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Panhandle Residents' Views Of High-level Nuclear Waste Storage

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PANHANDLE RESIDENTS' VIEWS OF
HIGH-LEVEL NUCLEAR WASTE STORAGE

May 1985

Julie Brody, Ph.D., Project Director

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PREFACE

The three surveys summarized in this report were conducted by TDA in cooperation with the Office of the Governor. Funding was provided by the Texas Nuclear Waste Programs Office, under a federal grant from the Nuclear Waste Fund. The fund was established by Congress to finance costs of high-level nuclear waste management, including state evaluation of U.S. Department of Energy site-selection studies.

A panel of academic consultants has assisted TDA in assessing socioeconomic effects of the proposed nuclear waste repository. Dr. Stanislav Kasl, of Yale University Medical School, was particularly helpful in reviewing plans for this research. Dr. Kasl previously served on the Behavioral Effects Task Group of the President's Commission on the Accident at Three Mile Island.

Steve Frishman, director of the Texas Nuclear Waste Programs Office, provided invaluable assistance in planning these studies. Judy K. Fleishman supervised data collection. She and her crew of energetic and dedicated interviewers deserve much of the credit for the exceptionally high participation rate obtained in this study. Interviewers for the study were Paula Alvarez, Jeanne Andersen, Jim Dumerauf, Christine Galavotti, Beth de Guzman, Laura Hernandez, Hobie Hukill, Karen King, David Knowlton, Claudia Pichardo, Greg Sampson, Javier E. Solis, Susan Swisher, Vicki Szukalla, and Shirley Weiler. Rachel Hilton provided skillful assistance in preparation of research materials, including this report.

TDA also thanks the many people of the High Plains who took time to share their thoughtful comments about how the nuclear waste repository program is affecting their lives.

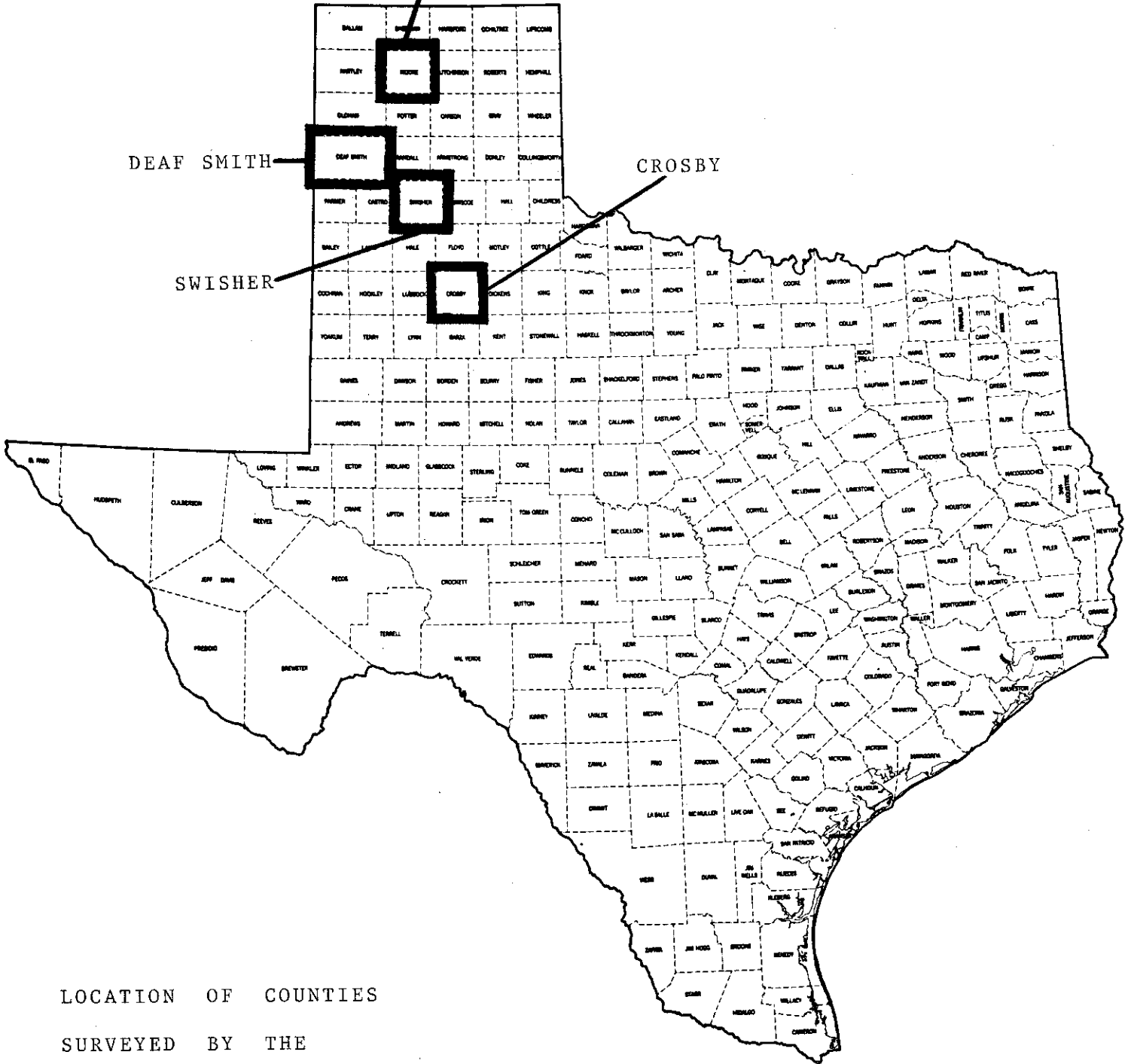
Julie Brody
Project Director
May, 1985

MOORE

DEAF SMITH

CROSBY

SWISHER



LOCATION OF COUNTIES
 SURVEYED BY THE
 TEXAS DEPARTMENT OF AGRICULTURE

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EXECUTIVE SUMMARY

Deaf Smith and Swisher counties, in the Texas Panhandle, are being considered by the U.S. Department of Energy as possible sites for the first national high-level nuclear waste repository. Deaf Smith County is tentatively ranked as one of three finalists for the repository, and Swisher County could still be chosen.

The Texas Department of Agriculture, in cooperation with the Governor, surveyed 841 residents of the High Plains in the summer of 1984 to document their views about potential socioeconomic effects of a repository in Texas. Telephone interviews were conducted in the Deaf Smith and Swisher county areas, surrounding the proposed sites, and in the Crosby and Moore county areas, two other Panhandle counties. TDA also conducted a specialized survey of farm operators in Deaf Smith and Swisher counties.

Major findings of the telephone surveys:

1. Residents of all four survey areas strongly oppose putting a high-level nuclear waste repository in Texas. Four out of five residents of Deaf Smith and Swisher counties said they would not allow construction of the repository in their county, if it were up to them. Approximately the same proportion of residents of Crosby and Moore counties said they would not allow construction of the repository in the Texas Plains.
2. Opposition to building a high-level nuclear waste repository in Texas is broad-based; diverse groups of Panhandle residents share the same views.
3. Concern about health and the environment is the most important factor in opposition to the nuclear repository. Panhandle residents think the repository is likely to pollute their water, soil and air and to lead to health problems for local residents and for repository workers. Moore and Crosby area residents believe health effects will extend beyond the repository site, affecting their own communities.

4. Panhandle residents also think a nuclear repository would hurt the economy and community life of their area, and these expectations about socioeconomic effects are important factors in overall attitudes towards the repository.
 - a. Survey participants expressed strongest concern about effects of the repository on agriculture. Eighty percent of Deaf Smith and Swisher area residents, and 68 percent of Moore and Crosby area residents expect farmland values in their county to decline if a repository is built in Texas.
 - b. Sixty percent of Deaf Smith and Swisher residents think the value of their own homes will go down if the repository is built in their county.
 - c. Panhandle residents do not think the repository would lead to an increase in industrial or commercial development in their county, but a slim majority of Deaf Smith and Swisher residents do believe the repository would create more jobs in their county.
 - d. Business owners are just as pessimistic as others about the socioeconomic effects of a nuclear waste repository in Texas.
5. While Panhandle residents oppose nuclear development in their area, they support new development that is consistent with the present economic base in agriculture and natural resources.
6. Although a substantial number of Panhandle residents have some exposure to U.S. Department of Energy information programs, relatively few of them have participated actively in the DOE public hearings process. Telephone interviews reached many people who have not been heard at DOE meetings. The large Hispanic population of Deaf Smith and Swisher counties has been under-represented in the DOE site-selection process.

Major findings of the mail survey of farm operators:

1. More than a third of the farmers in Deaf Smith and Swisher counties produce hybrid seeds, health foods or crops sold directly to consumers. Because production of these crops is broad-based, any effects of a

repository on these particularly vulnerable markets could potentially have wide-ranging effects in the site areas.

2. Farmers believe the DOE site-selection process has already affected them.
 - a. Nearly half said they believe the value of their own land has decreased because of the repository.
 - b. More than two-thirds said they think that landowners next to the proposed repository sites have already been hurt financially by the DOE site-selection process.
 - c. Thirteen percent said the repository has already prompted them to change their personal or financial plans. Some farmers said they are unable to sell land or mineral rights. Others have postponed plans to buy land or equipment or maintain existing investments.
3. Farmers expressed greatest concern about effects of the repository on marketability of agricultural produce, land and mineral values, and water availability. Four-fifths expect their crops to be harder to sell if a repository is built in their county, 84 percent think their land values will go down and 73 percent expect a decrease in water available for irrigation.
4. Many farmers are dissatisfied with the federal nuclear waste program. Eighty-three percent said the site-selection process is not fair, and approximately three-fourths said they don't trust the federal government to build a safe repository.

INTRODUCTION

Nuclear power plants have been generating electricity in the United States for 25 years. They have also been generating highly radioactive wastes--materials so dangerous that they must be isolated from the environment for at least 10,000 years. The U.S. Department of Energy (DOE) estimates that there were 10,000 tons of highly radioactive spent fuel in temporary storage in 1981, and that by the year 2000 there will be approximately 40,000 tons of spent fuel from commercial power plants (Hodel, 1984). Defense programs also produce high-level nuclear wastes that are now in temporary storage.

The federal government has taken responsibility for safe and permanent disposal of high-level nuclear wastes from both defense and commercial sources. In 1982, Congress enacted the Nuclear Waste Policy Act (NWPA) to set procedures for establishing a national repository for these wastes. NWPA details an elaborate site-selection process and schedule. Selection of the site for the first repository is set for 1991, and the repository is to open in 1998.

Texas is under consideration as a possible repository site because of the thick salt deposits found deep in the Permian Basin of West Texas. In December 1984, the Department of Energy identified two potential sites in the Texas Panhandle: one in Deaf Smith County and another in Swisher County. The Deaf Smith County site is near the Oldham County line, approximately 7 miles southwest of Vega and 20 miles northwest of Hereford. The Swisher County site is approximately 6 miles northeast of Tulia. Earlier last year, the Department of Energy had tentatively identified a site in Deaf Smith County two miles west of the site presently being considered and a site in Swisher County one mile southwest of the current site.

The two Texas sites are among nine being considered nationwide. Other sites are located in Louisiana, Mississippi, Nevada, Utah and Washington.

In December 1984, the Department of Energy tentatively ranked Deaf Smith County, along with sites in Washington and Nevada, as one of three finalists for the first high-level waste repository. Swisher County also remains as a possible site for future consideration. States and the public were invited to review and comment on DOE Draft Environmental Assessments that propose this ranking. When

final environmental assessments are complete, DOE will name three sites for site characterization, a more exhaustive study period involving extensive drilling at the proposed sites. More detailed discussion of the site selection process is available in the October, 1984 report of the Texas House-Senate Joint Study Committee on Hazardous Waste Disposal.

Anticipating that choosing a site for the repository would be highly controversial, Congress mandated consultation between the federal government and the state and local governments and individual citizens in the areas being considered. The Nuclear Waste Policy Act encourages public participation in the site-selection process, and it requires extensive study of the potential effects of the repository on the host state and local communities. The act also gives states the opportunity to veto location of a repository within their boundaries, although the veto can be overridden by a majority vote of both houses of Congress.

In addition to this veto option, the State of Texas also has the responsibility to negotiate mitigation for Texas communities affected by a repository or by repository studies, and to assure compliance with the Nuclear Waste Policy Act during the site-selection process. In order to meet these responsibilities, the State has monitored DOE's nuclear waste repository program and coordinated participation by state agencies and Texas citizens. The Texas Nuclear Waste Programs Office represents the Governor and serves as liaison between the State of Texas and the Department of Energy. The Texas Legislature and several state agencies, including the Texas Department of Agriculture, have also contributed to the state review process. The state has held public hearings, filed detailed official comments on DOE documents and initiated research to document Texas' perspective on environmental and socioeconomic effects of the proposed repository.

