. The previous studies have indicated that opponents to a particular nuclear facility have supported nuclear energy in general, but "not in my backyard" (NIMBY) because of certain risks associated with financial costs, depleted property values and environmental contamination (Bassett et al. 1996; Rogers 1998). These risks and the potential for a catastrophic accident have caused considerable public concern when officials try to site a nuclear facility. Nuclear risk perceptions and public concerns must decrease so that planners can obtain public support for building nuclear facilities near public communities.

Value of Community Wealth Implications

In this survey, support for or opposition to the possible nuclear facility is associated with adult Unicoi residents' perception that community wealth might change. The odds of support of or opposition to the nuclear facility were not calculated because of the zero responses in some categories. The only odds ratio that could be calculated for this question included the no opinion responses and opposition to the nuclear facility. In this case, the odds were 2.0 times more likely for a Unicoi resident to have no opinion than oppose the possible nuclear facility (Figure 20).

Obtaining an increase in wealth expected from the building of a nuclear facility is not enough incentive when compared to the perceived risks that this facility could contribute to the community. Moreover, when a public need (e.g. community wealth) was not yet satisfied then the public chose to support a nuclear facility in their town even though it contradicts their values (Boeree 1998; Rogers 1998).

Value of Health Implications

The association between the value of health and opposition to the nuclear facility ($p=0.0001$) is significant. In addition, residents are 18.8 times more likely to oppose than have no opinion and 30.0 times more likely to oppose than support the possible nuclear facility in Unicoi (Figure 18). Furthermore, the ability and motivation to make informed decisions involves innate values or beliefs (Yim and Vaganov 2003). Whether people value health is related to their opposition toward a possible nuclear facility built in town of Unicoi.

Summary

In sum, this research is significant because associations are observed between certain variables and risk perceptions. Underlying values such as health have been identified that influence residents deciding to oppose the building of a uranium enrichment plant. Identifying populations that make decisions based on health may help risk assessors better understand and possibly predict public responses to siting controversies.

Chapter 6

CONCLUSION

In a democratic society, risk management decisions should reflect the views of diverse populations where the stakeholders are the center of the decision making process. Good decisions remain open to certain influences such as technical and knowledge sources, value systems and perceptions held by stakeholders who are affected by risk management decisions. Ultimately, involving the stakeholders might lead to more efficient and accepted risk management decisions by the public (Charnley et al. 2000).

Statistical results of this research indicate several associations between variables of Unicoi residents and support of rather than opposition to a nuclear facility to be built in their town. The associated variables included: working with nuclear materials; residents basing their first reaction on facts or feelings; nuclear facility placed in Unicoi versus placement in Bluff, City Tennessee; whether they perceived the nuclear facility might affect their health; and whether they perceived the nuclear facility might affect their community wealth.

This research is significant for two reasons. First, associations were observed between certain variables and support for a proposed nuclear facility. Second, underlying values have been identified that contribute to decision-making. Analyzing human attitudes and values can help decision-makers better understand public responses to technology. In addition, decision-makers may be able to predict public attitudes about nuclear technology and the citizens' subsequent behavior when they have identified underlying public values.

Chapter 7

RECOMMENDATIONS

Recommendations for future research include developing a specific survey with more detailed questions. In addition:

1. When questions are asked about residents' perceptions of a nuclear facility built in Bluff City, Tennessee, another town should have been selected from a state further away such as Ohio, Arizona, or California with similar demographic characteristics as Unicoi, Tennessee.

2. When residents are asked about their occupation, their income level should be determined. Determining their specific income level will help to determine if the residents' responses were based on improving their income level.

3. More specific questions should be asked, such as age of respondent, proximity to the proposed Unicoi uranium enrichment plant, and his or her opinion about the existing nuclear fuels plant located only 20 miles away.

4. A question should have been asked about whether residents had ever heard of "Three Mile Island" or "Chernobyl." These incidents might have influenced their risk perceptions about the uranium enrichment plant built in Unicoi, Tennessee.

5. It is important to identify media sources the residents relied upon when they formed their opinions about the possible building of the nuclear facility.

6. Multivariate analytical methods should be applied in future studies to control for confounding and covariation among the variables of interest.

