“Public Opinion, Perceived Risk, and Nuclear Wastes: National and Nevada Perspectives”

92-10-03

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Public Opinion, Perceived Risk, and Nuclear Wastes:  
National and Nevada Perspectives

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I. Introduction

The U.S. Department of Energy has been charged with locating a suitable site to build a high-level nuclear waste (HLNW) repository. After reviewing and evaluating a large number of possible sites, the Department of Energy chose three potential sites and began impact studies on each. However, because of subsequent congressional actions amending the site evaluation process, two of the potential sites, Deaf Smith County, Texas and Hanford, Washington, are realistically out of the running, unless startling evidence emerges indicating that Yucca Mountain, Nevada is an unsafe location.

The political climate associated with the repository siting provides an important backdrop for understanding the risk perceptions research discussed in this paper. The State of Nevada has strongly opposed the location of the repository in Nevada. The state has questioned the geological integrity of the site, and has voiced other concerns. The Department of Energy recognized at least some of these concerns when it decided to re-evaluate the repository planning effort (Wald, 1989).

Media coverage of both the repository and the Department of Energy, has been intensely critical. At times it is difficult to tell when the reporting has ended and editorials have begun. In 1987, Congress created an independent federal agency, the Nuclear Waste Technical Review Board, to review the scientific and social issues involved in the repository debate (North, 1989).

Social science research has been notably absent from the debate about the repository. This paper, and indeed the volume as a whole, is an attempt to fill some of this void. This paper describes the results of two telephone surveys, one national and one in the state of Nevada, which examined the perceived risks associated with a HLNW repository. By expanding the findings on perceived risks presented in Kunreuther, Desvouis, and Slovic (1988), this paper further characterizes the public’s understanding and attitude toward the HLNW repository. It builds on the descriptive research on risk perceptions by Slovic, Fischhoff, and Lichtenstein (1985) and Fischhoff et al. (1981) by using their psychological taxonomy for risk characteristics. To our knowledge, this is the first attempt to examine these perceptions for a large sample of respondents across the United States. In addition, the survey of Nevada residents allows a closer examination of the perceptions of those people most likely to be affected by the repository.

As the first large-scale assessment of public risk perceptions, our surveys demonstrate the usefulness of survey techniques in understanding the factors that affect people’s perceptions of risk. They also enable us to discuss some of the important dimensions that affect the interface between risk perceptions and public policy. For example, we shed some light on the relationship between the public’s trust in the government to operate the repository effectively and their risk perceptions. The surveys have moved risk perception research from the laboratory to real risk situations. Our hope is that in the future such research can be used to improve public policy decisions.

The paper is organized into 10 sections. Data collection is highlighted in section II. Section III describes the perceptions that our survey respondents hold about various types of pollution. Section IV discusses respondents’ awareness and knowledge of nuclear waste issues. Section V presents respondents’ general attitudes toward the HLNW repository. Section VI describes the respondents’ perceived risks from the HLNW repository. In section VII, the characteristics of these perceived risks are discussed. In section VIII we develop risk perception models. Section IX is devoted to the respondents'
projected voting behavior and voting behavior models. In section X, we discuss our results in the context of risk perception research and public policy implications.

II. Data Collection

Two telephone surveys, one of Nevada households with telephones, and the second of households with telephones within the continental United States, excluding Nevada, provide the data for this study. The samples were drawn from the target populations by using standard random digit dialing techniques.

The questionnaires for the survey evolved as one part of the State of Nevada's socioeconomic impact assessment. As described in Kunreuther, Desvousges, and Slovic (1988), the questionnaire development process included focus groups, reviews by various researchers on the impact assessment team, and survey experts who were not associated with the project. After coordinated training sessions, survey groups at the Gordon Black Corporation (national sample) and the University of Nevada - Las Vegas (Nevada sample) conducted the surveys in March and April of 1987.

For the Nevada survey, 5,954 telephone numbers were included in the initial sample. Of these, 3,887 were residential numbers in service. No contact was made with the target respondent for 1,173 (30.2 percent) of these residential numbers, either because of continual busy signals, or because in spite of repeated attempts, the telephone was not answered. Of the 2,676 households in which an eligible respondent was reached, 1,001 (37.4 percent) provided complete interviews.

For the national survey, of the 3,419 telephone numbers at which a potential respondent was reached, 1,021 (35.1 percent) yielded completed interviews.

Because of the low response rates, our findings cannot be necessarily generalized, either to the population of Nevada or to that of the rest of the continental United States. Some scholars may object that these response rates are too low to support any of the findings. We believe that the data do provide insight into the nature of perceptions and attitudes toward the repository. Our findings should not, however, be used to guide policy decisions on nuclear waste without additional confirmatory evidence.

III. Perceived Seriousness of Pollution Sources

Peoples' perceptions about the risks posed by a HLNW repository are related to their opinions about nuclear waste. Our surveys asked respondents to rate the pollution problems from a variety of sources, including radioactive wastes from nuclear power plants, on a scale of 1 to 10, with 1 being not at all serious and 10 being very serious. This question preceded any introduction or mention of nuclear wastes in the questionnaires. The intent was to obtain a measure of relative concern before introducing the nuclear waste issue. The results are presented in Table 1.

For the national sample, water pollution from toxic chemicals, not radioactive wastes from nuclear power plants, has the highest average seriousness rating. National respondents, on average, assigned a seriousness rating of 7.9 to water pollution and 7.4 to radioactive wastes. The average rating for air pollution is 7.1, the third highest in the sample. Garbage from landfills has the least serious average rating.
For the Nevada sample, air pollution receives the highest average seriousness rating. Nevadans assigned an average rating of 7.9 to air pollution from cars and factories. Such high ratings for air pollution problems may reflect population clustering in Clark County (Las Vegas) and residents' concerns about air pollution in that area. The rapid increase in population growth, the corresponding increase in motor vehicles, and climatic conditions have all contributed to the air pollution problem in Las Vegas. Nevadans rated water pollution has the second most serious pollution source, with an average rating of 7.8, and garbage from landfills the lowest. They rated radioactive wastes from power plants an average 6.9 - a full scale point below the average for air pollution. Radiation from nuclear weapons testing was also included as a pollution source on the Nevada questionnaires, and received a relatively low average seriousness rating of 6.1.

The proportions of respondents that assign high ratings of 10 ("very serious") for each pollution source indicate that water pollution and radioactive wastes from nuclear power plants are regarded as the most serious problems. More than 42 percent of national respondents and 38 percent of Nevada respondents assign the highest seriousness rating to radioactive wastes from nuclear power plants. Water pollution is considered "very serious" by 35 percent of the national and 37 percent of the Nevada respondents.