As part of the state's research, the Texas Department of Agriculture, in cooperation with the Governor's Nuclear Waste Programs Office, conducted a telephone survey of residents of the Deaf Smith and Swisher county areas and of the Moore and Crosby county areas. TDA also conducted a mail survey of farm operators in Deaf Smith and Swisher counties. The surveys were conducted during the summer of 1984.

Purpose of Surveys

This research serves three purposes. First, it provides an additional avenue for public participation in the site-selection process. Public hearings conducted by the Department of Energy and by the Governor's Office have been important opportunities for citizens and state and local officials to state their views about the proposed repository. However, the hearings often were held during work hours or in inconvenient locations, which may have limited participation. In addition, some people may feel hesitant to speak out at a formal hearing in front of a large audience. The telephone survey enabled the state to assess the opinions of a representative cross-section of the community, including both residents who did attend public hearings and those who did not. The mail survey provides a closer look at the views of a broad spectrum of farm operators in the site counties.

A second purpose of the survey is to document local expectations about the socioeconomic effects of the repository. These expectations are, in themselves, an important effect of the nuclear waste repository program. Prospects for the future of potential site communities may affect current property values and investment decisions that have an economic impact on these communities throughout the site-selection process. A recent National Academy of Sciences report about the high-level nuclear waste repository said, "During the decision-making period, residents in the vicinity of the candidate sites are likely to place less emphasis on property maintenance (Miller, 1971), properties will be hard to sell (Corrigan, 1976), and economic development is often hampered" (NAS, 1984, pp. 89-90). In addition, uncertainty or fear about the repository may create stress, influencing health and the quality of life in areas being considered as possible repository sites. The National Academy of Sciences concludes, "The site-selection procedure mandated in the Nuclear Waste Policy Act of 1982 will impose adverse effects (e.g. community conflict, speculation) on the candidate host sites as well as on the site finally selected." The telephone survey is part of TDA's effort to document effects of the selection process that occur before a final decision is made.

A third purpose of the survey is to establish baseline data for monitoring future socioeconomic change throughout the course of the nuclear waste repository program. This

survey cannot provide a "true" baseline, since some effects of the nuclear repository program had occurred before the survey began, but it does provide a starting point for future study. Interviews conducted in the Moore and Crosby county areas also allow for comparisons between these Panhandle communities, which are more distant from the repository sites, and the Deaf Smith and Swisher county areas immediately surrounding the sites. If Texas remains on the list of possible repository sites during the coming years, information collected now will be critical to state efforts to document effects of the site-selection process. If Texas is not chosen, results of this survey could be useful in documenting whether any early effects of the site-selection process are reversed when the federal government moves out. For example, any effects on land values might evaporate quickly if Texas is dropped from the site list; but if the selection process encourages or discourages major investment in the site area, this effect might be more persistent.

In order to meet these three goals--giving local residents a greater voice in the site-selection process, documenting current concerns about social and economic effects and laying the groundwork for ongoing monitoring on this issue--interviewers asked High Plains residents how a nuclear waste repository would change their lives. The survey answers basic questions about whether Panhandle residents are for or against construction of a high-level nuclear waste repository in Texas. It also provides more detailed information about how they believe a nuclear repository would affect the economic and social profile of their communities, about their concerns for health and environmental effects of the repository and about their knowledge about the nuclear waste repository program.

Characteristics of Survey Counties

The counties included in the study are located in the Texas Plains. All four are nonmetropolitan areas with a substantial economic base in agriculture, particularly in cattle and feed grains. Deaf Smith and Swisher counties are major centers for hybrid seed production and cattle feeding and for production of wheat, sorghum, cotton, corn, sugarbeets, potatoes and other vegetables and a number of other crops. They are also home to a variety of agriculture-related businesses, including feedlots, seed companies, meat-packers, a sugar refinery, an agricultural implements manufacturing company, a major health-food supplier and other food processing plants.

Deaf Smith County, located about 20 miles southwest of Amarillo, had a population of about 21,165 in 1980, with its county seat and major population center in Hereford. Two-thirds of the county is considered "prime" farmland by the U.S. Department of Agriculture. The county produced \$248,133,000 in cash receipts from crops and livestock in 1983. Deaf Smith ranks second in the state in agricultural production.

Swisher County, located between Amarillo and Lubbock, had a population of 9,723 in 1980. Like Deaf Smith, it ranks among the top ten in the state in agricultural production. Swisher County reported \$123,402,000 in cash receipts from crops and livestock in 1983. The USDA rates more than four-fifths of the county as "prime" farmland. Tulia, the county seat, is the major population center of Swisher County.

Moore and Crosby counties are both rated about half "prime" farmland. In 1983, Moore produced \$104,357,000 in cash receipts from crops and livestock, and Crosby produced \$41,598,000. In addition to agriculture, both counties have significant oil and gas resources and related industries. Moore County, located about 20 miles north of Amarillo, had a population of 16,575 in 1980. Crosby County, just east of Lubbock, had 8,859 people in 1980.

Telephone and mail surveys were conducted in the Swisher and Deaf Smith county areas; and the Oldham County towns of Vega, Adrian and Wildorado were also included in the telephone survey because of their very close proximity to the proposed Deaf Smith County site. In addition, interviews were conducted in the Moore and Crosby county areas for comparison purposes. Moore and Crosby counties were selected because they are in the same general region as Deaf Smith and Swisher counties. They share many cultural and economic characteristics with the proposed site counties although they are not in the immediate vicinity of the proposed repository sites and do not border the site counties. Dumas, in Moore County, is roughly 65 miles from the Deaf Smith site and 90 miles from the Swisher site. Crosbyton, the county seat of Crosby County, is roughly 125 miles from the Deaf Smith site and 70 miles from the Swisher site.

Comparisons between survey results for Deaf Smith and Swisher counties, and those for Moore and Crosby counties are useful for two reasons. First, interviews in Moore

and Crosby counties indicate the extent of awareness and concern about the proposed nuclear waste repository beyond the immediate vicinity of the proposed sites. Second, continued monitoring of all four counties will allow future researchers to begin to separate social and economic changes that are widespread in the region from those that are particularly associated with proximity to the repository sites.¹

PREVIOUS RESEARCH

The design of the TDA surveys draws on earlier research about attitudes towards nuclear facilities. Since a national high-level nuclear waste repository has never been built before, efforts to anticipate the effects of constructing and operating a repository must rely on research about other kinds of projects. Research about nuclear facilities is especially relevant to assessing effects of the repository on public attitudes because earlier studies have shown that people view nuclear projects with particular dread (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978).

Other nuclear facilities offer imperfect models, however, because the repository is unique both in the technology used and in the site-selection process. In addition, the primary beneficiaries of the repository (nuclear power companies and their customers) are hundreds or thousands of miles away from the proposed Texas dump sites. Because of these differences, experiences at other nuclear projects may not be duplicated at the repository.

Still, previous research is useful in raising issues for further study and in suggesting appropriate research methods. This section reviews research about public opinion concerning nuclear projects and about communities facing construction of a nuclear facility.

Public Opinion

A recent report by the National Academy of Sciences (1984) traces the history of public attitudes towards nuclear power and nuclear wastes. The report notes little opposition to power plants and little concern over wastes during the earliest years of nuclear plant operation. During the seventies, support for nuclear power was beginning to erode, and worries about waste disposal were rising. In 1974, a survey by Opinion Research Corporation showed concern about disposal of nuclear wastes ranked ahead of radiation, nuclear accidents and thermal pollution as public concerns: Fifty-two percent of those surveyed said nuclear waste was a serious problem.

Public opposition to siting nuclear power plants in respondents' "own backyards" was also increasing during the seventies. Harris polls conducted since 1978 have found the public is opposed by margins of nearly two to one to construction of nuclear power plants within five miles of their homes. Since 1979, every survey of a

potential host community has shown at least 50 percent of local residents were opposed to construction of a nuclear power plant in their area (Freudenburg & Baxter, 1984). In Texas, surveys conducted by Texas A & M University (Hill & Dyer, 1984) found local residents similarly opposed to construction of low-level nuclear waste disposal sites: Four out of five respondents opposed a dump in their county. Residents feared that a nuclear waste site would cause pollution and disease, and 53 percent of them said nuclear wastes are "one of the most serious threats facing the world."

Opposition to nuclear power, in general, has also grown since the late seventies. Nationwide surveys conducted in 1983 and 1984 by Cambridge Reports showed two-to-one opposition to new power plants (Freudenburg & Baxter, 1984). Both recent and earlier polls consistently show women are more likely to oppose nuclear projects than men, but other patterns of relationships between attitudes and personal characteristics are unclear (NAS, 1984).

Reasons for Opposition

The reasons for public opposition to nuclear power plants also are unclear, but concerns about health and safety are certainly an important factor. Harris polls conducted in 1975-1979 found that beliefs about nuclear safety were the best predictors of overall attitudes towards nuclear plants. More than half of the people they surveyed rated health and environmental concerns about nuclear power a "major problem" (Freudenburg & Baxter, 1984).

Other researchers speculate that opposition to nuclear power may come from fears that accidents could be catastrophic (Slovic, Fischhoff, & Lichtenstein, 1981), from ethical concerns about possible damage to future generations (Douglas & Wildavsky, 1982) or from growing distrust of business and government institutions responsible for nuclear facilities. Slovic, Fischhoff and Lichtenstein (1981) note that distrust may stem from public awareness that experts have underestimated nuclear risks in the past, allowing dangerous exposures to radiation; and Freudenburg and Baxter (1984) argue that the accident at Three Mile Island is a crucial factor in increasing distrust. Tremendous cost overruns and regulatory battles plaguing nuclear power plants in recent years may be another source of opposition, as more people

conclude that nuclear power is both expensive and unreliable (Diamond, 1984).

Supporters of nuclear power have long argued that ignorance of nuclear technology is a primary factor in public opposition; but research, both in the United States and abroad, fails to support this theory. Recent studies have found no significant difference in knowledge between supporters and opponents of nuclear power (for reviews, see NAS, 1984; and Freudenburg & Baxter, 1984); and the National Academy of Sciences concludes, "The direction of research results...does not support the inference that public concern is the product of inadequate information or lack of education" (p. 28).

Expectations of Host Communities

In communities being considered as possible nuclear sites, expectations about how a nuclear project would affect the economy, health, and social life of the host area are other important factors in shaping public opinion. For the high-level nuclear waste repository, testimony at public hearings in Texas indicates substantial concern about these issues (for example, see Frishman, 1984). Local residents question the safety of the repository and its effects on agriculture and business.

Research sponsored by the Oak Ridge National Laboratory is another source of information about how host communities view nuclear facilities. Longitudinal studies conducted before and during construction of a nuclear power plant at Hartsville, Tennessee, indicate that community expectations about socioeconomic effects were important factors in overall attitudes towards the plant (Hughey, Lounsbury, Sundstrom, & Mattingly, 1983; Sundstrom, Lounsbury, Schuller, Fowler, & Mattingly, 1977). These studies asked local residents to rate the likelihood and desirability of 24 possible effects of constructing a nuclear plant in their area. Researchers found that attitudes fell into several general dimensions, reflecting expectations about economic growth, social disruption, and safety. Results showed that local residents expected both positive and negative effects, so overall support or opposition to the plant was a tradeoff between expected benefits and costs. Expectations about reactor safety were the strongest predictor of support or opposition.

The 1977 Oak Ridge study, conducted before construction began, found a strong majority--approximately two-thirds--of Hartsville residents favored the nuclear

plant. Five years later, less than half favored the plant. Increased opposition was associated with lowered expectations about economic benefits. Supporters in the earlier study expected the nuclear plant to promote strong economic growth, but development during the construction phase did not meet their expectations. Peelle (1982) reviews other studies that similarly show local support for nuclear power plants and other energy projects is based on hopes for economic growth, but communities surveyed before construction begins tend to overestimate benefits of these projects and underestimate their costs.

In summary, previous research shows that opposition to nuclear projects is widespread among the general public and in potential host communities. Safety concerns are a primary factor in public opposition, but supporters of nuclear projects expect substantial economic benefits.

TELEPHONE SURVEY METHODS

Sample

Residents of southern Oldham County, and of the Deaf Smith, Swisher, Crosby and Moore county areas participated in the TDA surveys. Crosby and Moore counties were chosen for comparison because they are economically and culturally similar to Deaf Smith and Swisher counties, but are somewhat farther away from the proposed repository sites. In selecting the comparison area, counties bordering on Deaf Smith and Swisher were ruled out, then the remaining counties in the Texas Plains were considered on the basis of these criteria: percent "prime" agricultural land, cash receipts from crops and livestock, oil and gas revenues, income from manufacturing, percent Hispanic population, percent of population in poverty and 1983 unemployment rate. Crosby and Moore counties were selected as the most closely comparable to Deaf Smith and Swisher.