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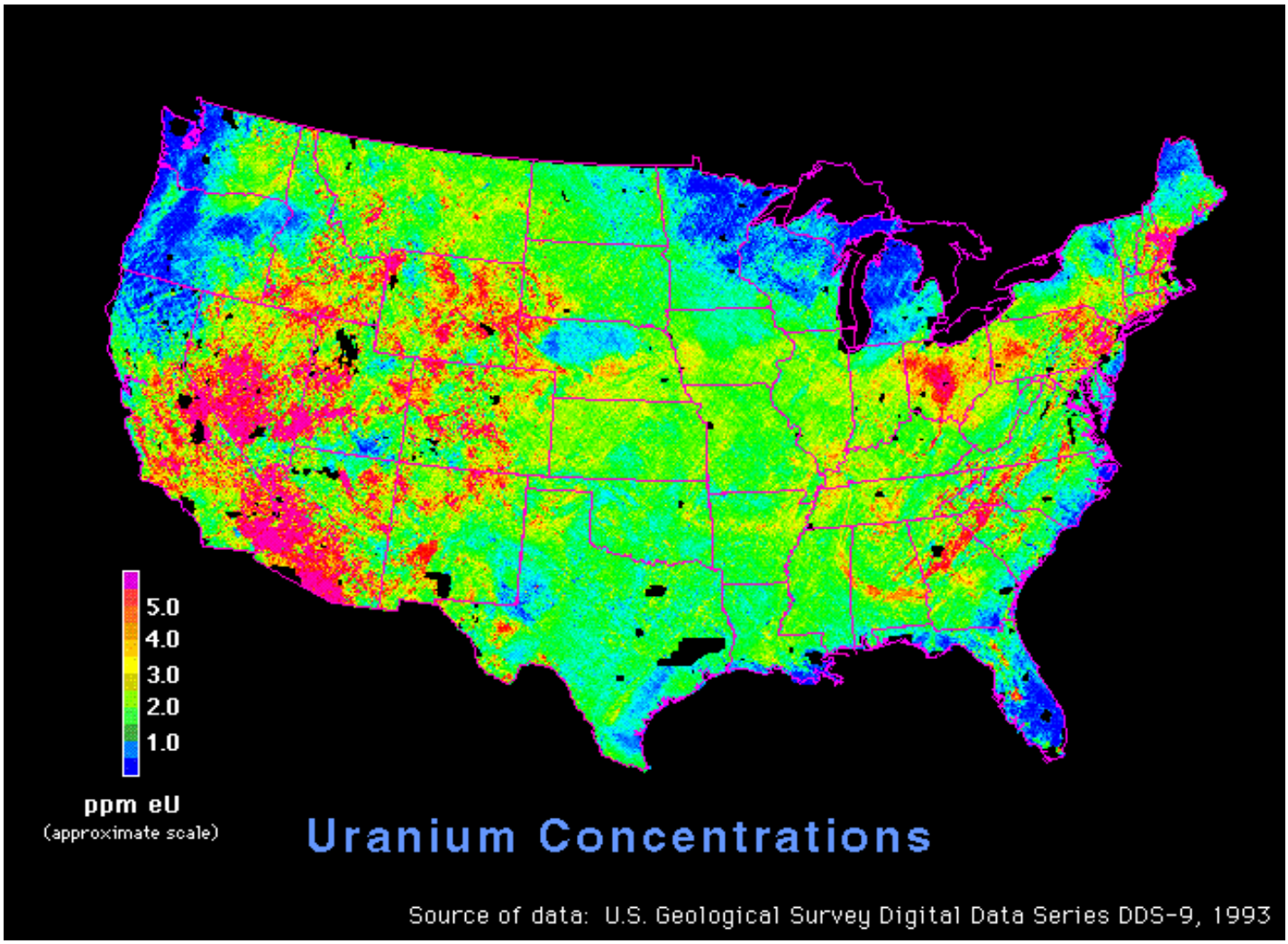
APPENDICES