The Nevada sample assigned somewhat lower ratings to radioactive wastes than did the national sample. Increased familiarity among residents of Nevada with radioactive materials may explain this difference. As hosts to the nation's nuclear weapons testing facility, Nevada residents are likely to be more knowledgeable about radioactive materials and the risks they present than the general population. As will be demonstrated in a later section of this paper, increased knowledge about a risk can result in lower risk perceptions.

IV. Salience and Knowledge of HLNW Issues

Not surprisingly, nuclear waste is a more salient issue for Nevada residents than for the nation as a whole. Figure 1 provides comparisons between the level of awareness about nuclear wastes between the two samples. As seen in Figure 1, 35 percent of the Nevada sample recalls having read or heard about high-level nuclear wastes more than 10 times in the three months before the survey, compared to only 17 percent of the national sample. Location of the nuclear weapons testing facility in Nevada and the state's nomination as a possible site for the HLNW no doubt have increased its residents' cognizance of nuclear issues.

The surveys also asked how respondents obtained information about high-level nuclear waste issues. Of the respondents who had read or heard about wastes during the past 3 months, more than 58 percent in the Nevada sample and almost 49 percent in the national sample had bought a newspaper or magazine or watched a television program specifically to learn about high-level nuclear wastes. Even higher percentages of respondents who indicated awareness about high-level nuclear wastes had discussed the issues with friends or relatives.

Relatively few respondents attended public meetings to obtain information. Less than 10 percent of the respondents in either the Nevada or national sample had attended a public or neighborhood meeting about high-level nuclear wastes. This finding underscores research by Regan, Desvouges, and Creighton (1990) that indicates that public meetings alone are not an effective way to communicate information.

Higher awareness of HLNW issues does not necessarily imply higher levels of knowledge. As a rough indication of knowledge, we developed three multiple choice
questions that addressed important aspects of nuclear waste disposal. Fewer respondents provided correct answers to these questions that might have been expected from the awareness results. About 20 percent of both samples knew where high-level nuclear wastes are currently stored in the United States. As shown in Figure 2, more than 75 percent of the Nevada sample and 64 percent of the national sample knew that underground disposal is the method being considered most seriously in the United States today. As shown in Figure 3, however, only 27 percent of the Nevada sample and 18 percent of the national sample knew that the repository would store wastes for longer than 1,000 years. Although imperfect, this measure of knowledge fits within the confines of the telephone survey mode. Clearly, developing a better measure of knowledge is an important area for improvement in subsequent studies.

V. General Attitudes Toward the Repository

To capture respondents' general attitudes toward the repository, the survey questionnaires asked a wide range of questions about the repository, its potential benefits and costs, and the equity of developing only a single repository. These survey questions are summarized in Table 2. Respondents were asked to indicate the extent to which they agreed or disagreed with each of the listed statements. The responses produce an interesting picture of the respondents' views about the repository:

- Almost 48 percent of the national sample agree or strongly agree that a repository is the best way to permanently store high-level nuclear wastes, compared to almost 53 percent of the Nevada sample.
- 46 percent of the national sample and 56 percent of the Nevada sample agree or strongly agree that each region should have a repository.
- Only 23 percent of Nevada residents think that Nevada is the safest place in the United State for the repository.
- Only about 30 percent of Nevada residents think that Nevada is the best site for a repository because the weapons testing site is located in Nevada.
- Only 27 percent of the national sample agree or strongly agree that the repository would stimulate economic growth in nearby communities. Nevada residents have more positive expectations, and are almost equally divided on this statement.
- Neither group of respondents, however, thinks that the economic benefits would greatly outweigh the risks.

The overall evaluation of the HLNW repository is rather negative. National respondents assess the repository as a bad economic deal - they do not think it would stimulate growth in nearby communities or yield benefits in excess of the risks. Nevada survey respondents seem unconvinced that their state is the safest place for the HLNW repository, but seem somewhat more optimistic about its economic potential.

VI. Perceived Seriousness of Risks

Previous studies of perceived risks have shown that risk perceptions can be measured using quantitative methods (Slovic, 1987; Fischhoff et al., 1981; and Slovic,
Fischhoff, and Lichtenstein, 1985). These studies have produced "cognitive maps" of risk attitudes and perceptions, which show perceptions to be influenced by two main factors: dread risk and unknown risk. Nuclear power and nuclear waste risks are rated highly on both the dread and unknown scales. Although these studies have not been based on national samples, they suggest high levels of perceived seriousness for the risks from a HLNW repository.

Survey respondents were asked to rate the perceived seriousness of various risks using a scale from 1 to 10, with 1 being not at all serious and 10 being very serious. Table 3 shows the results for both the Nevada and national samples. Nevada residents rated the risks for a repository that would be located at Yucca Mountain, while national respondents rated risks from a repository that would be located 100 miles from their homes. Generally, Nevada residents ranked all the health and safety risks slightly lower than did the national respondents.

On average, national respondents rate the potential risks from a repository more seriously than the risks perceived from any of the other sources included in the survey. The average seriousness rating for the risks from a repository is 6.2 for the national sample. Perceived risks from exposure to hazardous chemicals from abandoned landfills have the second highest average rating for the national sample at 5.8. Nuclear power risks follow at 5.2. Accidents at work receive the lowest average rating in the national sample.

In addition to rating the risks posed to national respondents, Nevadans were asked to rate the seriousness of risks from transporting wastes to Yucca Mountain and from testing nuclear weapons. The average rating of the transportation risks, 5.9, is the highest, followed closely by risks from the repository itself. The average rating for weapons testing, 4.7, is higher than the 4.3 rating for nuclear power plant wastes. Accidents on the job also receive the lowest average rating from the Nevada sample.

In short, respondents from both the national and Nevada samples perceive a HLNW repository as posing fairly high levels of risk. Nevada respondents view transporting radioactive wastes to the repository as even more of a risk than the repository itself.

VII. Risk Characteristics

Characterizing the risks associated with HLNW repository is an important step toward understanding risk perceptions. To address this issue, the surveys included questions on six characteristics that have proven important in previous psychometric studies of risk perception (Slovic, 1987; Slovic, Fischhoff, and Lichtenstein, 1985):

- accidents at the repository would involve certain death
- accidents at the repository would be catastrophic - they would kill many people at one time
- scientists understand the risks of repositories
- people living near the repository could control the risks
- people would dread living near the repository
- repositories pose a serious risk for future generations.
Results from both surveys indicate that perceptions of the risks associated with the HLNW repository are consistent with previous studies. These results are presented in Table 4.

The dread factor appears to have a significant role in the formation of repository risk perceptions. Roughly 80 percent of the respondents in both samples either agree or strongly agree that people would dread living near the repository. The dread associated with the repository may be highly correlated with people’s concern about the consequences of an accident at the repository. More than 70 percent of both samples think that an accident at the repository would involve certain death. Moreover, 80 percent of both samples think that an accident would be catastrophic.