Households invited to complete an interview were chosen randomly from current local phone books.² Use of phone books as a sample source excludes households without phones, those with unlisted phone numbers, and those with new phone listings. Phone listings were chosen as the sample list despite these limitations because phone book names and addresses allowed TDA to send introductory letters explaining the study to sample households. Local citizens' inquiries to TDA and the Texas Nuclear Waste Programs Office indicated that U.S. Department of Energy site-selection procedures and an earlier survey conducted by the U.S. Committee on Energy Awareness³ may have produced local distrust of outside studies related to the repository, so an advance letter was considered important to building trust in the legitimacy of this research. This procedure is commonly used in survey research (Dillman, 1978). The 1980 U.S. Census reports that the following percentages of households in the research counties have telephones: 89 percent of households in Deaf Smith County, 84 percent in Swisher, 83 percent in Crosby, and 86 percent in Moore.

Once the list of households was selected, standard procedures (Dillman, 1978) were used to randomly select one adult from each household to participate in the study. These procedures assure that men and women and various age groups are fairly represented.

Response rates for both interview forms were excellent, and survey participants are broadly representative of households in the study areas. For the Deaf Smith and Swisher county area, 752 households were chosen to participate in the survey, and 605 (80 percent) completed the interview. Telephone interviewers were unable to reach 13 percent of the households in the original sample list: Five percent of the phone numbers were no longer in service at the time of the survey, and interviewers got no answer after several attempts to call 8 percent of the homes. Among Deaf Smith and Swisher county households that were contacted by phone, 91 percent completed the survey.

For the Crosby and Moore county areas, 327 households were chosen to participate in the survey and 236 residents (72 percent) completed the interview. Eight percent of the phone numbers in the sample list were no longer in service and interviewers got no answer at 9 percent of the homes; 87 percent of the households that were contacted by phone completed the interview. Background characteristics of households that participated in the surveys and of those who declined to participate are described later in this report.

Procedure

Sample households were first contacted by mail. Governor Mark White and Texas Agriculture Commissioner Jim Hightower wrote jointly to each household on "State of Texas" letterhead in June 1984 to explain the survey. In addition, local elected officials, community leaders and the press were notified in order to increase awareness of the survey and encourage participation.

Beginning four days after introductory letters were mailed, 16 trained interviewers at the Texas Department of Agriculture began telephoning survey households to arrange a convenient time to complete the interview. Spanish-speaking interviewers and translations of all research materials were available for those who preferred to be interviewed in Spanish. Most interviews were conducted during evening and weekend hours. Phone numbers where interviewers got no answer were telephoned at least four times on different days and at different times in an effort to contact as many households as possible. Participants who declined to complete the interview were asked if they would be willing to answer a few questions from the survey. Texts of the advance letter and introductory scripts used by interviewers are available from TDA.

Deaf Smith and Swisher county interviews were conducted in June, and Crosby and Moore county interviews were conducted in July. Deaf Smith and Swisher interviews averaged 35 minutes in length, while Crosby and Moore residents participated in shorter interviews, averaging about 15 minutes each.

Instrument

The research instruments were structured telephone interviews. Questions were based on pilot research (see Appendix A) and on previous research by other authors. The wording of survey questions is shown in Appendix B and copies of the full survey instruments in English and Spanish are available from TDA.

The Deaf Smith/Swisher questionnaire includes a general measure of overall attitudes toward the nuclear waste repository and more specific measures of survey participants' expectations about effects of the repository on the economy, health and community life of their county. The questionnaire also includes measures of knowledge about the repository, actions taken because of concerns about the repository, perceived psychological stress, attitudes towards other kinds of industrial development, and background characteristics of survey participants.

The Crosby/Moore survey forms include measures of overall attitudes towards the repository, socioeconomic and health expectations, and perceived stress, as well as background information. The two questionnaires use identical wording, in most cases, to facilitate comparisons between Deaf Smith/Swisher and Crosby/Moore results.

The research instrument is reviewed in more detail in the following section of this report, and the sources and rationale for survey questions are described. Additional information about development of the questionnaire is found in the summary of pilot research in Appendix A, and statistical characteristics of the final scales are shown in the results section.

Overall attitudes towards the proposed high-level nuclear waste repository. Two pre-coded questions measured overall attitudes towards the proposed nuclear waste repository; and following these two items, survey participants were asked an open-ended question about the reasons for their views of the repository. Survey

participants also were asked how likely they thought it was that their county would be chosen as the repository site.

The two pre-coded items measuring overall attitudes towards the repository were pilot-tested in Deaf Smith and Swisher counties, and closely similar items were used in surveys of community attitudes towards a proposed nuclear power plant (Sundstrom et al., 1977; Hughey et al., 1983). Researchers at Oak Ridge National Laboratories demonstrated that these items are not biased to produce results unfavorable to nuclear facilities: They found strong local support for a nuclear power plant in their early research with this measure. TDA pilot studies and Oak Ridge research both found strong correlations between responses to these two questions, indicating that the items may be combined as a scale. Combining items into a scale minimizes the effects of random fluctuations in survey responses, providing a more stable measure of overall attitudes towards the repository; and it expands the range of possible scores, allowing for more fine-grained measurement of variation in responses.

Responses to the open-ended question were coded to indicate the most common categories of reasons local residents gave for supporting or opposing the repository. Since this question comes near the beginning of the interview, responses are not biased by later more-specific questions concerning socioeconomic and health effects and other issues related to the repository. Because of the question order, the spontaneous answers to the open-ended question are useful in indicating what issues are most salient to local residents in forming opinions about the repository.

Socioeconomic effects of the repository. The second section of the survey instrument asked respondents what kinds of social and economic changes they think a nuclear waste repository would produce in their own county. Participants were asked to indicate whether socioeconomic indicators would "go up," "stay the same," or "go down" over the next 15 years because of the repository. Deaf Smith and Swisher area residents were asked what changes they would expect on 15 indicators for their own county if their county is chosen as a waste site. Crosby and Moore residents were informed at the outset of the interview that Deaf Smith and Swisher counties are being considered as repository sites; and they were then asked what effects they expected in 7 indicators for their own counties, if a Texas Plains site is chosen. Items for this section were

chosen to reflect the range of socioeconomic issues raised in U.S. Department of Energy Hearings about the Texas repository sites (DOE, 1984), and of issues listed by Halstead, Leistritz, Rice, Saxowsky and Chase (1982) and Sundstrom et al. (1977).

Impact assessments for other large-scale development projects often include similar measures of local expectations about social and economic effects. However, earlier studies have assumed only one possible direction of change for each indicator. U.S. Department of Energy statements and public testimony by local residents have often been at odds about effects of a nuclear waste repository in Texas, so this study differs from earlier research in asking survey participants to indicate what direction of change they anticipate. This study also allows participants to indicate whether they consider new commercial and industrial development to be "good" or "bad" for their community.

Health and environmental effects of the repository.

Two sets of questions asked survey participants about possible health and environmental hazards that could be associated with a nuclear waste repository. These questions include issues raised in public hearings sponsored by the U.S. Department of Energy and the Texas Governor's Office (Frishman, 1984). A pilot survey of Deaf Smith and Swisher counties identified health and environmental concerns as the most important factors in public opposition to the repository (Appendix A), and other studies reviewed earlier in this report found similar results.

The TDA interviews first asked how likely respondents thought it was that a particular hazard would occur and then how concerned they would be about it if it did happen. Previous research by Slovic, Fischhoff and Lichtenstein (1982) suggests the importance of measuring the perceived level of risk (likelihood of hazard) separately from the perceived severity of the outcomes (concern about a problem if it did occur). Their research indicates that separate measurement of the perceived likelihood and severity of problems will result in lower likelihood estimates. Research participants who are not given an opportunity to assess the severity of a hazard separately from its probability tend to inflate their probability estimates; so use of separate measures in the TDA study provides a more conservative and more informative index of public concern than a single measure would. Research by Sundstrom, Lounsbury, DeVault, and

Peelle (1981) supports the argument for separate measurement of perceived likelihood and desirability of expected outcomes, but they found their likelihood measure alone was a better predictor of general attitudes towards a nuclear power plant.

Knowledge about the repository. Twelve statements in the Deaf Smith/Swisher survey measured knowledge about the nuclear waste repository and about the site-selection process. Interviewers asked survey participants whether they thought each statement was true or false or whether they didn't know. Half of the statements were worded so that correct answers were true and half were worded so that correct answers were false. Statements were selected to represent a broad variety of aspects of the nuclear waste repository program. All knowledge items may be verified in documents published by the U.S. Department of Energy. In addition, the Texas Nuclear Waste Programs Office and leaders of citizen groups in Deaf Smith and Swisher counties reviewed these items to assure broad consensus about their accuracy. The pilot survey of residents of this area found the knowledge items form a reliable scale (coefficient alpha = .80).⁴

Actions in response to the repository. Eleven items asked Deaf Smith and Swisher area residents what actions, if any, they had taken because of a concern about the nuclear waste repository. For example, respondents were asked whether they had ever testified at a public hearing or whether they had joined a community group because of concern about the repository. Pilot research found the items used in the present study form a reliable scale (coefficient alpha = .77).

Perceived stress. Substantial research indicates that nuclear facilities may be a source of psychological stress for residents of surrounding communities (For summaries, see Hartsough & Savitsky, 1984; and Sills, Wolf & Shelanski, 1982). Lazarus (1981) offers a model for analyzing stress as a product of people's appraisal of the degree of risk and their appraisal of their options for coping with perceived risk either through psychological defense or through active efforts to change the source of risk or mitigate its effects. These appraisals are, in turn, precursors of coping efforts and psychological well-being. Baum (1983) and Brody (1984) have shown that this model is useful in understanding responses to environmental hazards.

Several sets of items in the present study measure elements of Lazarus' model. Five questions based on Folkman and Lazarus (1980) ask respondents whether the nuclear waste repository represents a situation that they can change or one they must accept. Previous research indicates that people's beliefs about whether they can control their future are a factor in levels of stress and stress-related illnesses. Although Folkman and Lazarus use a single item to measure the concept of control, their own research indicates that their response categories are not mutually exclusive. Therefore, the present study uses a separate question to measure each of the original responses.

In addition to measuring perceptions of control, which may be a precursor of stress, the surveys assess current levels of perceived stress in the survey counties. The measure of stress used here includes eight items from the Perceived Stress Scale (PSS) developed by Cohen, Kamarck and Mermelstein (1983). Four of these items were specifically designed for use in telephone surveys. Four additional items from the longer version of the PSS were also included to improve the reliability of the scale for the present study. For the four-item telephone scale, Cohen et al. report scores ranging from 0 to 15, with means of 4.8 to 6.2, standard deviations of 3.6 and 4.0, and a coefficient alpha reliability estimate of .72. They also report other analyses supporting the reliability and validity of their scale.

Four questions from the PERI Demoralization Scale (Dohrenwend, Shrout, Egri & Mendelsohn, 1980) were also used in the present study. The PERI scale is a widely-used measure of demoralization in general populations. The four questions used here form the Hopelessness-Helplessness subscale of the PERI. Kasl, Chisholm, and Eskenazi (1981) found that workers at the Three Mile Island nuclear power plant scored higher on this subscale after the TMI accident than did workers at a nuclear plant that had not suffered an accident. Use of perceived stress measures in the present study will allow for repeated monitoring of the site counties and comparison counties over the course of the nuclear waste program, so that differences like those observed at TMI can be documented if they occur in Texas.

Attitudes towards development. Survey participants were asked how they would feel about a variety of energy- and agriculture-related industries that might locate in their county. Responses were coded on a five-point Likert-type scale ranging from "strongly opposed" to

"strongly favor." This scale allows comparisons between local residents' attitudes towards the high-level nuclear waste repository and their attitudes towards other types of development, including some that involve potential environmental hazards.

Background information. Finally, survey participants were asked a series of questions concerning their personal background. These items included questions about the respondents' age, education, income, and ethnicity; and about ownership of property in the proposed repository site area. This study differs from earlier research in giving greater attention to sources of income and economic interests, for example farm versus nonfarm interests, as a possible factor in attitudes towards nuclear facilities. Since telephone interviews were conducted in June and July 1984, background questions concerning the nine-square-mile proposed repository sites refer to the areas tentatively identified by the U.S. Department of Energy in February 1984. Sites currently being considered are slightly different from those under consideration at that time.

Characteristics of Survey Participants and Non-respondents

Survey participants for both the Deaf Smith/Swisher and Crosby/Moore areas are broadly representative of households in the research counties. Respondents range in age from 18 to 91, with an average age of 49 years for residents of the Deaf Smith/Swisher area and an average age of 46 for the Crosby/Moore area. A substantial majority of survey participants from both locations are high school graduates, and the median income for both groups is in the \$20,000 to \$29,000 range. Approximately a third of the residents of both survey areas reported income from farming: Twenty-two percent of Deaf Smith/Swisher area residents and 8 percent of Crosby/Moore area residents said farming was their largest source of income. Approximately one out of four reported income from a business that they own. Additional information about background characteristics of survey participants is shown in Table 1.