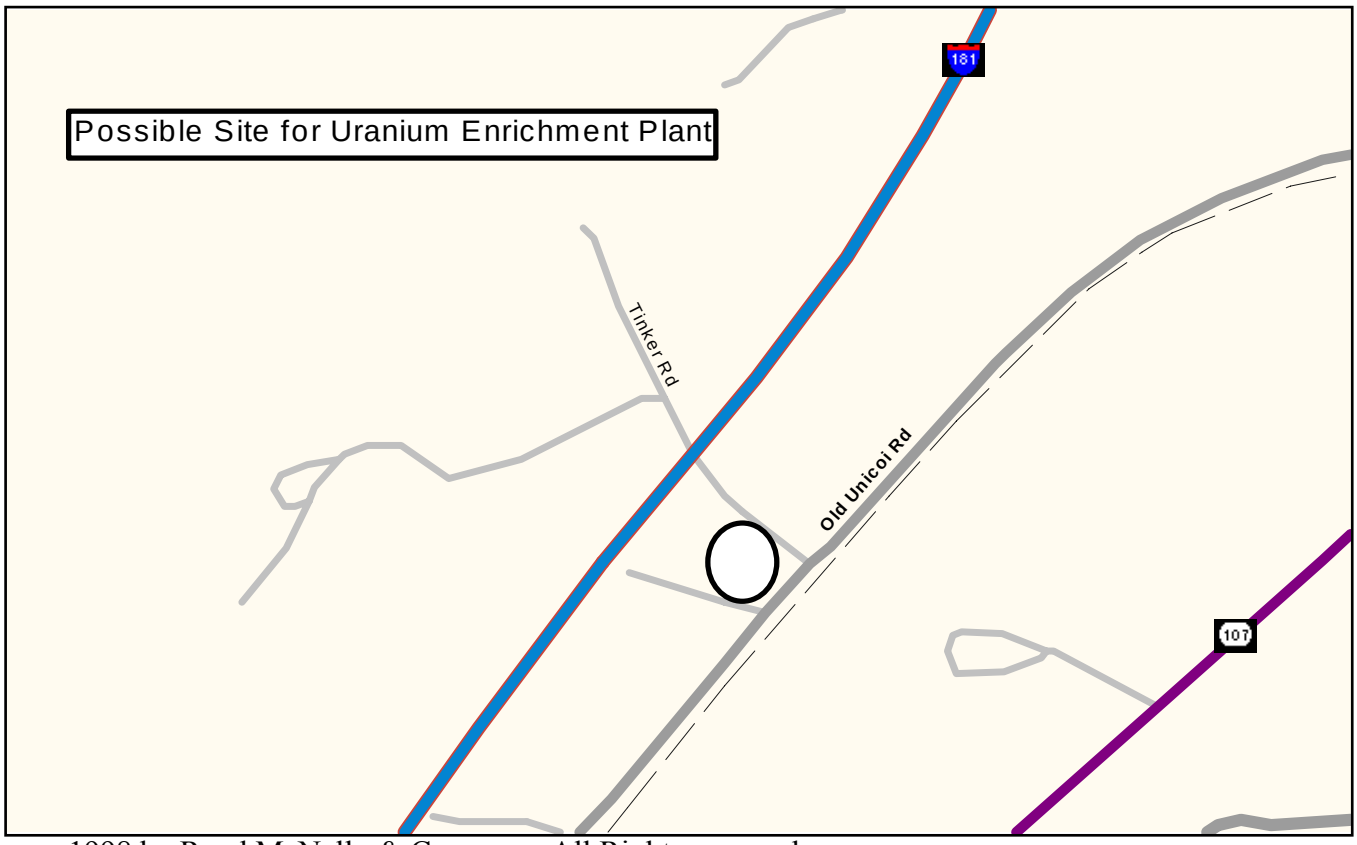
Appendix A

Uranium Concentrations in the United States



Appendix B

Possible Site for Uranium Enrichment Plant



O* Approximate location for proposed 100 acre site near Tinker Rd and Old Unicoi Rd.
Heavy North/South Line crosses Tinker Rd = Interstate 181
Dashed Line = Clinchfield Railroad

Appendix C

IRB Approval

EAST TENNESSEE STATE UNIVERSITY

Institutional Review Board Box 70565 Johnson City, Tennessee 37614-1707 (423) 439-6134 Fax (423) 232-5650

April 8, 2003

Shannon Sellards
Environmental Health
Box 14779

RE:"Risk Perception of Adults in the Town of Unicoi, Tennessee, Regarding the Building of an Uranium Enrichment Plant."
IRB No. c03-136e
Dear Ms. Sellards:
I reviewed the above-referenced study and find that it qualifies as exempt from coverage under the federal guidelines for the protection of human subjects as referenced as Title 45-Part 46.101. You are therefore authorized to begin the research.