The unknown factor also figures into risk perceptions about the HLNW repository. Roughly 37 percent of the national respondents and 41 percent of the Nevada respondents either disagreed or strongly disagreed that scientists understand the risks involved with the repository. Thus, the unknown nature of repository risks are also important to respondents.

The surveys clearly indicate that respondents doubt that people who live near the repository could control its risks. More than 90 percent of all respondents either disagree or strongly disagree with the statement that local people could control the risks. In the focus group sessions that preceded the actual surveys, we found that people had difficulty articulating technological control. Since the surveys contained only one question about control, respondents may not have had adequate opportunity to express their opinions. We suggest that future research efforts explore the dimensions of local control more fully.

Concern for the risks that the repository presents for future generations is also evident in both samples. Because the wastes in the repository would be stored for very long periods of time, perhaps thousands of years, such concern for future generations seems particularly relevant. Roughly 70 percent of the Nevada sample and 80 percent of the national sample agree or strongly agree that the repository would pose a serious risk for future generations.

We consider the likelihood of large releases of radiation from the repository as an additional dimension of perceived risk. Both survey questionnaires asked respondents to indicate the likelihood of large releases of radiation as a result of an accident, general deterioration, or human malevolence during the first 5 or 20 years that the repository would be open (different time periods were randomly assigned to respondents.) Our results indicate that time period makes almost no difference in the responses. Various types of radiation releases are perceived just as likely to occur in the first 5 years as in the first 20 years.

As shown in Table 5, the two sources of large radiation releases that are considered most likely by Nevada and national respondents are transportation accidents and contamination of underground water. In the national sample, almost 80 percent of respondents think that releases from transportation accidents are somewhat or very likely, and almost 75 percent think that releases from leaks into groundwater are somewhat or very likely. The percentages are almost identical for the Nevada sample. These perceived likelihoods of large radiation releases are orders of magnitude greater than the estimates provided by technical experts (Peters, 1983).
VIII. Risk Perception Models

To evaluate the perceptions associated with the HLNW repository further, we have developed a heuristic model to predict perceived risks. The model suggests that people form their perceptions of the risks from the HLNW repository according to the equation:

\[ PR = F(A, K, C, E, L, S) \]

where,

- PR = perceived risk from the repository
- A = individual's attitudes toward repository siting (and probably nuclear-related issues in general)
- K = knowledge about the repository issues
- C = characteristics of the risk
- E = experiences associated with repository or nuclear issues
- L = individual's location relative to the repository
- S = individual's socioeconomic characteristics.

We use this scheme as the basis for a series of econometric models to estimate respondents' perceived seriousness of the risks associated with the HLNW repository. This model is a first step in beginning to understand the formation of risk perceptions. We hope that it serves to spark other conceptual and empirical investigations. The same models are presented for both the national and the Nevada samples. The models predict the respondent's perceived seriousness of the risks associated with the repository as expressed on a 10-point scale, with 10 as the most serious and 1 as the least serious rating. The reported coefficients for the continuous variables are standardized and represent the change in the standard deviation of the scale point rating of perceived risk that results from a one standard deviation change in the independent variable, all other things being equal. Coefficients for qualitative explanatory variables, however, cannot be expressed in this manner and are left unstandardized. These variables either have a value of 0 or 1, which makes it meaningless to standardize their coefficients. Since risk perception is expressed on a scale with the endpoints limited at 1 and 10, two-limit tobit models are the appropriate form for estimation. The tobit procedure, however, produced results very similar to ordinary least squares. We have chosen to present ordinary least squares models because of widespread familiarity with the technique and ease of interpretation.

The variables used in the regression models are defined in Table 6. These variables are related to the conceptual heuristic model in Table 7. There is no variable to correspond with L, the individual's location relative to the repository, because all respondents were asked to consider that the repository would be located at either Yucca Mountain (Nevada survey) or, equivalently, 100 miles from their homes (national survey). In a subsequent model of voting behavior, we do consider residence in either of two counties closest to the proposed repository site. None of the regression variables correspond to E, experiences associated with repository or nuclear issues. While it would be difficult to include experiences with repository issues since no repositories currently
exist, our analysis could have included a measure of Nevadans' familiarity with nuclear issues. This is an area that merits further consideration in subsequent studies. The focus group results suggest that experience is likely to be an important influence of risk perceptions (Desvousges and Frey, 1989).

Results from the models are presented in Table 8 (national sample) and Table 9 (Nevada sample). Both the F-values for the models and the adjusted $R^2$ values indicate that the models are reasonably good predictors of perceived seriousness of risks associated with the HLNW repository. The adjusted $R^2$ of 40 percent in the final Nevada model is very encouraging for cross-sectional data.

Model 1 demonstrates the contribution of the variables that represent knowledge of nuclear waste and repository issues and trust in the federal government. In both the national and Nevada models, these variables are significant and negative. Increased knowledge of nuclear and repository issues and higher levels of trust in the federal government to operate the repository safely decrease the perceived risk of the repository. As more variables are added in subsequent models, knowledge and trust continue to be significant and negative, but their relative influences on risk perceptions decrease. The coefficient for the knowledge variable is roughly twice as large for the Nevada sample as for the national sample, which may reflect Nevadans' higher general awareness about nuclear issues. Both trust and knowledge are potentially affected by risk communication activities related to the siting of the repository. Our results suggest that helping respondents become more knowledgeable about nuclear waste and increasing the trust in the federal government to handle wastes effectively would lead to lower perceived risks. Developing higher levels of trust would, however, require significantly different process for siting the HLNW, and much higher levels of public involvement (Regan, Desvousges, and Creighton, 1990).

Perceived characteristics of repository risk are added to the regression in Model 2. Two dichotomous variables, MODERATE AMOUNT OF DREAD and HIGH AMOUNT OF DREAD, indicate the degree of dread the respondent expressed of the repository. Construction of these variables is defined in Table 6. Their coefficients indicate how much the intercept of the regression changes if the respondent is in either the moderate or high dread category instead of the low dread category. The coefficients for both dread variables are significant and positive for national and Nevada data in Model 2 and all subsequent models. Thus, respondents who indicate moderate or high dread of the repository have higher risk perceptions for the repository than those who have low dread. The coefficient for the high dread group is larger than for the moderate dread group, which also conforms to expectations. Similarly, MODERATE LIKELIHOOD and HIGH LIKELIHOOD indicate the respondents' expressions of the likelihood of large accidental releases of radiation from the repository. Both likelihood variables are also significant and positive. The strength of their contributions indicates a definite link between the perceived likelihood of radiation releases and the perceived risk of the repository.

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135% of national respondents and 32% of Nevada respondents fall into the moderate dread category. 9% of national respondents and 8% of Nevada respondents are in the high dread category.