The very strong response rate for this study is one indication that results reported here are representative of the research counties as a whole, and several additional analyses were designed to further test the representativeness of survey results. Demographic characteristics of survey participants were compared with U.S. Census figures, and responses of survey participants were compared with responses of those who declined to complete the full interview.

Table 1
Background Characteristics of Survey Participants

Characteristic	Percent of Deaf Smith/Swisher Households	Percent of Moore/Crosby Households
Gender		
Male	46	54
Female	54	46
Ethnicity		
Mexican-American/Hispanic	15	8
White/Anglo	84	91
Black, Other	1	1
Interviewed in Spanish	6	3
Education		
0 to 8th grade	14	10
9 to 11th grade	16	10
High school diploma	34	40
Some college or technical school	21	23
College degree	10	13
Graduate or professional school	5	3
Children under 18 in household	42	57
Owners of property in Deaf Smith/Swisher Counties*		
home owners	80	
farm owners	29	
business owners	20	
Occupation		
farmer	15	15
farmworker	3	3
professional, managerial	22	19
clerical & service	16	10
blue collar	10	15
homemaker	15	20
retired	15	14
not employed	2	3
Income		
less than \$10,000	18	13
\$10,000 to \$19,000	24	22
\$20,000 to \$29,000	21	24
\$30,000 to \$39,000	14	18
\$40,000 to \$49,000	6	8
\$50,000 or more	16	15
Income Sources*		
farming	35	32
farming largest source	22	8
wages, salaries, tips, commissions	62	69
business ownership	25	22

*These categories are not mutually exclusive, so percentages sum to more than 100.

Census Data

Survey results are not exactly comparable to U.S. Census figures because the TDA studies use slightly different geographic boundaries and because they represent a sample of adults by household; while Census figures may be reported by individuals, including both children and adults. Nevertheless, the demographic characteristics of survey participants are generally similar to U.S. Census figures for the survey counties for gender, education, income, and home ownership. However, Census figures show a larger proportion of Hispanics.

The ethnic background of survey respondents deserves special attention, because Hispanics have not been active in the U.S. Department of Energy site-selection process. The inclusion of Hispanics in this survey is of particular interest, since earlier public hearings and comments provide little information about their views.

Fifteen percent of the Deaf Smith- and Swisher-area residents who participated in the survey identified themselves as Hispanic, as did 8 percent of those from the Crosby and Moore county area. These figures are nearly identical to the proportion of Spanish surnames in the original sample list for this study: 16 percent of the households in the Deaf Smith/Swisher sample were listed in the phone book under Spanish surnames, and 8 percent of the Crosby/Moore sample were listed under Spanish surnames. The close agreement between the percent of Spanish surnames in the sample and the percent of Hispanics among households that completed the survey indicates that interview techniques and procedures for contacting sample households were unbiased with respect to ethnicity.

However, the proportion of Hispanics in this research is substantially lower than the proportion of Hispanics in the general population of the research counties. The 1980 U.S. Census reports Hispanic populations of 41 percent for Deaf Smith County, 28 percent for Swisher, 37 percent for Crosby, and 20 percent for Moore.

There are several reasons for this discrepancy. First, this survey represents a sample of households. Because of the larger household size in Hispanic communities, the proportion of Hispanic households is smaller than the proportion of Hispanic population. The U.S. Census reports 31 percent Hispanic households for

Deaf Smith County, 17 percent for Swisher, 25 percent for Crosby, and 14 percent for Moore. Second, the Hispanic population of the Deaf Smith/Swisher sample is diluted by inclusion of several Oldham County communities in the sample group. Only 5 percent of Oldham County residents are Hispanic, according to the Census. Third, Hispanics are under-represented because the decision to select the research sample from telephone listings limits the participation of migrants and of households without phones. In summary, Hispanics are under-represented in the research sample because of the decision to contact households with listed telephones; but there is no indication of ethnic bias in response rates.

Non-respondents

Another technique for evaluating whether survey results are representative is to analyze the characteristics of individuals who were included in the research sample, but declined to complete an interview. To allow for this analysis, Panhandle residents who said they did not want to complete an interview were asked why they preferred not to participate. The most common reason was poor health. In the Deaf Smith/Swisher area, nearly a fourth of those who declined to complete an interview cited poor health as their reason. Many of these residents were quite elderly and chronically ill or recovering from severe illnesses, and many of them had extreme difficulty hearing interviewers over the phone. In addition, 10 individuals (18 percent of those who declined to participate) said they were too busy, and another 10 residents felt that they didn't know enough about the repository to complete the survey. Other reasons for not participating included family problems and concern that the study would not affect the site selection decision.

Panhandle residents who indicated that they did not want to complete the full interview were also asked if they would be willing to answer just a few questions. Because of the smaller sample size for the Crosby/Moore surveys, responses to the short interviews were not analyzed. For the Deaf Smith/Swisher area, 52 percent of local residents who were contacted by phone, but declined to complete an interview, agreed to the brief survey. Differences between residents who completed the full interview and these 30 individuals who answered only a few questions were tested statistically.⁶

Survey participants did not differ significantly from non-participants in their overall attitude toward the nuclear waste repository. Eighty-one percent of those who completed the brief survey responded "definitely no" to the question asking whether they would allow construction of a nuclear waste repository in their county. Five percent said "probably no," 9 percent were unsure, 2 percent said "probably yes," and 4 percent said "definitely yes."

Deaf Smith and Swisher residents who completed the full survey and those who completed the brief interview also did not differ significantly on any of the following characteristics: gender, preference for being interviewed in Spanish, property ownership, or distance of property from the repository site. However, residents who preferred not to complete the interview were significantly older than those who did complete the interview. The average age of survey participants was 49 years compared with an average age of 62 years for those who answered only a few questions ($F = 17.13$, $p < .01$). This finding is not surprising, considering that the most common reason for not completing the survey was poor health. Regression analyses reported later in this report indicate that age is not a significant factor in attitudes towards the nuclear waste repository.

TELEPHONE SURVEY RESULTS

Deaf Smith and Swisher County Areas

Telephone interview responses were analyzed by a variety of statistical techniques to summarize the views of Deaf Smith and Swisher county residents and explore the primary reasons for their attitudes towards the nuclear waste repository. These results are discussed here. Detailed information about the exact wording of survey questions and percentages of local residents who chose each response option is shown in Appendix B. A preliminary summary of these results was published in the fall of 1984 (TDA).

Opposition to the Repository

Residents of Deaf Smith and Swisher counties are very strongly opposed to construction of a nuclear waste repository in their area. When asked, "if it were up to you, would you allow construction of a high-level nuclear waste repository in your county," 73 percent of the survey participants said "definitely no," and another 8 percent said "probably no." Asked "do you think construction of the nuclear waste repository would be a good thing for your county," 68 percent said "definitely no," and 7 percent said "probably no." Asked whether they agreed or disagreed with the statement that the nuclear waste repository "doesn't really affect me personally," 74 percent said they "strongly disagree," and 9 percent "somewhat disagree." About 60 percent think it is "very likely" or "somewhat likely" that the repository will actually be built in their county.

Responses to the first two interview questions--would you allow construction of the repository if it were up to you and would the repository be a good thing for your county--are strongly correlated ($r = .85$, $p \leq .01$), so they were summed to create a more stable measure of overall attitudes towards the nuclear waste repository (see the "methods" section of this report). To allow for comparisons among subgroups of Deaf Smith and Swisher area residents, scores on this measure were computed for subgroups defined by ethnicity, gender, property ownership, and income source. The average response for each of these subgroups fell between "definitely" and "probably" opposed to the nuclear waste repository. These results indicate that opposition to the repository is broad-based, with strong consensus among diverse groups within Deaf Smith and Swisher county communities.

In addition, the final survey results are quite similar to the earlier pilot results (Appendix A). The average score for overall attitudes towards the repository was less than a tenth of a point different from the average score for the pilot survey. Although the pilot used a much smaller sample, it represents an independent replication of the final study's results. The closely similar findings for the two samples support the validity of both studies.

Social and Economic Effects of the Repository

One element in public opposition to the repository is concern that a nuclear facility would change the economy and community life of the site area. Deaf Smith and Swisher county residents clearly believe a nuclear waste repository would have negative social and economic effects for their communities over the next 15 years. They expressed greatest concern about effects of the repository on agriculture and on property values. About 80 percent of the survey participants said a nuclear repository in their county would cause a decline in the value of farmland, and 72 percent said the repository would mean lower levels of agricultural production. In addition, 60 percent said the value of their homes would decline if their county were chosen as a repository site.

Many residents also expect negative effects on industrial development, tax rates, traffic and the cost of living. Nearly half expect the amount of industry in their county to go down and the tax rates to go up if their county is chosen for the repository. Sixty percent anticipate increased traffic, and 57 percent expect an increase in the cost of living. In general, Deaf Smith and Swisher county residents expect little change in their own household income, the quality of local services, or the number of places to go for fun or entertainment. Survey participants were divided in their views about effects of the repository on local schools, crime rates and the number of stores and businesses.

A majority of survey participants did expect one economic benefit for job-hunters. About 52 percent said they expected an increase in the number of jobs in their county if it is chosen as a repository site.

Just as for overall attitudes toward the nuclear waste repository, the generally pessimistic outlook on potential socioeconomic effects of the repository represents a

consensus among economic subgroups within the community. Business owners are no more likely than other community members to expect social and economic benefits from the repository, and although farmers are somewhat more pessimistic than nonfarmers, both farm and nonfarm families expect more negative social and economic effects than positive ones. Relationships between background characteristics and expectations about socioeconomic effects of the repository are described in further detail in the discussion of multiple regression results later in this chapter.

Attitudes Towards Economic Development

Negative expectations about social and economic effects of the nuclear waste repository do not reflect general opposition to economic development. The survey asked Panhandle residents whether they would favor or oppose several different types of energy- and agriculture-related facilities in their county. Results show that opinions about nuclear facilities are sharply different from views on other types of development. More than half of the respondents said they "strongly favor" or "somewhat favor" each type of development with the exception of a nuclear power plant or a low-level radioactive waste disposal site. The nuclear facilities received less than 15 percent support. A food processing plant, windmills for electric power generation and a new feedlot received the most positive ratings. Approximately two-thirds of the residents of the Deaf Smith and Swisher county areas said they "strongly favor" a new food processing plant in their county, 56 percent "strongly favor" power-generating windmills and 43 percent "strongly favor" a new feedlot. These responses show that Deaf Smith and Swisher county residents support economic development that is consistent with the present agricultural base of the local economy.

Health and the Environment

Among issues addressed in this research, health and environmental problems associated with the repository are the top concerns of Deaf Smith and Swisher county residents. Interviewers asked survey participants to rate 13 possible health and environmental hazards to indicate, first, how likely they thought it was that each problem would occur if a repository were built in Texas and, second, how concerned they would be in the hypothetical instance that each of the problems did occur in their county. For every one of these possible health and

environmental problems, more than half of the Deaf Smith and Swisher county residents said the problem was "very likely" or "somewhat likely" to occur if a repository were built in their county. In addition, more than half of them said they would be "extremely concerned" about each problem if it occurred.

Deaf Smith and Swisher county residents are particularly worried about the possibility of radioactive wastes escaping into their water: 61 percent consider this kind of accident "very likely," and 81 percent said they would be "extremely concerned" if water contamination did occur. In addition, more than half of the survey participants said that they think contamination of food and soil and health problems for county residents and for workers at the repository are "very likely" to occur if the repository is built in their county.

Comments by Survey Participants

Comments by local residents during the telephone interviews confirm statistical analyses showing that concern about environmental and socioeconomic effects of the repository are crucial elements in public opposition to building the repository in Texas. Interviewers asked survey participants an open-ended question about why they favor or oppose building the repository in Texas. This question was asked near the beginning of the interview, so responses were not influenced by specific questions about health and economic effects later in the survey. Since no specific answers are suggested by the question, the responses offered spontaneously by survey participants indicate what issues come most readily to mind when local residents think about the repository. These responses provide significant information about what issues are important to local residents. At the same time, failure to mention a particular topic does not necessarily indicate that it is not a concern.

The most common responses were coded after the interviews, and percentages for these responses are shown in Table 2. Examples of comments are also included below.

As in the statistical analyses, safety issues emerge as important concerns in Panhandle residents' comments about why they oppose a repository in Texas. About 60 percent mentioned health and environmental hazards in explaining their views about the repository.

- This repository is highly dangerous for residents. We've lived so comfortable for so many years, and now there's this dark cloud hanging over us. For the sake of everybody, I hope it (repository) doesn't come here.