It is understood this project will be conducted in full accordance with all applicable sections of the IRB guidelines. It is also understood that the IRB will be immediately notified of any proposed changes that may affect the exempt status of your research project. If you feel it is necessary to call further attention to any aspects of this study, please refer to the above-titled project and IRB number. I appreciate your bringing this project before the IRB for its concurrence of exempt status.

Sincerely

James J. Fox, III, Ph.D.
Chair- ETSU Campus
Institutional Review Board
/cs
Exemption Reference: 45 CFR § 46.101(2)(b)(2)

Appendix D

Pretest Survey

URANIUM ENRICHMENT PLANT SURVEY

Hello. My name is Shannon Sellards and I am a graduate student from East Tennessee State University and live in South Unicoi County. I am conducting a research project. I will be asking opinion questions about the possible building of a uranium enrichment plant in Unicoi. All responses will be confidential. This survey will only take approximately five minutes. If any of the questions make you feel uncomfortable you can choose not to answer any or stop at any time without penalty. If you have any questions in the future you may call 914-6435. If you are under 18 do not participate. May I ask you a couple of questions? [If yes, continue, no then hang up] Thank you

1) How many years have you lived in the town of Unicoi?_____(number of years)
2) In what town and state were you born?_____(town and state)
3) Did you graduate from high school?_____(Yes or No)
If NO, what grade did you complete?_____(grade)
Do you have a GED?_____(Yes or No)
4) Did you attend a college or university?_____(Yes or No)
How many years of college?_____(years)
Did you graduate college?_____(Yes or No)
5) Did you go onto graduate or doctorate school?_____(Yes or No)
How many years of school?_____ (years)
Did you graduate?_____(Yes or No)
6) Were you aware that a company wanted to put a uranium enrichment plant in Unicoi?_____(Yes or No) (If No, Skip to question #21)
7) IF YES, How did you learn about this?_____(type of media)
Do you remember when you first learned about it?____(Yes or No)
8) Did you try to get more information about the possible uranium enrichment plant?_____(Yes or No)
9) IF YES, from where did you get more information? _____ (type of media)

10) Do you know something about the uranium enrichment process?_____(Yes or No)

IF NO, Skip to question # 11, IF YES, please explain quickly _____

11) Do you know how the uranium enrichment process works?____(Yes or No)

IF YES, please explain quickly _____

NOW, I have a few more quick questions

13) How did you feel when you first learned that a uranium enrichment plant would possibly be built in the town of Unicoi?_____(positive or negative)

14) Would you say that you felt POSITIVE or NEGATIVE or Have no feeling about it?_____ (If No feeling, skip to #21)

IF POSITIVE, Would you say you felt VERY positive or just SOMEWHAT positive about it?_____ (very or somewhat)

IF NEGATIVE, Would you say you felt VERY negative or just SOMEWHAT negative about it?_____(very or somewhat)

16) As best you remember, what was your first reaction based on? (Fact or Feeling)

17) Today, Would you say that you feel POSITIVE or NEGATIVE about having a uranium enrichment plant built in the town of Unicoi? _____ (positive or negative)

IF POSITIVE, would you say you feel VERY positive or just SOMEWHAT positive about it?_____ (very or somewhat)

IF NEGATIVE, would you say you feel VERY negative or just SOMEWHAT negative about it?_____(very or somewhat)

18) Would you feel Comfortable or Uncomfortable if a uranium enrichment plant were built in Johnson City, TN?_____(comfortable or uncomfortable)

19) Do you think your health would be changed by a uranium enrichment plant? (Yes or No)_____

IF YES, how would your health be changed? _____

20) Do you think that your financial situation would be changed if a uranium enrichment plant were built in Unicoi? _____ (Yes or No)

If YES, Would the result be POSITIVE or NEGATIVE? _____

IF POSITIVE, Would you say you feel VERY positive or SOMEWHAT positive about it?_____(very or somewhat)

IF NEGATIVE, Would you say you feel VERY negative or SOMEWHAT negative about it? _____(very or somewhat)