240% of national respondents and 33% of Nevada respondents fall into the moderate likelihood category. 16% of national respondents and 22% of Nevada respondents are in the high likelihood category.
that the repository presents risks for future generations is also a positive and significant influence on perceived risk. We have not included future generations into the dread composite because the variable attempts to tap a different dimension of risk - the possible effects on subsequent generations. The different time dimension implied by this variable also influenced our decision to leave it as a separate variable.

In the national sample, the variable that measures respondents' belief that scientists understand the risks associated with a HLNW repository (SCIENTISTS UNDERSTAND THE RISKS) is negative and significant in Model 2, but becomes insignificant in other models when additional variables are introduced. This variable is negative but insignificant in all the models run on the Nevada data. The variable was a rough attempt to measure the "known" dimension of perceived risk that Slovic et al (1985) found to be important. The lack of significance in the model may reflect our inability to develop questions that adequately measure this risk characteristic rather than the importance of the characteristic on risk perception. Because of the time limitations in a telephone interview, it was not possible to pursue all risk characteristics with equal thoroughness.

Various attitudinal indicators are introduced to the regression in Model 3. Not surprisingly, the variable that indicates the respondent's aversion to nuclear power (NO NUKER) makes a large, positive, and significant contribution to risk perceptions in the national and Nevada samples in Model 3 and all subsequent models. Respondents who do not support nuclear power have higher risk perceptions for the repository than those who do. LIBERAL, which indicates the respondent's political persuasion, does not appear to be statistically significant in either the national or Nevada samples. ECONOMIC BENEFITS, the variable that measures the respondent's perception of the economic benefits associated with the repository tends to lower risk perceptions significantly. This variable has a stronger influence in the Nevada sample, which may reflect the greater overall optimism of at least some Nevadans about the possible economic benefits associated with the repository.

Model 4 includes common socioeconomic variables in the regression. The respondent's sex is a significant influence on risk perceptions in both the national and Nevada samples. Females tend to perceive the repository risks more seriously than males, all other things being equal. This finding is consistent with previous research about attitudes toward nuclear power in particular, and risks in general (Mitchell, 1984 and Desvougeses et al., 1990). Socioeconomic variables play a more important role in the formation of risk perceptions for the nation as a whole than for respondents from Nevada. In the national sample, the respondent's race and level of education are also significant variables at the .05 significance level. Non-whites tend to view the repository risks more seriously than whites, and each year of education lowers the respondent's risk perceptions. None of these variables are significant for the Nevada sample. The respondent's income, a variable included in many regression models, does not appear to be statistically significant for either the national or Nevada sample. This was also true for other model specifications that included income, which implies that the risk perceptions for these respondents are not influenced by income levels.

For the Nevada sample, Model 4 also includes two dichotomous variables, LINCOLN and NYE, which indicate whether or not the respondent is a resident of either of the two counties closest to the proposed Yucca Mountain site. Both of these variables are insignificant, which suggests that the risk perceptions of respondents in the two counties
nearest the site do not appear to be different from those of other Nevada residents in our sample.

Model 5 includes only the significant variables from Model 4 for each sample. The major differences in Model 5 between the samples are in the socioeconomic variables. The national model includes two more socioeconomic variables - race and education - than the Nevada model. Otherwise, the data indicates that respondents from the national sample and from the Nevada sample form risk perceptions very similarly. As implied by our conceptual model, attitudes about the repository and nuclear waste issues (TRUST IN THE FEDERAL GOVERNMENT, NO NUKER, and ECONOMIC BENEFITS), knowledge about nuclear waste issues (KNOWLEDGE OF HLNW), and risk characteristics (MODERATE AMOUNT OF DREAD, HIGH AMOUNT OF DREAD, MODERATE LIKELIHOOD, HIGH LIKELIHOOD, AND FUTURE RISKS) are important influences in the formation of risk perceptions. Location and socioeconomic factors appear to be less important. Experience, a component of the conceptual model, is not measured in our regression models because we were not able to include a measure into the telephone survey questionnaire. This was a priority area for the in-person surveys, which were not conducted because of budget constraints.

I X. Voting Models

The survey questionnaires asked Nevada respondents where they would vote to locate the HLNW repository. Their self-projected voting behavior is reported in Table 10. Approximately 24 percent of the Nevada respondents indicated that they would vote to locate the repository at Yucca Mountain. More than 40 percent said they would not vote to locate the repository at any of the three proposed sites. Nevada respondents were also asked if they would vote for the location of the repository at Yucca Mountain if their community would receive a large grant for improved public services as compensation. More than half, indeed almost 60 percent said they would not vote for the repository under those conditions.

We have developed a model to explain this voting behavior. The model contends that voting behavior is based on risk perception, perceived risk characteristics, attitudes toward the repository, and location. The model predicts the likelihood of an affirmative vote for the repository at Yucca Mountain. Because the dependent variable in the model is binary, that is, can take either one of two values, probit rather than ordinary least squares regression models are appropriate. In these models, the reported coefficient is proportional to the change in probability of voting for the location of the repository at Yucca Mountain that results from one unit of change in the independent variable. In Table 11, the dependent variable is the likelihood of voting for the location of the repository at Yucca Mountain.

In Model 1, we use a single explanatory variable, perceived risk, to predict the likelihood of voting for the location of the repository at Yucca Mountain. The significant chi-squared value and the number of correctly predicted votes as a percentage of actual votes indicate that the model is fairly successful.

3This relationship only holds at the mean values of the independent variables (Maddala, 1983).
In Model 2, variables that indicate the respondent's trust in the federal government to operate the repository safely and the respondent's knowledge of nuclear and repository issues are added to the equation. These variables were used to predict the risk variable, which presents a problem of simultaneity. To correct for this bias, we use the predicted value for perceived risk instead of the actual survey response in Model 2 and all subsequent voting models. Both the trust and knowledge variables have positive and significant influences on predicted voting behavior. Respondents who indicate trust in the federal government or exhibit a high level of knowledge about nuclear waste issues are more likely to vote for the repository than those who do not. The predicted risk variable is negative and significant, but has a smaller influence than the risk variable in Model 1.

Model 3 incorporates variables that indicate attitudes toward economic benefits and development. Not surprisingly, the variable that measures the respondent's expectations of the economic benefits resulting from the repository is positive and significant. Respondents with more optimistic expectations of economic benefits are more likely to vote for the repository. The variable that indicates whether or not the respondent has a pro-development view is positive but not statistically significant. As defined in Table 6, these were respondents who think that there is no limit to growth for industrialized nations and that people have the right to change the environment to meet their needs. All previously introduced variables retain a significant and fairly constant influence.