Table 2

Percentage of Local Residents Who Mentioned Selected Issues in
Response to Open-Ended Question About Reasons for
Opinions About Repository

Issue	Percentage
Harm to agriculture	40
Health and environmental hazards	
Water contamination	34
Transportation accidents	3
Other health and environmental risks	26
Site-selection is unfair	10
Economic harm, other than effects on agriculture	7
Economic benefits	
Increased employment	6
Other economic benefits	7
Concern about children, future generations	6
Need for more information	5

Note. Since each survey participant may have mentioned none or more than one of these reasons for supporting or opposing the repository, percentages may not be summed across categories.

- I feel strongly that they've created something they don't know how to harness nor ensure that human error won't cause a major catastrophe.
- (I) spent 20 years in the military working with nuclear weapons. I know what that stuff can do. I am very concerned. Civilian facilities are not as rigidly inspected as military ones. Contractors care only about profit, not quality.
- Nuclear power plants leak. They're shut down because of poor engineering. Management said so. The same problems will occur with the nuclear repository. It will be a continuous problem.
- I have no confidence in the "fact" that it (the repository) could be sealed.

Worries about whether the repository would be safe are often focused on the possibility of contamination of water in the Ogallala aquifer. When asked why they favor or oppose the repository, roughly a third of Deaf Smith and Swisher county residents spontaneously mentioned concern about contamination of their water.

- Anything gets in the water and we're gone. The Ogallala is the lifeblood of this community.
- (The repository) would take up quite a bit of land and drill through our drinking water. Out here, we don't have much water....If the repository screws that up, I don't know where we'll be.
- I don't think they can possibly keep out the water. The site will get wet.

The possibility of an accident at the nuclear repository is viewed as an economic problem as well as a health problem by many Panhandle residents. They fear that their land, water and crops could be contaminated and that agricultural products will be stigmatized as unhealthy, even if they are not actually contaminated. Many Deaf Smith and Swisher residents see the possibility of harm to the agricultural economy as a fundamental threat to their way of life. They are incredulous that the federal government would even consider building a nuclear waste repository on such exceptionally rich farmland. In answers to the open-ended question about

reasons for their views about the repository, approximately 40 percent of the survey participants mentioned concern about possible damage to agriculture.

- (The repository) would ruin our land. We have lots of cattle. This would ruin our grass. People would have to move away. (I) hope somebody is strong enough to stop this. Why would anybody want to come here (to build the repository) where we have good farmland?
- There's lots of sorry land around, put it (the repository) there. I don't think it's good to put it in an area where people are trying to make a living from the land, or in any populated area. For every reason--health, living, and water--it shouldn't be here. This is agricultural country. Our wheat goes all over the world. It would be a big mess.
- We have beautiful farmland. (The repository) would mess it up and cause people to leave, selling at a loss. Underground water might be contaminated, and we depend on it for family use and for stock. This is the largest cattle feeding area in the U.S. People wouldn't want to eat meat from here if they put the repository in.
- Leakage would ruin crops, water and soil. It would ruin our lifestyle. Our town would regress.
- (The repository) would put farmers out of business. From there, there would be a chain reaction of worsening conditions.
- People are fearful it (the repository) would ruin the economy. We grow a lot of crops for feedyards. What if people won't send cattle here because of the repository?
- It's gonna mess up the economy. Before you know it, no one's gonna be here. They'll move, and it'll destroy our way of life.
- This is the best agricultural land in the world. The world will be hungry one day and look to us for food, but they won't take contaminated food.

Some Deaf Smith and Swisher county residents expressed other concerns about the social and economic effects of the repository on their communities. They are worried about an influx of newcomers from outside the area, about general effects on local business, and about their own jobs in food processing plants.

- I'm against this repository for job security and health reasons. Both my husband and I work in a food company, and I'm afraid we will lose our jobs.
- During the construction phase, the county will be like a boom town in an oil boom. This will cause burdens on local schools and services, but once it is completed, all the construction workers, etc. will leave, and the county will be worse off than before....A large number of people are scared to death, and this has reduced the value of land.
- (The repository) would bring a bad element to Hereford. (I'm) worried about the kinds of people that would come in, and I would probably move to another area.
- Hereford is having a hard time getting business. If the repository is brought in, we'd have an even harder time attracting business.

In addition to their concern for the future of their communities in general, some survey participants are worried about the future for their own children and grandchildren.

- We will live in fear. I don't want my children growing up with the repository here.
- We have children and don't want to leave them problems with the land.
- The repository will hurt the people I care about, my grandchildren, my friends and relatives. I'm against it because farming is our livelihood and it will destroy farming in this county.

Deaf Smith and Swisher residents who oppose the repository often express bitterness and distrust towards the Department of Energy. Some feel that the site-selection procedure is unfair, and they doubt that public participation will have any effect on the final site decision. They resent the possibility that they may have to receive wastes generated thousands of miles away.

- The federal government is using us as guinea pigs....The feds slipped in here on a pretense of oil and gas exploration, hitting on people in economic

difficulties and offering a price. They lie and go to out-of-state owners who do not have community ties. Residents here did not produce wastes and should not be responsible for disposing of them....The feds are sneaky, and if they really knew what they were doing, they would not have to use false pretenses.

- If it was safe, they would keep it where it's at....The thing that gripes me is that when they started building nuclear plants, they didn't consider waste disposal. I don't believe many government projects have gone like they planned.
- If the repository is built, it will be the end of Hereford. I have already sold half of my land. I feel bitter....I feel we are being severely taken advantage of. I am very disturbed because my entire living comes from farming and my son has invested a lot of money in this farm. It's not fair and not right.
- Let them clean their own laundry.
- The government has a tendency to flub up and then cover up. Why are they picking on us? We've got good water, land, cattle, and farms; and I wouldn't want to live here if (the repository) comes.
- Sometimes a guy feels helpless about this thing because they are going to build it anyway, no matter what people say.
- The DOE has lost our faith. Their drill shafts are crooked and have seepage. They have no guidelines.
- Why don't they build it on 1600 Pennsylvania Avenue? This is being pushed down our throats.

When asked why they favor or oppose building the repository in Texas, 6 percent of the survey participants mentioned the prospect of new jobs for their area. Even those who look forward to economic benefits from the repository often expressed ambivalence, however.

- (The repository) will bring money and the risk of blowing up.
- Swisher County is drying up. We don't have very much water, not much industry. We need something. I'm trying to be neutral because I see both sides. If I owned land, my feelings would be entirely different.

- (The repository) will have jobs for the poor. For the benefit of these poor, I would like to see it come to our county. It will not benefit me.
- I could see the county doubling in population. (The repository) could be good for the county even though cost and crime will go up. But people will have a job.

Those in the minority that supports the repository expressed confidence in the safety of the repository and in government decision-making procedures. They stressed the possibility of economic benefits.

- My grandson just came back from being on a nuclear submarine, and he says that there is more radiation in the sun than on a nuclear submarine.
- We need the power that the nuclear plants bring us, and we need to get rid of the waste; so if the government thinks this is the best site, they should know.
- I feel like (the repository) will get a little money circulating in the county. Farmers are hurting.

Several supporters of the nuclear waste repository program said they believe opposition to the repository is based on ignorance about nuclear facilities. However, statistical analyses detailed later in this report indicate that knowledge about the repository is associated with stronger opposition to it.

Knowledge About the Nuclear Waste Repository

In addition to questions about Panhandle residents' opinions and expectations, the telephone interviews included 12 factual questions about the nuclear waste repository program. On the average, survey participants answered seven questions correctly, and they said they didn't know the answers to four. Approximately four out of five Deaf Smith and Swisher county residents are aware that the U.S. Department of Energy is investigating their area because of its underground salt deposits and that exploratory drilling has already begun in their county. Seventy-seven percent are aware that exposure to radiation can cause birth defects and about 70 percent know that high-level nuclear wastes are radioactive for thousands of years and that drilling will be restricted over the nuclear repository.

Deaf Smith and Swisher county residents are not as well informed on some other aspects of the repository program. Less than one out of four correctly indicated that a Texas repository would be built below the Ogallala aquifer. Only 37 percent are aware that the President of the United States is personally responsible for giving final approval for the nuclear waste repository site, and 38 percent are aware that the Department of Energy would not be able to put all the salt dug out of the repository during construction back into the repository when it is complete.

Many Deaf Smith and Swisher county residents would like to be better informed about the repository. When asked whether they agree or disagree with the statement, "I need to know more" about the nuclear waste repository, 46 percent said they "strongly agree," and 22 percent "somewhat agree." Hispanics were more likely than others to feel that they needed more information. Four-fifths of Hispanic residents said they needed more information, compared with approximately two-thirds of non-Hispanics.

Actions in Response to the Repository

One source of information about the nuclear waste repository is Department of Energy public information pamphlets and documents. Sixty percent of the survey participants said they had read a government publication about the nuclear waste repository and 28 percent said they had gone to a government meeting or public hearing about the repository. Nearly as many--26 percent--said they attended a meeting of a community group, such as POWER or STAND, about the repository. About 22 percent said they contacted a public official about the repository and 7 percent joined a community group to deal with the repository.

Although a substantial number of Deaf Smith and Swisher county residents have some exposure to DOE information programs, relatively few have participated actively in the public hearing process. About 8 percent said they testified or spoke up at a government meeting about the repository. This finding indicates that the telephone survey reached many people who had not previously been heard at DOE meetings.

Hispanic residents, in particular, have been inactive in the repository site-selection process. Anglos are three-and-a-half times as likely as Hispanics to have attended a government meeting about the repository, and

they are twice as likely as Hispanics to have ever read a government publication about the facility. Only one Hispanic who participated in the survey had ever spoken at a government meeting about the repository and none had ever joined a community group to deal with the repository.⁸ Some Deaf Smith and Swisher-area residents already have made changes in their personal lives because of the repository. About 8 percent said they had changed financial plans for their family or for their farm or business because their area is under consideration as a repository site. About 44 percent said they have thought about moving out of the area because of the repository.

Perceived Stress

Telephone interviews for the Deaf Smith and Swisher areas included a measure of perceived psychological stress and the hopelessness-helplessness subscale of a standard measure of demoralization. These scales were included to provide a baseline measure for future research concerning effects of the nuclear waste program. The average perceived stress score for Deaf Smith and Swisher residents falls near the lowest mean scores reported by Cohen et al. (1983) in their studies of college students. This finding indicates that college students may not be an appropriate comparison for a more general sample of community residents in the Texas Panhandle.

The average Deaf Smith/Swisher score for hopelessness-helplessness is higher than the mean scores reported by Kasl et al. (1981) for workers at the Three Mile Island and Peach Bottom nuclear power plants. Means reported in the earlier study range from .45 to .75, compared to a mean of .79 for Deaf Smith and Swisher counties. All of these average scores fall at the low end of the hopelessness-helplessness response scale.

For both of the stress measures included in this study, comparisons between Deaf Smith and Swisher scores and results for other groups outside of Texas are difficult to interpret. For example, they could be due to differences in the demographic composition of the samples or regional differences in the social rules for acknowledging stresses to an interviewer. These measures are included here primarily as "baseline" measures to allow for monitoring of psychological stress in Deaf Smith and Swisher counties, and in Crosby and Moore counties if the nuclear waste program continues in Texas.

Factors Explaining Public Views of the Repository

Results reported so far show strong local opposition to building a nuclear waste repository in Texas, and they show high levels of concern about health and the environment and about social and economic effects of the repository. Further statistical tests using multiple regression and path analysis provide additional information about what factors are most important in explaining local views about the repository.⁹ These statistical techniques allow researchers to investigate relationships among several research variables simultaneously. They show which factors in the research model have direct, independent effects on a final outcome variable, and which factors have indirect effects, operating through intermediate variables.

The following section of this report briefly reviews the rationale for the regression model and describes the techniques used to construct regression equations. Results of the multiple regressions and path analysis are described and compared to earlier research. Detailed statistical information about results is shown in Tables 4 to 9. Additional information about the rationale for the model and the measurement techniques is found in the literature review and description of the survey instrument earlier in this report.

Previous research about residents living near a proposed nuclear facility indicates that the process of deciding whether to favor or oppose the facility involves evaluating what effects are likely to be associated with it, weighing possible benefits against possible costs. In earlier studies economic growth was the primary "benefit" expected from nuclear facilities, and health and environmental risks were the perceived "costs." Figure 1 shows a simplified model applying these earlier findings to the measures used in this study.

Scales were computed to represent several variables in the model: overall attitudes towards the nuclear waste repository, expectations about socioeconomic effects of the repository, expectations about health risks, and knowledge about the nuclear waste program. Another scale, number of "don't know" answers, was also computed to control for a possible source of response bias. Research scales are described in Table 3.