21) What is your occupation?_____(occupation)

22) What type of work do you do?_____(type of work)

Have you ever worked with nuclear materials? _____(Yes or No)

Has a member of your family worked with nuclear materials?_____(Yes or No)

THESE ARE ALL THE QUESTIONS I HAVE, DO YOU HAVE ANY QUESTIONS FOR ME? THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

Appendix E

Uranium Enrichment Plant Survey

Hello. My name is Shannon Sellards from East Tennessee State University. I live in Unicoi County. I am conducting a research project. May I ask you opinion questions about the possible building of the uranium enrichment plant in Unicoi, TN.? This only takes two minutes. Are you over 18? All responses are confidential. If these questions make you feel uncomfortable you may choose not to answer. If you have any questions in the future you may call me at 914-6435 or Dr. Sikora. Thank you

1) Were you born in Unicoi? 1 Inside Unicoi□ 2 Outside Unicoi □

2) How long have you lived in Unicoi?

1 Under 10 years □ 2 Over 10□

3) What is the highest level of school you have attended or completed?

High School 1□

College 2□

4) Were you aware that a company wanted to put a uranium enrichment plant in Unicoi? (If no, Skip to question #21) 1YES□ 2NO □

5) If yes, how did you learn about this? 1Media□ 2Word of mouth□

6) Did you try to get more information? 1YES□ 2NO □

7) If yes, from where did you get more information?

1Media□ 2Word of mouth□ 3Other□

8) Do you know about the uranium enrichment process? (IF N0, Skip to question # 25)

1YES □ 2NO□

9) If yes, please explain_ Omit

10) How did you feel when you first learned that a uranium enrichment plant may be built in the town of Unicoi?

1 Positive□ 2 Negative□ 3 Neutral □

(If Neutral skip to #21)

11) If positive, would you say you felt very or somewhat positive about it?

1 Very □ 2Some

12) If negative, would you say you felt very or somewhat negative about it?

5 Very□ 6Some

13) As best you remember, what was your first reaction based on?

Fact	1
Feeling	2
Both	3

14) Today, would you say that you feel positive, negative, or neutral about having a uranium enrichment plant built in the town of Unicoi?

1 Positive□ 2 Negative □ 3 Neutral □

15) If positive, would you say you feel very or somewhat positive about it?

1 Very □ 2 Some

16) If negative, would you say you feel very or somewhat negative about it?

1 Very □ 2 Some

17) Would you feel positive, negative, or neutral if a uranium enrichment plant was built in Bluff City, TN?

1 Positive□ 2 Negative □ 3 Neutral □

18) Do you think your health would change by the uranium enrichment plant?

1Yes□ 2 No□

19) If yes, how would your health change? Not enough responses so this was omitted.

1Positive □ 2 Negative□

20) Do you think that your wealth would change if the uranium enrichment plant was built in Unicoi?

1 Yes□ 2 NO□

21) If yes, would the result be positive, negative?

1 Positive□ 2 Negative□

22) If positive, would you say you feel very or somewhat positive about it?

1Very□ 2 Some

23) If negative, would you say you feel very or somewhat negative about it?

1 Very□ 2 Some

24) Do you think that your community wealth would change if the uranium enrichment plant was built in Unicoi?

1Yes□ 2 NO□

25) If yes, would the result be positive, negative?

1 Positive□ 2 Negative □

26) If positive, would you say you feel very or somewhat positive about it?

1 Very□ 2 Some

27) If negative, would you say you feel very or somewhat negative about it?

1 Very□ 2 Some

28) Do you voluntarily participate in any activity that others consider a risk to your health or safety?

1 YES □ 2 NO□

29) If yes, what would that be? _I omitted this question.

30) What is your occupation? I classified this question in to blue collar, white collar_

31) What type of work do you do? omit

32) Have you ever worked with nuclear materials?

1Yes□ 2 NO □ Don't know□

33) Has a member of your family worked with nuclear materials?

1Yes □ 2 NO □ Don't know□

34) Do you have any children?

1Yes□ 2 NO□

35) If yes, what are your children's ages?