Model 4 considers the respondent's relative location to Yucca Mountain in the predictive equation. Dummy variables are created for residents of Lincoln and Nye counties, the counties closest to the proposed repository site. County residence exerts a positive influence on voting behavior for both counties. Respondents who live in either county are more likely to vote for the repository than those who live elsewhere in Nevada. The variable for Lincoln county is statistically significant.

A second dependent variable, the likelihood of voting for the location of the repository at Yucca Mountain if the respondent's community will receive a large grant to improve community services, is estimated in Table 12. The structure of each model is identical to that of the voting models discussed above. The chi-squared values and correct prediction percentages indicate that when a large grant for improved public services is linked to the repository's location, all models remain fairly good predictors of the likelihood of an affirmative vote. The contributions of some individual variables, however, differ from their roles in the simpler voting question. In particular, the variable that indicates a pro-development view (PRO-DEVELOPMENT VIEW) exerts a stronger and significant influence on voting behavior. Respondent's with this outlook are 40 percent more likely to vote for the repository with a grant than those who do not. On the other hand, knowledge about nuclear waste issues, becomes negative but statistically insignificant.

X. Discussion

People generally view a HLNW repository as a very undesirable facility that would have a strong negative effect on the lives and their community. Although the respondents show some recognition that the repository would have a economic benefit, the general opinion seems to be that the repository would be a bad economic bargain—the risks would outweigh the benefits. Nevada respondents in our sample show more recognition of potential benefits than the respondents from the rest of the nation, but a sizable majority of Nevada residents (almost three-fourths) do not think that their state is the safest place for the repository to be located. More than 60 percent of the respondents in our Nevada sample opposed the location of the repository at Yucca Mountain.
Our results on risk perception, which is the main focus of this paper, are very interesting in their assessment of both the magnitude and dimensions of the risks from the HLNW repository. Overall, our survey results produce a very negative image of the HLNW repository. The respondents rate the perceived risks from the HLNW repository more seriously than any other risks included in our study. The perceived risks to future generations from nuclear wastes the dreaded nature of the risks, and the perceived likelihood of a potential accident seem to be important explanations for this strong negative view of the repository.

Despite many efforts by the Department of Energy to reduce concerns about the HLNW repository in Nevada, the Nevada respondents in our survey perceive the risks to be very serious. Our results show that these perceptions are systematically related to the dreaded nature of the risks, and the likelihood of accidental releases of radiation. Lack of trust in the federal government to manage the repository also leads to higher levels of perceived risk. This pattern suggests that DOE's risk communication efforts have been ineffective for the respondents in our survey. Such results underscore the importance of two-way communication about risks; that is, information received from the public is as important as information given to the public (National Research Council, 1989; Desvouges and Smith, 1988). This type of communication has been notably absent in the Department of Energy's risk communication efforts. Our results are consistent with risk communication research (Covello, Slovic, and Winterfeldt, 1987) and other studies that examined trust (Kunreuther et al., 1990).

The negative view of the HLNW repository and the concerns about its safety seem consistent with the current opposition to the repository in Nevada. As Slovic (1987) suggests, stronger negative perceptions also have a potential for serious "ripple effects." Socioeconomic impacts can be associated with even minor mishaps because concerns may ripple through decisions about vacations, retirement, or industrial location. Because of the potential for ripple effects, some attempt to systematically monitor risk perceptions over time for a panel of respondents appears to be a worthwhile endeavor. With its long-term aspects, the nuclear waste issue would be an ideal context for such a panel study.
XI. References


Figure 1

Number of times read or heard about high-level nuclear wastes in past 3 months

<table>
<thead>
<tr>
<th>Frequency</th>
<th>National</th>
<th>Nevada</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 times</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>5 to 10 times</td>
<td>43</td>
<td>38</td>
</tr>
<tr>
<td>more than 10 times</td>
<td>17</td>
<td>35</td>
</tr>
</tbody>
</table>
Figure 2

"Which method for disposing of HLW is being considered most seriously today in the United States?"

<table>
<thead>
<tr>
<th>Method</th>
<th>National</th>
<th>Nevada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put them in the ocean floor</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Bury them underground</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Shoot them into space</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Don't know</td>
<td>19</td>
<td>11</td>
</tr>
</tbody>
</table>

Percent of Respondents
Figure 3

"How long do you think an HLNW repository will store wastes?"

<table>
<thead>
<tr>
<th>Duration</th>
<th>National</th>
<th>Nevada</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 10 years</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>10 to 100 years</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>101 to 1000 years</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>more than 1000 years</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>don't know</td>
<td>27</td>
<td>22</td>
</tr>
<tr>
<td>Sources of Pollution</td>
<td>How Seriously Rated</td>
<td>% of National Sample</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>GARBAGE FROM LANDFILLS</td>
<td>1 not at all serious</td>
<td>3.6</td>
</tr>
<tr>
<td>AIR POLLUTION FROM CARS AND FACTORIES</td>
<td>1 not at all serious</td>
<td>2.1</td>
</tr>
<tr>
<td>RADIOACTIVE WASTES FROM NUCLEAR POWER PLANTS</td>
<td>1 not at all serious</td>
<td>5.2</td>
</tr>
<tr>
<td>WATER POLLUTION FROM TOXIC CHEMICALS</td>
<td>1 not at all serious</td>
<td>1.6</td>
</tr>
<tr>
<td>ACID RAIN FROM POWER PLANTS</td>
<td>1 not at all serious</td>
<td>4.0</td>
</tr>
<tr>
<td>RADIATION FROM NUCLEAR WEAPONS TESTING</td>
<td>1 not at all serious</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>10.8</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>11.2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>10 very serious</td>
<td>13.3</td>
</tr>
<tr>
<td>Average Rating</td>
<td>6.1</td>
<td>5.4</td>
</tr>
</tbody>
</table>

1 Respondents in the national sample were not asked to rate the seriousness of radiation from nuclear weapons testing.
### Table 2: Respondents' Overall Views of the Repository

"A repository is the best way to permanently store high-level nuclear wastes."

<table>
<thead>
<tr>
<th></th>
<th>NEVADA SAMPLE (%)</th>
<th>NATIONAL SAMPLE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRONGLY AGREE</td>
<td>7.4</td>
<td>8.8</td>
</tr>
<tr>
<td>AGREE</td>
<td>45.5</td>
<td>39.9</td>
</tr>
<tr>
<td>DISAGREE</td>
<td>19.5</td>
<td>18.8</td>
</tr>
<tr>
<td>STRONGLY DISAGREE</td>
<td>4.8</td>
<td>7.8</td>
</tr>
<tr>
<td>DON'T KNOW</td>
<td>22.3</td>
<td>24.2</td>
</tr>
</tbody>
</table>

"Each region of the country should have a repository."