Figure 1. Model of Expected Predictors of Overall Attitudes Towards the Nuclear Waste Repository

Table 3

Description of Research Scales

Scale Name	Description					
<u>Overall Attitude Towards Repository</u>	<u>N Items</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	
	2	8.67	2.24	2	10	
Comments: Created by summing two questions asking survey participants whether they would allow construction of the repository and whether they thought it would be good for their county. The correlation between these two items is .85 ($p \leq .01$). High scores represent stronger opposition to the repository.						
<u>Socioeconomic Expectations</u>	<u>N Items</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	<u>Alpha</u>
	14	1.71	.39	1	3	.82
Comments: Created by summing responses to questions asking survey participants whether they expected a series of indicators to "go up," "stay the same," or "go down." Scoring was reversed for some items, so that the high end of the scale for each item (and for the scale as a whole) represents a desirable change. Preliminary analyses indicate broad consensus among survey participants that an increase in agriculture, industry, stores, or entertainment would be good for their county. The question concerning traffic was omitted because correlation analyses indicate it would not contribute to a coherent scale, since many people recognize that an increase in traffic (an undesirable change) would be likely with an increase in business (a desirable change).						
<u>Health Risks</u>	<u>N Items</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	<u>Alpha</u>
	13	3.14	.83	1	4	.96
Comments: Created by summing responses to questions asking survey participants how likely they thought it was that health and environmental problems would develop at the repository. Higher scores indicate greater perceived risk.						
<u>Knowledge</u>	<u>N Items</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	<u>Alpha</u>
	12	7.16	2.49	0	12	.63
Comments: Created by counting the number of correct answers to factual questions about the nuclear waste program.						
<u>Action</u>	<u>N Items</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	<u>Alpha</u>
	10	2.40	2.18	0	10	.78
Comments: Created by counting the number of actions survey participants reported for questions about their response to the repository.						

Table 3 (continued)

Scale Name	Description					
<u>Perceived Stress</u>	<u>N Items</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	<u>Alpha</u>
	8	1.26	.74	0	3.50	.74
Comments: Created by summing responses to questions from Cohen et al. (1983). Scoring was reversed for some items, so higher scores consistently represent greater stress.						
<u>Hopelessness</u>	<u>N Items</u>	<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	<u>Alpha</u>
	4	.79	.88	0	4	.84
Comments: Created by summing responses to the hopelessness-helplessness subscale of the PERI demoralization scale.						
<u>Don't Know</u>		<u>Mean</u>	<u>SD</u>	<u>Min.</u>	<u>Max.</u>	
		4.49	5.00	0	47	
Comments: Following a procedure suggested by Cohen and Cohen (1975), this scale was created by counting the number of "don't know" responses survey participants used in answering interview questions. Use of this scale in regression analyses controls for any response bias that would result if certain subgroups of participants--for example, women--are more or less confident than others about their knowledge and opinions about the repository.						

Note: Scales for socioeconomic expectations, health risks, perceived stress, and hopelessness were computed by the following procedure: (1) "Don't know" responses were coded as missing, (2) non-missing responses were summed, and (3) the sum was divided by the number of nonmissing responses. "SD" is the standard deviation, a measure of variation in scale scores. Coefficient alpha is a measure of internal consistency reliability; values of at least .60 are generally considered adequate for research purposes.

Background characteristics of survey participants are also included in the model. Previous research indicates that women are more concerned than men about nuclear facilities, but other relationships between background characteristics and attitudes towards nuclear projects are less consistent. This study includes several demographic variables commonly used in other research: education, gender, ethnicity, age, and income.

In addition, the model includes other background variables that may be more directly related to whether survey participants have a personal or financial stake in the decision to build a repository nearby. For example, other studies found that parents of young children were more concerned than others about the accident at Three Mile Island, because young children were considered particularly vulnerable to ill-effects of radiation releases. The TDA study similarly includes presence of children at home as a possible factor in attitudes towards the nuclear repository. Property ownership may also be important, since effects on land values have been a key issue in discussions of the repository. Similarly, sources of income could be a factor, since the repository may have differential effects on farming and other businesses. The following variables are included to test the effects of property and income sources on attitudes towards the repository: property ownership, distance of property from the proposed repository sites, income from business ownership, farming as the largest source of household income, and income from wages or salaries.

Regression Results

The research model (Figure 1) shows overall attitudes towards the nuclear waste repository as a function of expectations about the socioeconomic effects and health risks of living near the project. Multiple regression analyses confirm that these expectations are highly significant predictors of overall attitudes towards the repository (Table 4). Fifty-two percent of the variation in overall attitudes is explained by the model. Concern about health and environmental risks is the strongest predictor of opposition to the repository, and pessimism about socioeconomic effects of the repository is also a strong factor. Background characteristics and knowledge about the nuclear waste program have no significant direct effects on overall attitudes towards the repository. That is, background characteristics and knowledge do not contribute independently to explaining overall attitudes. They contribute only indirectly through their relationship

Table 4

Regression of Overall Attitudes Towards the Nuclear Repository on
Expected Outcomes, Knowledge, and Background Characteristics

Variable	Unstandardized Coefficient (B)	S.E.B.	Beta	Adjusted R ²	Overall F(15,388)
Socioeconomic benefits**	-1.77	.26	-.31	.52	30.29**
Environmental risks**	1.30	.13	.48		
Nuclear waste knowledge	.03	.05	.03		
Education	-.00	.08	-.00		
Male	.15	.17	.03		
Hispanic	-.17	.27	-.03		
Income	-.03	.06	-.02		
Farming largest income source	.05	.23	-.01		
Business income	-.15	.20	-.03		
Income from wages	-.22	.20	-.05		
Distance from site	.00	.01	.02		
Children in household	.21	.21	.05		
Age	.01	.01	.10		
Property ownership	-.05	.22	-.01		
"Don't know" reponses	-.00	.00	-.00		

**p ≤ .01.

with health and socioeconomic expectations. These indirect effects are discussed in the description of path analysis results.

The proposed model is also a significant predictor of perceived health and environmental risks; however, only 13 percent of the variation in perceived risk is explained by background characteristics included in this study (Table 5). Gender is the strongest predictor for this scale: Women rate these hazards as more likely than men do. Local residents who have higher incomes consider hazards less likely, while those with the greatest knowledge about nuclear wastes are more concerned about risks. Farmers and Hispanics rate health and environmental risks higher, and education is associated with lower risk assessments.

The model is least successful in explaining expectations about socioeconomic effects of the repository (Table 6). Although background characteristics are statistically significant predictors of socioeconomic expectations, only 6 percent of the variation in this scale is explained. The small proportion of variance explained by demographic factors is another indication of very broad consensus among demographic subgroups within the site counties in their views about the nuclear waste repository. The only significant predictors of socioeconomic expectations are farm income and gender. Households where farming is the primary source of income expect fewer socioeconomic benefits from the repository, while men expect greater benefits.

Regression results presented so far indicate that knowledge about the nuclear waste repository has a limited role in formation of overall attitudes towards the repository. Although this study does not focus on the sources of knowledge about the nuclear waste program, further information about this issue would be useful in understanding how local residents respond to a proposed nuclear facility; so for exploratory purposes, knowledge scores were regressed on selected background characteristics.

This analysis shows that 28 percent of the variation in knowledge is explained by background characteristics (Table 7). Education is most strongly associated with greater knowledge. Men and farmers also score higher, and Hispanics score lower. The relationship between education and knowledge is expected, since more-educated individuals have better access to information about a technical subject. The finding that Hispanics are less

Table 5

Regression of Expected Health and Environmental Risks
on Background Characteristics

Variable	Unstandardized Coefficient (B)	S.E.B.	Beta	Adjusted R ²	Overall F(13,390)
Nuclear waste knowledge*	.05	.02	.16	.13	5.46**
Education*	-.01	.04	-.14		
Male**	-.38	.08	-.23		
Hispanic*	.30	.13	.13		
Income**	-.09	.03	-.17		
Farming largest income source**	.30	.11	.14		
Business income	-.04	.10	-.02		
Income from wages	-.06	.10	-.04		
Distance from site	.00	.00	.03		
Children in household	.01	.10	.01		
Age	-.00	.00	-.09		
Property ownership	.04	.11	.02		
"Don't know" reponses	.00	.01	.01		

**p ≤ .01.

*p ≤ .05.

Table 6

Regression of Socioeconomic Expectations on Background Characteristics

Variable	Unstandardized Coefficient (B)	S.E.B.	Beta	Adjusted R ²	Overall F(13,390)
Nuclear waste knowledge	- .00	.01	-.01	.06	3.13**
Education	-.01	.02	-.03		
Male*	.10	.04	.12		
Hispanic	.10	.06	.09		
Income	.03	.01	.12		
Farming largest income source**	-.20	.06	-.20		
Business income	.01	.05	.01		
Income from wages	.06	.05	.07		
Distance from site	-.00	.00	-.07		
Children in household	-.03	.05	-.04		
Age	-.00	.00	-.03		
Property ownership	-.03	.05	-.03		
"Don't know" reponses	.01	.01	.08		

**p < .01.

*p < .05.

Table 7

Regression of Knowledge About Nuclear Waste on Background Characteristics

Variable	Unstandardized Coefficient (B)	<u>S.E.B.</u>	<u>Beta</u>	Adjusted R^2	Overall F(10,393)
Education**	.58	.10	.32	.28	16.87**
Male**	1.30	.22	.26		
Hispanic*	-.79	.35	-.11		
Income	.08	.08	.05		
Farming largest income source**	1.23	.29	.20		
Business income	.05	.27	.01		
Income from wages	.11	.27	.02		
Distance from site	.00	.01	.00		
Age	.01	.01	.07		
Property ownership	.49	.29	.08		

**p \leq .01.*p \leq .05.

knowledgeable is consistent with other analyses showing that Hispanics have not participated as much as Anglos in the repository site-selection process.

Path Analysis

Path analysis is a useful technique for evaluating the importance of factors that contribute to attitudes towards the repository both directly and indirectly. Expectations about socioeconomic effects and health and environmental risks are the only significant factors contributing directly to overall attitudes towards the repository. However, several background characteristics contribute indirectly because of their relationships with socioeconomic and health expectations. Statistically significant path coefficients are shown in Figure 2. Direct and indirect effects, calculated according to procedures outlined by Finney (1972), are shown in Table 8.

Concern about health and the environment remains the most important factor in opposition to the repository. Expectations about socioeconomic effects is the second strongest predictor. Gender, farm income, knowledge about the nuclear waste program, education, ethnicity, and total income have indirect effects on overall attitudes towards the repository. Women, farmers, and Hispanics are more strongly opposed to the repository; and greater knowledge about the repository is also associated with stronger opposition. Residents with greater education and higher income are less strongly opposed to the repository.

Factors Predicting Action Concerning the Repository

In addition to addressing the question of what factors are important in overall attitudes towards the repository, multiple regression analyses are also useful in exploring what factors determine whether local residents will be actively involved in the site-selection process or take other action because of the repository. Previous research indicates that the decision to take action in a particular setting is based on an assessment of whether the situation is personally threatening and of whether action could change the outcome or not.

In the case of the nuclear waste repository, expectations about socioeconomic effects and health risks are measures of whether local residents see the repository as a potential threat. Background characteristics, such as distance from the proposed sites or dependence on farm income, may also be related to perceptions of threat.

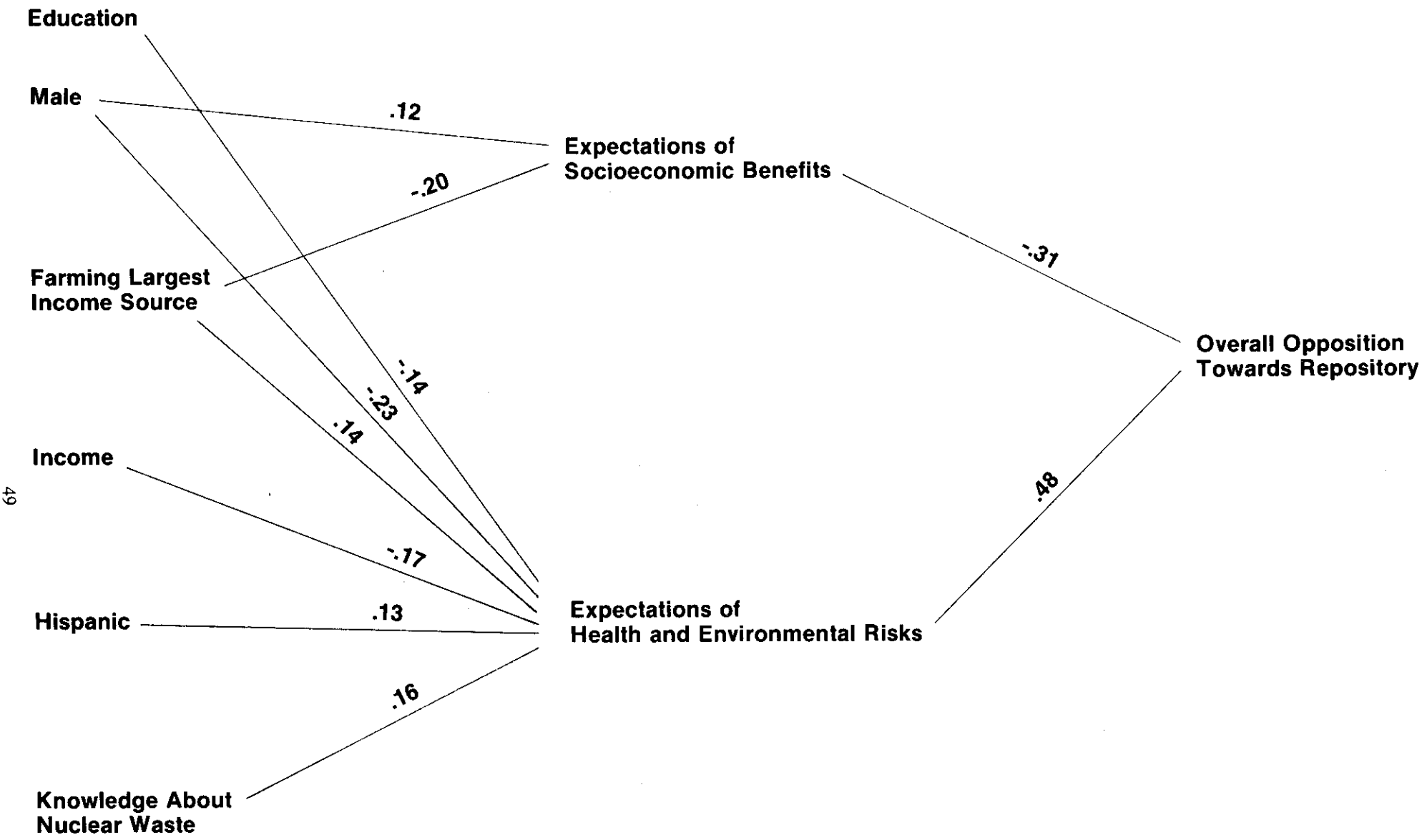


Figure 2. Path Model Showing Statistically Significant Paths ($p \leq .05$)