1Under 18□ 2 Over 18□

These are all the questions. Do you have any questions for me? Thank you

Appendix F

Uranium Enrichment Plant Events in the Media

JUNE EVENTS 2002

18th- Erwin/Unicoi Economic Development Board stated a 100 acre site within city of Unicoi had survived three rounds of site selection for siting a nuclear plant. Many landowners had been contacted by this time and signed consent papers for Urenco purchase their land. (Erwin Record, 2002)-

25th-" Urenco eyes county for nuclear plant" (Erwin Record, 2002)-

26th- Continued talk of landowners that didn't sell would have the plant built around him. (Erwin Record, 2002)-

JULY EVENTS 2002

3rd--"Consortium has controversial history in Louisiana" "Local officials say facility would be safe" " Urenco says decision still weeks away" (Erwin Record, 2002)

9th-- " Urenco named as nuclear consortium" (Johnson City Press, 2002)

11th--"Site for plant narrower than what consortium wants" (Erwin Record,2002)-

"Consortium identified as interested in Unicoi for $1B Uranium plant" (Johnson City Press, 2002)

12th- "Other proposed sites for nuclear plant may be released next week" (Johnson City Press, 2002)

13th- "Opponents of locating uranium enrichment plant in Unicoi to meet Monday" (Johnson City Press, 2002)

14th-"Process to build enrichment plant began during October" (Johnson City Press, 2002)"Relationship between NFS and Urenco may form" (Johnson City Press, 2002)

15th- Peaceful protest was staged at the Town Hall in Unicoi (Erwin Record, 2002)-

16th- "Unicoi demonstrators protest possible plant; others are backing it" (Johnson City Press,

2002)-" Urenco probably attracted by dedicated work force" (Erwin Record, 2002)-

21st-Urenco still waiting for nuclear decision" (Johnson City Press, 2002)

22nd-County Commissioner meeting discussed a possible lawsuit against the Erwin Record. Proposed site is narrowed down. Nuclear Fuels Service informed workers that the new site would be safe (Erwin Record, 2002)-

25th- Plans for nuclear plant possibly in nearby Erwin getting nuclear attention (Johnson City Press, 2002)

31st-"Decision imminent, Urenco says" (Erwin Record, 2002)-" Unicoi residents say tourism not nuclear energy should be focus of economic development there." Uranium enrichment plant decision could come soon (Johnson City Press 2002)

AUGUST EVENTS 2002

9th- Rezoning was discussed (Erwin Record, 2002)-

12th-Strong voice of Citizens for the Preservation of the Valley Beautiful (Erwin Record, 2002)

13th-"Citizens fill hall; zoning decision delayed" (Erwin Record, 2002)

14th-"Can U spell Democracy" (Erwin Record, 2002)-

18th - Urenco won't make public its list (Erwin Record, 2002)-

23rd-"Unicoi not on short list" (Erwin Record, 2002)

24th- Unicoi wont see nuclear plant (Johnson City Press, 2002)

SEPTEMBER EVENTS 2002

15th-Final selection and Unicoi was not it (Erwin Record, 2002)-

OCTOBER EVENTS 2002 -

20th "Alderman says input on plant advisable" (Johnson City Press, 2002)

22nd--"Unicoi BMA OKs 2 versions of minutes" (Erwin Record, 2002

Appendix G
Response Results

Table 7 Response results for place of birth and time lived in Unicoi compared to feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
Were you born in Unicoi? YES	20	13	22	55	36.4%	23.6%	40.0%	37.0%
NO	27	18	50	95	28.4%	18.9%	52.6%	63.0%
TOTAL	47	31	72	150	N/A	N/A	N/A	100
How long have you lived in Unicoi? <10 YEARS	12	8	24	44	27.3%	18.2%	54.5%	29.0%
>10 YEARS	35	23	48	106	33.0%	21.7%	45.3%	71.0%
TOTAL	47	31	72	150	N/A	N/A	N/A	100

Table 8 Response results for resident school level and type of job compared to feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
What is the highest level of school you have attended or completed? HIGH SCHOOL	24	16	40	80	30.0%	20.0%	50.0%	53.0%
COLLEGE	23	15	32	70	32.9%	21.4%	45.7%	47.0%
TOTAL	47	31	72	150	N/A	N/A	N/A	100
What is your occupation? WHITE COLLAR	12	8	26	46	26.1%	17.4%	56.5%	31.0%
BLUE COLLAR	13	8	14	35	37.1%	22.9%	40.0%	23.0%
NOT EMPLOYED	22	15	32	69	31.9%	21.7%	46.4%	46.0%
TOTAL	47	31	72	150	N/A	N/A	N/A	100

Table 9 Response results for workers or family members of workers with nuclear materials compared to feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi.