<table>
<thead>
<tr>
<th></th>
<th>NEVADA SAMPLE (%)</th>
<th>NATIONAL SAMPLE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRONGLY AGREE</td>
<td>16.3</td>
<td>12.0</td>
</tr>
<tr>
<td>AGREE</td>
<td>39.8</td>
<td>33.9</td>
</tr>
<tr>
<td>DISAGREE</td>
<td>30.4</td>
<td>32.1</td>
</tr>
<tr>
<td>STRONGLY DISAGREE</td>
<td>8.5</td>
<td>17.2</td>
</tr>
<tr>
<td>DON'T KNOW</td>
<td>4.4</td>
<td>4.7</td>
</tr>
</tbody>
</table>

"Nevada is the safest place in the United States for the repository."

<table>
<thead>
<tr>
<th></th>
<th>NEVADA SAMPLE (%)</th>
<th>NATIONAL SAMPLE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRONGLY AGREE</td>
<td>2.9</td>
<td>NA</td>
</tr>
<tr>
<td>AGREE</td>
<td>20.5</td>
<td>NA</td>
</tr>
<tr>
<td>DISAGREE</td>
<td>40.8</td>
<td>NA</td>
</tr>
<tr>
<td>STRONGLY DISAGREE</td>
<td>22.1</td>
<td>NA</td>
</tr>
<tr>
<td>DON'T KNOW</td>
<td>12.9</td>
<td>NA</td>
</tr>
</tbody>
</table>

"Nevada is the best place for the repository because the nuclear weapons test site is already here."

<table>
<thead>
<tr>
<th></th>
<th>NEVADA SAMPLE (%)</th>
<th>NATIONAL SAMPLE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRONGLY AGREE</td>
<td>3.6</td>
<td>NA</td>
</tr>
<tr>
<td>AGREE</td>
<td>27.0</td>
<td>NA</td>
</tr>
<tr>
<td>DISAGREE</td>
<td>42.3</td>
<td>NA</td>
</tr>
<tr>
<td>STRONGLY DISAGREE</td>
<td>20.0</td>
<td>NA</td>
</tr>
<tr>
<td>DON'T KNOW</td>
<td>6.5</td>
<td>NA</td>
</tr>
</tbody>
</table>

"A repository would stimulate economic growth in nearby communities."

<table>
<thead>
<tr>
<th></th>
<th>NEVADA SAMPLE (%)</th>
<th>NATIONAL SAMPLE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRONGLY AGREE</td>
<td>6.2</td>
<td>3.3</td>
</tr>
<tr>
<td>AGREE</td>
<td>38.8</td>
<td>23.6</td>
</tr>
<tr>
<td>DISAGREE</td>
<td>40.2</td>
<td>48.1</td>
</tr>
<tr>
<td>STRONGLY DISAGREE</td>
<td>6.7</td>
<td>17.0</td>
</tr>
<tr>
<td>DON'T KNOW</td>
<td>7.5</td>
<td>8.0</td>
</tr>
</tbody>
</table>

"The economic benefits to nearby communities from a repository would greatly outweigh the risks."

<table>
<thead>
<tr>
<th></th>
<th>NEVADA SAMPLE (%)</th>
<th>NATIONAL SAMPLE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRONGLY AGREE</td>
<td>3.6</td>
<td>2.4</td>
</tr>
<tr>
<td>AGREE</td>
<td>24.5</td>
<td>22.7</td>
</tr>
<tr>
<td>DISAGREE</td>
<td>49.1</td>
<td>49.0</td>
</tr>
<tr>
<td>STRONGLY DISAGREE</td>
<td>14.6</td>
<td>19.2</td>
</tr>
<tr>
<td>DON'T KNOW</td>
<td>7.8</td>
<td>6.5</td>
</tr>
<tr>
<td>Sources of Risks</td>
<td>Accident at Home</td>
<td>Accident on the Job</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>How Serious Rated</td>
<td>% of Nat'l Sample</td>
<td>% of Nevada sample</td>
</tr>
<tr>
<td>1 not at all serious</td>
<td>13.6</td>
<td>20.4</td>
</tr>
<tr>
<td>2</td>
<td>16.0</td>
<td>15.9</td>
</tr>
<tr>
<td>3</td>
<td>15.3</td>
<td>14.8</td>
</tr>
<tr>
<td>4</td>
<td>9.6</td>
<td>7.4</td>
</tr>
<tr>
<td>5</td>
<td>21.6</td>
<td>19.9</td>
</tr>
<tr>
<td>6</td>
<td>5.4</td>
<td>6.0</td>
</tr>
<tr>
<td>7</td>
<td>5.5</td>
<td>4.3</td>
</tr>
<tr>
<td>8</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>9</td>
<td>3.2</td>
<td>1.0</td>
</tr>
<tr>
<td>10 very serious</td>
<td>4.9</td>
<td>4.8</td>
</tr>
</tbody>
</table>

**Average Rating**: 4.3 | 3.9 | 3.9 | 3.6 | 5.2 | 4.3 | 5.8 | 5.2 | 6.2 | 5.6 | NA | 4.7 | NA | 5.9

**Actual Survey Question**: On a scale form 1 to 10, with 1 being not at all serious and 10 being very serious, how serious are the risks you personally face each year from...

1 Respondents in the national sample were asked about the risks from a high-level repository if it were located 100 miles from their homes

2 Respondents in the Nevada sample were asked about the risks from a high-level repository if it were located at Yucca Mountain, which for most residents of Nevada, is approximately 100 miles from their homes

3 Respondents in the national sample were not asked about the risks from a nuclear weapons testing site

4 Respondents in the national sample were not asked about the risks from the transportation of high-level nuclear wastes
<table>
<thead>
<tr>
<th>RISK</th>
<th>ACCIDENT WOULD INVOLVE CERTAIN DEATH</th>
<th>ACCIDENT WOULD KILL MANY PEOPLE AT ONE TIME</th>
<th>SCIENTISTS UNDERSTAND THE RISKS</th>
<th>PEOPLE LIVING NEAR THE REPOSITORY COULD CONTROL THE RISKS</th>
<th>PEOPLE WOULD DREAD LIVING NEAR THE REPOSITORY</th>
<th>REPOSITORY POSES A SERIOUS RISK FOR FUTURE GENERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of National Sample</td>
<td>% of Nevada Sample</td>
<td>% of National Sample</td>
<td>% of National Sample</td>
<td>% of National Sample</td>
<td>% of National Sample</td>
</tr>
<tr>
<td>strongly agree</td>
<td>24.3</td>
<td>24.3</td>
<td>28.7</td>
<td>26.8</td>
<td>13.2</td>
<td>9.0</td>
</tr>
<tr>
<td>agree</td>
<td>49.6</td>
<td>51.6</td>
<td>53.9</td>
<td>54.3</td>
<td>50.3</td>
<td>49.8</td>
</tr>
<tr>
<td>disagree</td>
<td>23.4</td>
<td>21.1</td>
<td>15.7</td>
<td>16.2</td>
<td>29.1</td>
<td>34.0</td>
</tr>
<tr>
<td>strongly disagree</td>
<td>2.7</td>
<td>3.1</td>
<td>1.7</td>
<td>2.8</td>
<td>7.5</td>
<td>7.2</td>
</tr>
</tbody>
</table>