Table 8

Direct and Indirect Effects of Model Variables on Overall Attitudes Towards the Nuclear Waste Repository

Source	Direct	Indirect	Total
Socioeconomic benefits	-.31		-.31
Environmental risks	.48		.48
Nuclear waste knowledge		.08	.08
Education		-.07	-.07
Male		-.15	-.15
Hispanic		.06	.06
Income		-.02	-.02
Farming largest income source		.13	.13

Assessments of whether their area is likely to be chosen are also important: For example, residents who believe the repository would be harmful may not do anything about it if they also believe the repository is unlikely to be built nearby. Figure 3 shows a simplified model of how perceptions about the repository might affect active responses to the site-selection process.

Regression results show that the proposed model explains 35 percent of the variation in the number of actions taken in response to the repository (Table 9). Knowledge about the nuclear waste program, education level, and disagreement with the statement "I need more information before I can act" are all significantly related to Action Scale scores. Pessimism about socioeconomic effects of the repository, belief that their county is likely to be chosen for the repository, and disagreement with the statement that "this is a situation that must be accepted or gotten used to" are also significant predictors. Overall attitudes towards the repository, expectations about health risks, and other background characteristics are not significantly related to action scores.

Comparing results of this analysis with results of earlier regressions for overall attitudes towards the repository indicates that somewhat different processes are involved: Decisions about whether to favor the repository have a different basis than decisions about whether to take action related to the repository. Overall support for or opposition to the repository is not a significant predictor of action scores, and the factors related to overall opinions about the repository are somewhat different from the factors related to action. Although concerns about health and the environment are the strongest predictors of opposition to the repository, expectations about socioeconomic effects are more closely related to action scores. In addition, education and information are more important factors in predicting action. This finding may indicate that education and access to information are prerequisites to participating in the highly-technical DOE site-selection process.

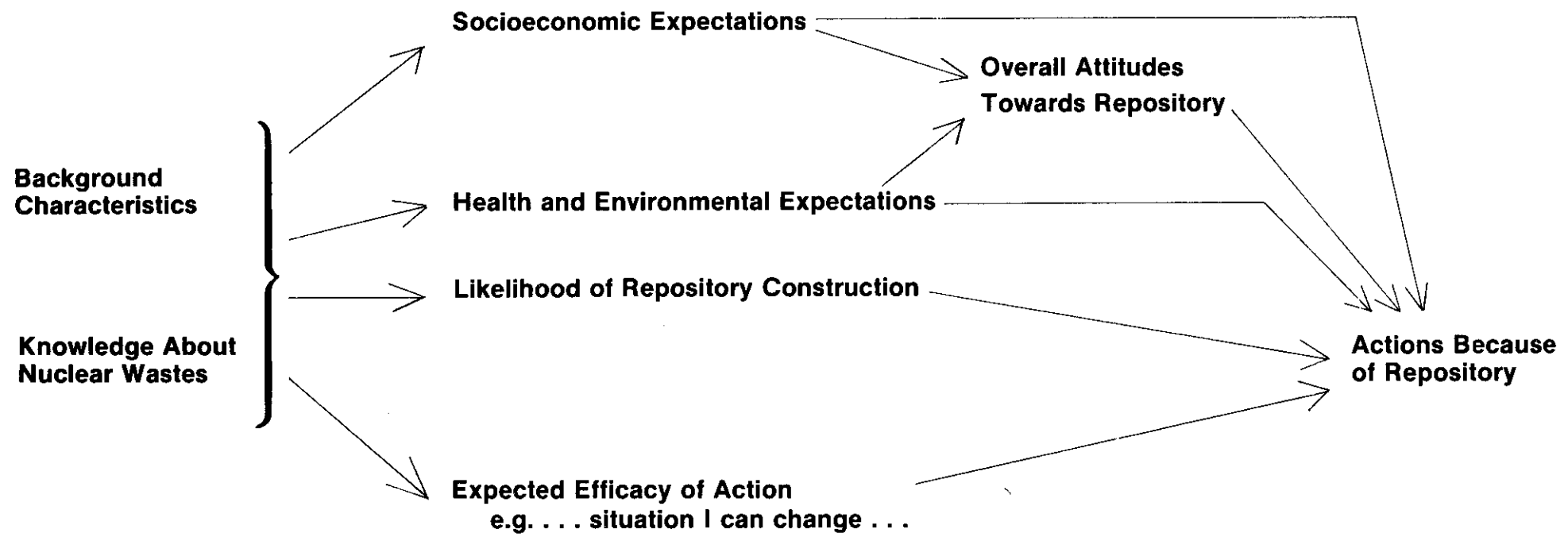


Figure 3. Model of Expected Predictors of Actions Taken Because of the Nuclear Repository

Table 9

Regression of Repository-Related Actions on Model Variables

Variable	Unstandardized Coefficient (B)	S.E.B.	Beta	Adjusted R ²	Overall F(22,350)
Overall attitudes towards repository	.04	.06	.04	.35	9.96**
Socioeconomic benefits**	-.77	.34	-.14		
Environmental risks**	.20	.18	.08		
Likelihood of repository**	.26	.10	.12		
Must accept repository*	-.19	.08	-.13		
Can change situation	-.05	.06	-.03		
Must holdback	.03	.06	.02		
Need information**	-.20	.06	-.14		
Repository affects me	-.10	.09	-.06		
Nuclear waste knowledge**	.22	.57	.25		
Education*	.19	.09	.12		
Male	-.10	.21	-.02		
Hispanic	.08	.32	.01		
Income	.10	.07	.08		
Farming largest income source	.15	.27	.03		
Business income	.18	.24	.04		
Income from wages	-.03	.24	-.01		
Distance from site	-.02	.01	-.08		
Children in household	.11	.24	.03		
Age	-.00	.01	-.01		
Property ownership	.23	.26	.04		
"Don't know" reponses	-.01	.03	-.03		

**p ≤ .01.

*p ≤ .05.

Crosby and Moore County Areas

Public opposition to the high-level nuclear waste repository extends beyond the proposed site counties to other areas of the Texas Plains. Residents of the Crosby and Moore county areas are aware of the nuclear waste repository issue, they are strongly opposed to locating the repository in the Texas Plains, and they believe a Texas repository would affect their own lives and the future of their communities.

When asked whether they would allow construction of the repository in the Texas Plains if the decision were up to them, two-thirds of the Crosby and Moore county residents said "definitely no" and 17 percent said "probably no." Two-thirds said a repository in the Texas Plains would "definitely" not be good for their county, and 12 percent said it would "probably" not be good for their county. Eighty-one percent of the Moore and Crosby county residents said they had heard about the nuclear waste repository before they were contacted about the telephone poll. About 28 percent of the Moore and Crosby county residents think it is "very likely" or "somewhat likely" that the repository will actually be built in Texas, less than half the proportion of Deaf Smith and Swisher residents who feel this way.

Although Moore and Crosby residents are more distant from the proposed nuclear waste sites, the repository is not an academic issue in these areas. Nearly half of those polled said a repository in the Texas Plains would affect them or their families personally. They expected negative effects on local health and economics.

Like residents of Deaf Smith and Swisher counties, Moore and Crosby residents are particularly concerned about the effect of a nuclear repository on agriculture. More than two-thirds expect the value of farmland in their own counties to go down if a repository is built in Texas and about half think agricultural production would go down. Roughly a third of the Moore and Crosby residents think the repository would cause an increase in the cost of living and a decrease in population, industry, and stores and businesses for their county; while 40 to 50 percent expected these indicators to remain the same.

People in Moore and Crosby counties are also deeply concerned about health and environmental hazards associated with the repository. Forty percent believe it is "very likely" that a Texas repository would lead to

health problems for residents of their own county, and 29 percent think health problems are "somewhat likely" for their county. Moore and Crosby residents are also concerned about accidents that could take place at the repository. Interviewers asked questions about five other possible health and environmental problems, and two-thirds to four-fifths of the Moore and Crosby residents rated each of these problems as "very likely" or "somewhat likely." More than 80 percent said they would be "extremely concerned" or "very concerned" if one of these accidents did occur. A comparison of Deaf Smith/Swisher and Crosby/Moore responses for selected questions is shown graphically in figure 4.

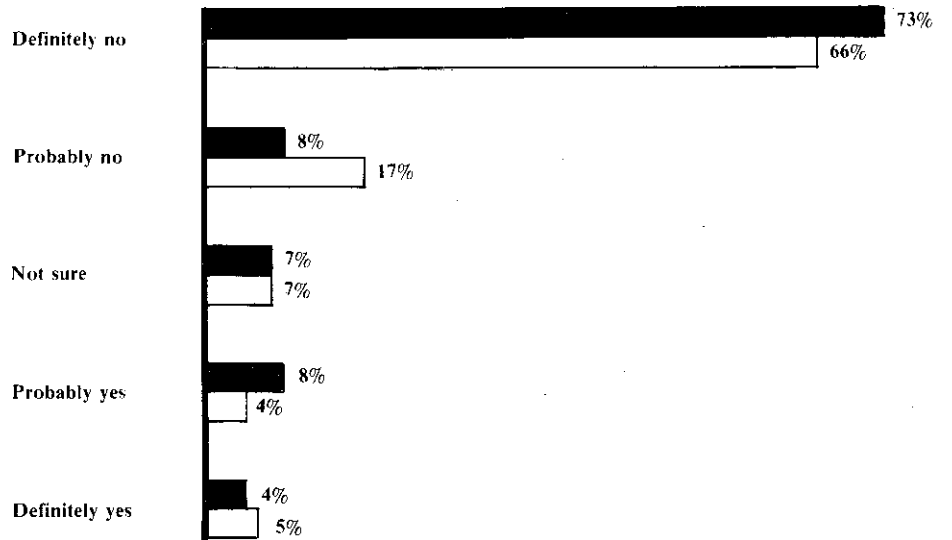
Factors in Overall Attitudes Towards the Repository

Multiple regression analysis shows that the factors involved in forming overall attitudes towards the nuclear waste repository are generally similar in the site counties and in the Crosby/Moore area. As in Deaf Smith and Swisher counties, concern about health and environmental risks is the strongest predictor of overall support or opposition for the repository among Crosby and Moore county residents. Expectations about socioeconomic effects are also an important predictor for both studies, but effects of ethnicity differ. In the Crosby and Moore county areas, Hispanics are significantly less likely than non-Hispanics to oppose building the nuclear repository in Texas. For Deaf Smith and Swisher counties, ethnicity has a small, indirect effect on overall attitudes, with Hispanics somewhat more likely than non-Hispanics to oppose the repository. The proposed model of overall attitudes towards the repository as a function of expectations about socioeconomic effects, concerns about health and environmental risks, and background characteristics explains 38 percent of the variance in Crosby and Moore residents' assessments of the repository.