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
Have you ever worked with nuclear materials? YES	12	2	8	22	54.5%	9.1%	36.4%	15%
NO	35	29	64	128	27.3%	22.7%	50.0%	85%
TOTAL	47	31	72	150	N/A	N/A	N/A	100%
Has a member of your family ever worked with nuclear materials? YES	24	14	28	66	36.4%	21.2%	42.4%	44%
NO	23	17	44	84	27.4%	20.2%	52.4%	56%
TOTAL	47	31	72	150	N/A	N/A	N/A	100%

Table 10 Response results for having children compared to feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
Do you have any children? YES	37	24	59	120	30.8%	20.0%	49.2%	80%
NO	10	7	13	30	33.3%	23.3%	43.3%	20%
TOTAL	47	31	72	150	N/A	N/A	N/A	100%
What are your children's ages? UNDER 18	15	8	16	39	38.5%	20.5%	41.0%	32%
OVER 18	23	16	43	82	28.0%	19.5%	52.4%	68%
TOTAL	38	24	59	121	N/A	N/A	N/A	100%

Table 11 Response results of residents obtaining more nuclear information and their knowledge compared with feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
How did you learn about this? MEDIA	39	23	53	115	33.9%	20.0%	46.1%	77%
WORD OF MOUTH	8	8	18	34	23.5%	23.5%	52.9%	23%
TOTAL	47	31	71	149	N/A	N/A	N/A	100%
Did you try to get more information? YES	22	5	30	57	38.6%	8.8%	52.6%	38%
NO	24	26	42	92	26.1%	28.3%	45.7%	62%
TOTAL	46	31	72	149	N/A	N/A	N/A	100%
Do you know about the uranium enrichment process? YES	31	17	35	83	37.3%	20.5%	42.2%	55%
NO	16	14	37	67	23.9%	20.9%	55.2%	45%
TOTAL	47	31	72	150	N/A	N/A	N/A	100%

Table 12 Response results for nuclear risk perceptions based on facts or feelings compared to feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
What was your first reaction based on [2002]? FACT	30	9	17	56	53.6%	16.1%	30.4%	39.%
FEELING	14	15	37	66	21.2%	22.7%	56.1%	47%
BOTH	3	1	16	20	15.0%	5.0%	80.0%	14%
TOTAL	47	25	70	142	N/A	N/A	N/A	100%
Today, would you say you feel positive, negative or neutral about having a uranium enrichment plant built in the Town of Unicoi [2003]? POSITIVE	42	7	2	51	82.4%	13.7%	3.9%	34%
NEUTRAL	1	21	5	27	3.7%	77.8%	18.5%	18%
NEGATIVE	4	8	65	71	5.2%	10.4%	84.4%	48%
TOTAL	47	30	72	149	N/A	N/A	N/A	100%

Table 13 Response results for possible building of a nuclear facility in Bluff City, Tennessee and residents' perception of whether their health might change compared to feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
Would you feel positive, negative or neutral if a uranium enrichment plant was built in Bluff, City, Tennessee? POSITIVE	29	2	5	36	80.6%	5.6%	13.9%	25.0%
NEUTRAL	8	4	45	57	14.0%	7.0%	78.9%	39.6%
NEGATIVE	10	25	16	51	19.6%	49.0%	31.4%	35.4%
TOTAL	47	31	66	144	N/A	N/A	N/A	100%
Do you think your health would be changed by the enrichment plant? YES	4	4	53	61	6.6%	6.6%	86.9%	41%
No	43	27	19	89	48.3%	30.3%	21.3%	59%
TOTAL	47	31	72	150	N/A	N/A	N/A	100%

Table 14 Response results for wealth might change, community wealth might change, and involvement in risky activity compared to feelings when residents first learned about the possible building of a uranium enrichment plant in Unicoi