**Actual Survey Question:** I am now going to read some statements about the risks from a high-level nuclear waste repository in the United States. Please tell me the extent to which you agree with each.
<table>
<thead>
<tr>
<th>EVENT</th>
<th>ACCIDENT AT THE REPOSITORY</th>
<th>REPOSITORY WATERS LEAKING INTO GROUNDWATER</th>
<th>WASTES BEING TRANSPORTED TO REPOSITORY</th>
<th>TERRORIST SABOTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of National Sample</td>
<td>% of Nevada Sample</td>
<td>% of National Sample</td>
<td>% of Nevada Sample</td>
</tr>
<tr>
<td>very likely</td>
<td>21.5</td>
<td>23.7</td>
<td>35.7</td>
<td>39.3</td>
</tr>
<tr>
<td>somewhat likely</td>
<td>41.1</td>
<td>38.0</td>
<td>39.1</td>
<td>34.8</td>
</tr>
<tr>
<td>somewhat unlikely</td>
<td>23.9</td>
<td>23.6</td>
<td>16.8</td>
<td>15.6</td>
</tr>
<tr>
<td>very unlikely</td>
<td>13.6</td>
<td>14.6</td>
<td>8.4</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Actual Survey Question: The federal government is planning to make the repository as safe as possible. But there is always some chance that radiation could be released. I'm going to read a list of various ways that a large amount of radiation could be released into the environment from a repository. I'd like you to think about how likely or unlikely each might be. During the first (5 or 20) years a repository would be open, how likely do you think it is that a large amount of radiation could be released from...
<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERCEIVED RISK FROM HLNW REPOSITORY</strong></td>
<td>A variable that indicates the seriousness of respondent's perceived risk from the location of a HLNW repository near his home. In the national survey, respondents were told that the repository would be located 100 miles from their home. In Nevada, the repository would be located at Yucca Mountain, which is approximately 100 miles from most population centers in that state. Response is expressed on a scale of 1 to 10, with 1 being not at all serious and 10 being very serious. In the Risk Perception Models, this is the dependent variable.</td>
</tr>
<tr>
<td><strong>KNOWLEDGE OF HLNW</strong></td>
<td>A scalar variable with values ranging from 0 to 3 that indicates how many of the following questions that the respondent answered correctly:</td>
</tr>
<tr>
<td></td>
<td>• &quot;Do you think most of the high-level wastes are now stored...&quot;</td>
</tr>
<tr>
<td></td>
<td>a. at the power plants that produced them</td>
</tr>
<tr>
<td></td>
<td>b. at regional processing centers</td>
</tr>
<tr>
<td></td>
<td>c. or, at one temporary storage site</td>
</tr>
<tr>
<td></td>
<td>d. don't know</td>
</tr>
<tr>
<td></td>
<td>• &quot;Which method for disposing of high-level nuclear wastes is the option being considered most seriously in the United States today?&quot;</td>
</tr>
<tr>
<td></td>
<td>a. putting the wastes on the ocean floor</td>
</tr>
<tr>
<td></td>
<td>b. burying them deep underground</td>
</tr>
<tr>
<td></td>
<td>c. or, shooting them into space</td>
</tr>
<tr>
<td></td>
<td>d. don't know</td>
</tr>
<tr>
<td></td>
<td>• &quot;Do you think the high-level nuclear waste repository will be designed to store wastes for...&quot;</td>
</tr>
<tr>
<td></td>
<td>a. 1 to 10 years</td>
</tr>
<tr>
<td></td>
<td>b. 10 to 100 years</td>
</tr>
<tr>
<td></td>
<td>c. 100 to 1,000 years</td>
</tr>
<tr>
<td></td>
<td>d. longer than 1,000 years</td>
</tr>
<tr>
<td></td>
<td>e. don't know</td>
</tr>
<tr>
<td><strong>TRUST IN FEDERAL GOVERNMENT</strong></td>
<td>A variable that the level of trust that the respondent places in federal government officials to make the HLNW as safe a possible. Response is expressed on a scale from 1 to 10, with 1 meaning no trust and 10 meaning complete trust.</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>SCIENTISTS UNDERSTAND RISKS</strong></td>
<td>A dummy variable that indicates respondent's agreement with the following statement:</td>
</tr>
<tr>
<td></td>
<td>• &quot;Scientists adequately understand the risks from a repository.&quot;</td>
</tr>
<tr>
<td></td>
<td>1 = strongly agree</td>
</tr>
<tr>
<td></td>
<td>0 = all other responses</td>
</tr>
<tr>
<td><strong>MODERATE AMOUNT OF DREAD</strong></td>
<td>A dummy variable created to measure respondent's dread of living near a HLNW repository.</td>
</tr>
<tr>
<td></td>
<td>• 1 = strongly agreed with 1 or 2 of the following statements</td>
</tr>
<tr>
<td></td>
<td>• 0 = did not strongly agree with any of the following statements</td>
</tr>
<tr>
<td></td>
<td>&quot;An accident at a repository usually would involve certain death&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;An accident at a repository would kill many people.&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;People would dread living near a repository.&quot;</td>
</tr>
<tr>
<td><strong>HIGH AMOUNT OF DREAD</strong></td>
<td>A dummy variable created to measure respondent's dread of living near a HLNW repository.</td>
</tr>
<tr>
<td></td>
<td>• 1 = strongly agreed with 3 of the following statements</td>
</tr>
<tr>
<td></td>
<td>• 0 = did not strongly agree with 3 of the following statements</td>
</tr>
<tr>
<td></td>
<td>&quot;An accident at a repository usually would involve certain death&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;An accident at a repository would kill many people.&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;People would dread living near a repository.&quot;</td>
</tr>
<tr>
<td><strong>MODERATE LIKELIHOOD</strong></td>
<td>A dummy variable created to measure how likely respondent considered large accidental releases of radiation from certain sources associated with a repository.</td>
</tr>
<tr>
<td></td>
<td>• 1 = respondent thought that 1 or 2 of the following radiation sources would very likely release large amounts of radiation</td>
</tr>
<tr>
<td></td>
<td>• 0 = respondent did not think that any of the following radiation sources would very likely release large amounts of radiation</td>
</tr>
<tr>
<td></td>
<td>&quot;An accident happening at a repository.&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;The wastes leaking into underground water.&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;The wastes being transported to a repository.&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;Terrorist sabotage at a repository.&quot;</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| HIGH LIKELIHOOD      | A dummy variable created to measure how likely respondent considered large accidental releases of radiation from certain sources associated with a repository.  
• 1=respondent thought that 3 or 4 of the following radiation sources would very likely release large amounts of radiation  
• 0=respondent did not think that 3 or 4 of the following radiation sources would very likely release large amounts of radiation  
• "An accident happening at a repository."  
• "The wastes leaking into underground water."  
• "The wastes being transported to a repository."  
• "Terrorist sabotage at a repository."                                                                                                                                                                    |
| FUTURE RISK          | A dummy variable that indicates whether or not respondent strongly agrees with the statement:  
• "A repository would pose serious risks for future generations in Nevada."  
  1=strongly agree  
  0=all other responses                                                                                                                                                                                                                                         |
| NO NUKER             | A dummy variable that indicates whether or not respondent is in favor of nuclear power  
• 1=does not favor nuclear power  
• 0=favors nuclear power                                                                                                                                                                                                                                       |
| LIBERAL              | A dummy variable that reports respondent’s self-described political persuasion.  
• 1=very liberal or somewhat liberal  
• 0=all other responses                                                                                                                                                                                                                                      |
| ECONOMIC BENEFITS    | A scalar variable that indicates how many of the following statements that the respondent strongly agreed with:  
• "A repository would stimulate economic growth in nearby communities"  
• "The economic benefits to nearby communities from a repository would greatly outweigh the risks."                                                                                                                                                                     |
<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>A variable that reports the midpoint of respondent's self-reported age grouping.</td>
</tr>
<tr>
<td>SEX</td>
<td>A dummy variable that indicates respondent's sex.</td>
</tr>
<tr>
<td>RACE</td>
<td>A dummy variable that indicates respondent's race.</td>
</tr>
<tr>
<td>CHILDRREN</td>
<td>A variable that reports the number of children in the respondent's household under age 12.</td>
</tr>
<tr>
<td>INCOME</td>
<td>A variable that reports midpoint of respondent's self-reported income grouping.</td>
</tr>
<tr>
<td>EDUCATION</td>
<td>A variable that reports the approximate number of years of education completed by respondent.</td>
</tr>
<tr>
<td>PRO-DEVELOPMENT VIEW</td>
<td>A dummy variable that indicates that respondent either strongly agreed or agreed with both of the following statements:</td>
</tr>
<tr>
<td></td>
<td>- &quot;People have the right to change the environment to meet their needs.&quot;</td>
</tr>
<tr>
<td></td>
<td>- &quot;There are no limits to growth for advanced countries like the United States.&quot;</td>
</tr>
<tr>
<td></td>
<td>1=strongly agreed or agreed with both statements</td>
</tr>
<tr>
<td></td>
<td>0=all other responses</td>
</tr>
<tr>
<td>LINCOLN</td>
<td>A dummy variable that indicates whether or not Nevada respondent is a resident of Lincoln County.</td>
</tr>
<tr>
<td></td>
<td>1=resident</td>
</tr>
<tr>
<td></td>
<td>0=nonresident</td>
</tr>
<tr>
<td>NYE</td>
<td>A dummy variable that indicates whether or not Nevada respondent is a resident of Nye County.</td>
</tr>
<tr>
<td></td>
<td>1=resident</td>
</tr>
<tr>
<td></td>
<td>0=nonresident</td>
</tr>
</tbody>
</table>
### TABLE 6. DESCRIPTION OF VARIABLES (CONTINUED)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOTE</td>
<td>A dummy variable that indicates whether or not respondent would vote for a repository to be located at Yucca Mountain. In one voting model, VOTE is the dependent variable.</td>
</tr>
<tr>
<td>VOTE WITH GRANT</td>
<td>A dummy variable that indicates whether or not respondent would vote for a repository to be located at Yucca Mountain if his community would receive a large grant for improved public services as compensation for the repository's location. In one voting model VOTE WITH GRANT is the dependent variable.</td>
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<td>HIGH LIKELIHOOD</td>
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<td></td>
<td>FUTURE RISK</td>
</tr>
<tr>
<td>E</td>
<td></td>
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<tr>
<td>L</td>
<td>LINCLOLN</td>
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<td>individual's location relative to repository</td>
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<td>All respondents in the national sample are assumed to live within 100 miles of repository</td>
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<td>Model 1</td>
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Significance levels for t-values using two-tailed tests:

<p>| | |</p>
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<td>.05</td>
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<td>.10</td>
<td>±1.645</td>
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1 Unstandardized coefficients reported
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<th>MODEL 1</th>
<th>MODEL 2</th>
<th>MODEL 3</th>
<th>MODEL 4</th>
<th>MODEL 5</th>
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<td>.399</td>
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Significance levels for t-values using two-tailed tests:

- .01 ± 2.575
- .05 ± 1.960
- .10 ± 1.645

\(^1\) Unstandardized coefficients reported for these variables
Table 10  Voting Behavior

"If a vote were held today on building a permanent repository, would you vote for locating a repository at..."

<table>
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<th>Proposed Repository Site</th>
<th>Percent of Nevada Respondents in Favor of Locating Repository</th>
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</thead>
<tbody>
<tr>
<td>Hanford, Washington</td>
<td>4.2</td>
</tr>
<tr>
<td>Yucca Mountain, Nevada</td>
<td>24.3</td>
</tr>
<tr>
<td>Deaf Smith County, Texas</td>
<td>18.6</td>
</tr>
<tr>
<td>None of the above</td>
<td>44.0</td>
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<tr>
<td>Don't know</td>
<td>9.0</td>
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</table>

"Suppose instead your community were offered a large grant for improved public services like schools, parks, or hospitals to have the repository located at Yucca Mountain. Would you vote to locate the repository under these terms?"

<table>
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<th>Vote</th>
<th>Percent</th>
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<tr>
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<td>No</td>
<td>58.7</td>
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<tr>
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<td><strong>coefficients</strong> (t-values)</td>
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<td>CHI-SQUARED</td>
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<td></td>
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</tr>
<tr>
<td>NYE</td>
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Significance levels for t-values using two-tailed tests:

- .01 ±2.575
- .05 ±1.960
- .10 ±1.645
<table>
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<th>Table 12: Voting Behavior Model</th>
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<td><strong>Coefficients (t-values)</strong></td>
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<td>PREDICTED AS PERCENTAGE OF ACTUAL</td>
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<td>PRO-DEVELOPMENT VIEW</td>
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<td>LINCOLN</td>
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<td>NYE</td>
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Significance levels for t-values using two-tailed tests:

- .01 ± 2.575
- .05 ± 1.960
- .10 ± 1.645