	RESPONSES (#)				RESPONSES (%)			
Questions	Positive	Neutral	Negative	TOTAL	Positive	Neutral	Negative	TOTAL
Do you think your wealth would change if the uranium enrichment plant was built in Unicoi? YES	18	6	15	39	46.2%	15.4%	38.5%	26%
NO	29	25	56	110	26.4%	22.7%	50.9%	74%
TOTAL	47	31	71	149	N/A	N/A	N/A	100%
Do you think your community wealth would change if the uranium enrichment plant was built in Unicoi ? YES	47	25	49	121	38.8%	20.7%	40.5%	81%
NO	0	6	23	29	0.0%	20.7%	79.3%	19%
TOTAL	47	31	72	150	N/A	N/A	N/A	100%
Do you voluntarily participate in any activity that others consider a risk to your health or safety? YES	7	5	15	27	25.9%	18.5%	55.6%	18%
NO	40	26	57	123	32.5%	21.1%	46.3%	82%
TOTAL	47	31	72	150	N/A	N/A	N/A	100%

Table 15 Fisher's exact test and odds ratio results for risk perceptions compared to demographic questions

	Response When "First Learned…"(Q10) [2002]					
Questions	p-value	Positive vs Neutral	Neutral vs Negative	Positive vs Negative	Negative vs Positive	Negative vs Neutral
Were you born in Unicoi?	0.3414	1.0	1.6	1.7	0.6	0.6
How long have you lived in Unicoi?	0.5977	0.9	0.7	0.7	1.5	1.4
What is the highest level of school you have attended or completed?	0.8873	0.9	0.8	0.8	1.2	1.3
What is your occupation?	0.8091	0.9	0.6	0.7	2.0	1.9
Have you ever worked with nuclear materials?	0.0410 *	4.9	0.5	2.7	0.4	1.8
Has a member of your family ever worked with nuclear materials?	0.4293	1.3	1.3	1.6	0.6	0.8
Do you have any children?	0.8638	1.08	0.7	0.8	1.2	1.3
What are your children's ages?	0.4424	1.3	1.3	1.7	1.2	1.1

*significant at $p<.05$

Table 16 Fisher's exact test and odds ratio results for risk perceptions compared to knowledge questions

	Response When "First Learned…"(Q10) [2002]					
Questions	p-value	Positive vs Neutral	Neutral vs Negative	Positive vs Negative	Negative vs Positive	Negative vs Neutral
How did you learn about this?	0.5898	1.7	0.9	1.6	0.6	1.0
Did you try to get more information?	0.0109 *	4.8	0.5	1.3	0.8	3.7
Do you know about the uranium enrichment process?	0.1757	1.6	1.3	2.1	0.5	0.8

*significant at $p<.05$

Table 17 Fisher's exact test and odds ratio results for risk perceptions compared to perception questions

	Response When "First Learned…"(Q10) [2002]					
Questions	p-value	Positive vs Neutral	Neutral vs Negative	Positive vs Negative	Negative vs Positive	Negative vs Neutral
What was your first reaction based on [2002]?	0.0005 *	3.6	1.3	4.7	0.2	0.8
Today, would you say you feel positive, negative, or neutral about having a uranium enrichment plant built in the Town of Unicoi [2003]?	0.0001 *	126.0	34.0	341.2	0.003	0.03
Would you feel positive, negative, or neutral if a uranium enrichment plant was built in Bluff, City, Tennessee?	0.0003 *	7.2	0.06	9.3	0.1	17.6
Do you think your health would change by the uranium enrichment plant?	0.0001 *	0.6	0.05	0.03	30.0	18.8
Do you think your wealth would change if the uranium enrichment plant was built in Unicoi?	0.0589 *†	2.6	0.9	2.3	0.4	1.1
Do you think your community wealth would change if the uranium enrichment plant was built in Unicoi?	0.0001 *	0	2.0	0	0	0.5
Do you voluntarily participate in any activity that others consider a risk to your health or safety?	0.4761	0.9	0.7	0.7	1.5	1.4

*significant at $p<.05$
† $0.05<p<0.1$

.VITA

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Honors and Awards:	Deans List, Gamma Theta Upsilon Honor Society, Recognition from Representative David Hartley House District #62 as finalist in 1991Ohio Miss TEEN Pageant as one of Ohio's finest young citizens that the future holds bright promise