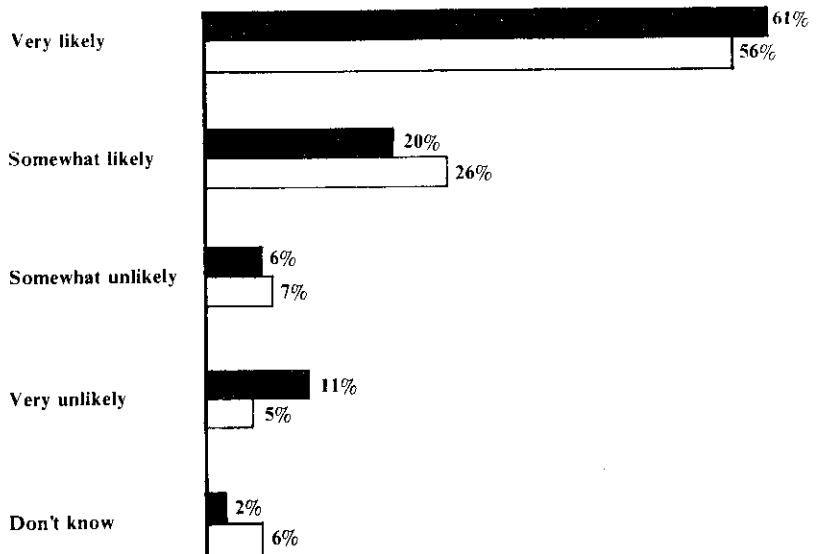
Just as for the Deaf Smith/Swisher analyses, expectations about socioeconomic and environmental effects of the repository are not well-explained by background characteristics included in the Crosby/Moore surveys. Multiple regression analysis shows no significant relationship between background characteristics and socioeconomic expectations. For expectations about environmental effects, only 4 percent of the variance is explained by background characteristics ($F = 1.94$, $p < .05$). Gender is the only significant predictor, with men reporting lower levels of concern than women ($\beta = -.22$, $p < .01$). Scales used in the multiple regression analysis are described in Table 10. Multiple regression results are shown in Table 11.

Figure 4. Responses to Selected Nuclear Waste Survey Questions

Would you allow construction of a high-level nuclear waste repository in the Texas High Plains?



How likely is it that radioactive wastes would escape into the water supply?



What will happen to the value of farmland in your county if a high-level nuclear waste repository is built in the High Plains?

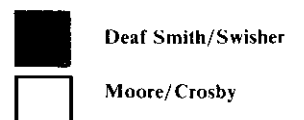
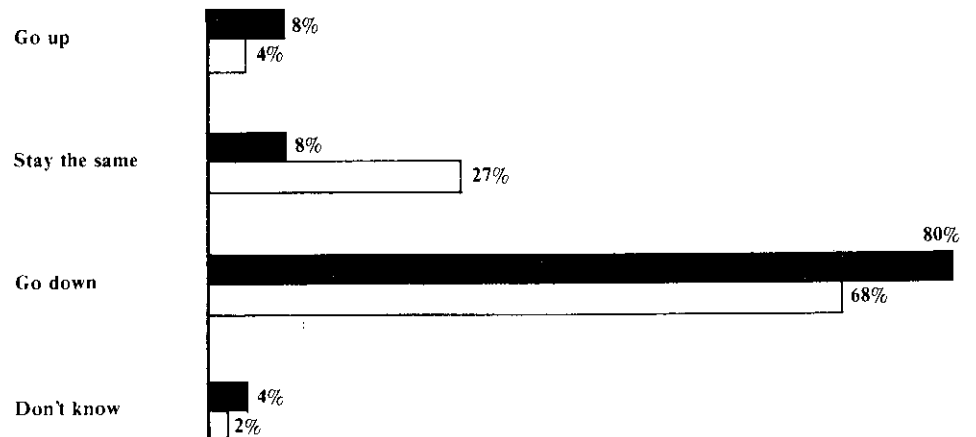


Table 10

Description of Research Scales for Crosby and Moore Counties

Scale Name	Description					
	N Items	Mean	SD	Min.	Max.	Alpha
Overall Attitude Towards Repository	2	8.68	2.02	2.00	10.00	--
Socioeconomic Expectations	6	1.68	.39	1.00	2.67	.63
Health Risks	6	3.16	.73	1.00	4.00	.88
Perceived Stress	4	1.06	.68	0	3.50	.61
Hopelessness	4	.61	.65	0	3.50	.61
Don't Know	--	1.30	2.36	0	21.00	--

Note: Scales were computed using the same techniques described in Table 3 for the Deaf Smith/Swisher data. The interview question concerning population growth is not included in the socioeconomic expectations scale because this question was not asked in the Deaf Smith/Swisher study.

Table 11

Regression of Overall Attitudes Towards the Nuclear Repository on
Expected Outcomes and Background Characteristics:
Crosby/Moore Area

Variable	Unstandardized Coefficient (B)	S.E.B.	Beta	Adjusted R ²	Overall F(12,203)
Socioeconomic benefits**	-1.33	.32	-.26	.38	12.00**
Environmental risks**	1.31	.17	.47		
Had heard about repository	.30	.32	.06		
Education	-.01	.11	-.01		
Male	.20	.23	.05		
Hispanic*	-1.00	.47	-.13		
Income	.11	.08	.09		
Farming largest income source	.52	.27	.11		
Business income	.74	.27	.00		
Children in household	-.19	.28	-.05		
Age	-.01	.01	-.08		
"Don't know" reponses	.03	.05	.03		

**p ≤ .01.

*p ≤ .05

Comparisons with Earlier Research

Previous polls reviewed by Freudenburg & Baxter (1984) show the public opposes construction of new nuclear power plants by about two to one. The TDA surveys show much stronger opposition--approximately seven or eight opponents to one supporter in both of the study areas--to building a high-level nuclear waste repository in Texas. This intense opposition is quite similar to results reported by Hill and Dyer (1984). They found 80 percent of local residents opposed location of a low-level radioactive waste disposal site in their county.

Results of the TDA interviews are also consistent with earlier research by Sundstrom, Hughey, and their colleagues showing that public expectations about effects of a nuclear facility play an important role in the formation of overall attitudes towards siting the facility nearby. In their studies for Oak Ridge National Laboratories, these authors found a third to a half of the variance in overall attitudes towards a nuclear power plant was explained by expectations about socioeconomic benefits and environmental risks. The TDA studies found that these factors explain about half of the variance in overall attitudes towards the nuclear repository for the Deaf Smith and Swisher areas and about a third of the variance for the Crosby and Moore areas.

The TDA studies also join numerous earlier polls in showing women more concerned than men about effects of a nuclear facility. In addition, TDA analyses found that other background characteristics--education, knowledge, ethnicity, and income-- have indirect effects on overall attitudes towards the repository. The earlier Oak Ridge studies did not investigate indirect effects, and they did not explore factors involved in forming expectations about a nuclear facility. Future research concerning sources of these expectations would be particularly useful, since variables included in the present studies explain only a small proportion of the variance in expectations about socioeconomic and environmental effects of the nuclear repository.

Relationships between education and knowledge, and attitudes towards the repository are of particular interest because of their implications for public education campaigns. The National Academy of Sciences concludes that previous research does not support nuclear

industry claims that opposition to nuclear facilities stems from ignorance about them. The TDA study shows complex relationships among education, knowledge about nuclear waste, attitudes towards the repository, and actions taken because of the repository. Knowledge about the nuclear waste program is associated with greater concern about environmental risks related to the repository, so more-knowledgeable residents express stronger opposition to constructing the repository in their area. More-educated residents are slightly less opposed to the repository, but both education and knowledge are positively related to taking action because of the repository. This relationship between education and knowledge, and actions related to the repository is not surprising, given the level of expertise needed to participate in the very technical DOE site-selection process. Alternatively, active participation in DOE hearings and document reviews may lead to greater knowledge about the repository. (However, this hypothesis of reverse causation is not a plausible explanation for effects of education.) Repeated research monitoring changes in these communities could clarify relationships between knowledge and activism.

The somewhat different patterns of predictors for overall attitudes towards the repository and for actions taken because of the repository indicate the importance of investigating these two phenomena separately. As in earlier research, residents who have little hope for change are unlikely to take action. This finding means that local residents who do not participate in the site-selection process include those who believe public participation won't make any difference.

In summary, opposition to building a high-level nuclear waste repository in Texas is stronger than public opposition to nuclear power plants in general. As in earlier research, concerns about socioeconomic and environmental effects of a nuclear facility are key factors in public opposition to the repository.

SURVEY OF FARM OPERATORS

Because of the rich agricultural resources of both Deaf Smith and Swisher counties and the key role of agriculture in the Panhandle economy, concerns about possible effects on farming have been central to public discussions about building a nuclear waste repository in Texas. In order to address issues of particular concern to farmers, TDA surveyed farm operators to supplement results of the more general telephone poll of Deaf Smith and Swisher county residents. Like the telephone surveys, this study documents expectations about how a nuclear waste repository could affect local communities. The farm operator survey also focuses on current effects of the site-selection process and on agricultural operations that might be particularly vulnerable to effects of a repository.

Procedures

The farm operator survey was mailed to 989 farm operators in Deaf Smith and Swisher counties in mid-September, along with an explanatory letter from Governor Mark White and Texas Agriculture Commissioner Jim Hightower. Farm operators were chosen for the study because of their day-to-day responsibility for farm management. Agricultural production reports by the Texas Crop and Livestock Reporting Service are also based on surveys of farm operators. Names and addresses of farm operators in Deaf Smith and Swisher counties were obtained from records maintained by TDA and USDA.

A reminder letter was sent to farmers about one week after the original survey mailing, and farmers who hadn't returned a survey after three weeks received a telephone reminder asking them to mail it in. Prepaid return envelopes were enclosed with the survey forms, and surveys were returned by mail directly to TDA in Austin. "State of Texas" letterhead was used for all mailings.

Forty-six surveys were returned by the post office as undeliverable. Of the remaining 943 surveys, 67 percent were completed and returned. For comparison, the Texas Crop and Livestock Reporting Service, a joint program of TDA and USDA, reports response rates of 30 to 40 percent for mail surveys of Texas farm operators, and response rates of 50 to 60 percent for surveys using a combination of mail and telephone responses.¹⁰

Seventy-one surveys indicated that the respondent was no longer operating a farm or ranch in Deaf Smith or Swisher county. Some of these individuals had quit farming, and others were operating land in other counties. Removing these cases from the sample leaves 564 valid surveys.

The survey instrument included both closed- and open-ended questions. In a series of questions similar to those used in the TDA telephone surveys, farmers were asked about changes in economic indicators for their own farms. Surveys asked whether farmers expected these indicators to go up, stay the same, or go down if the repository were built in their county; and they asked farmers whether the site-selection process had already caused any economic changes for their operation. Open-ended questions asked farmers to describe any changes in business or personal plans they had already made or expected to make because of the repository. Farmers also were asked whether they agreed or disagreed with several more-general statements about the nuclear waste repository program and the future of farming in their area. In addition, they were asked to provide basic demographic information about themselves and background information about the size of their farms, the types of crops and livestock produced, and their use of irrigation. The wording of survey questions is shown in Appendix C, and copies of the instrument are available from TDA.

Background Characteristics

Farms included in this survey range from 10 acres to 10 sections (6400 acres) in size, with an average of 1334 acres per farm. About four-fifths of the farms studied include irrigated cropland, with an average of 743 irrigated acres for farms that include land of this type. In addition, 58 percent of the farms studied include unirrigated cropland, averaging 769 acres per farm; 48 percent include unimproved pasture, averaging 562 acres; and 15 percent include improved permanent pasture, averaging 223 acres. Wheat, sorghum, cotton, and cattle are the primary agricultural products, although many other crops are also grown on these farms.

Farmers who participated in the survey ranged in age from 25 to 89 years, with an average age of 51. About half of them own all the land they operate in Deaf Smith and Swisher counties, and another third own some of the land. On the average, survey participants had farmed their land for 22 years, and it had been farmed by their

families for 36 years. Some families had farmed their land for more than a century. About four-fifths of the farmers surveyed earn at least half of their household income from farming; two-thirds earn more than three-fourths of their household income from their farms. Additional information about survey participants is shown in Appendix C.

Specialty Crops

Public discussion about the proposed nuclear waste sites has focused on several large specialty operations--including Richardson Seed Farms, which is located in and adjacent to the Deaf Smith site, and Arrowhead Mills, a Hereford health-food company--that may be particularly vulnerable to business losses if a repository is built in Texas. This survey documents that a substantial number of farms in the site counties are linked to these businesses, so any effects on their operations would be widely felt. Thirty-seven percent of the farmers surveyed produce seed for sale. They reported seed crops including barley, millet, oats, rye, triticale, wheat, sorghum, hybrid sorghum, sorghum-Sudan hybrids, Sudan grass and other grasses, such as kleingrass, rangegrass, and sideoats grama.

Seven percent of the survey participants said they sell to health-food markets, and 6 percent sell food directly to consumers. Health food sales include barley, beef, sunflower seeds, corn, oats, rye, soybeans, triticale, and wheat; and sales directly to consumers include 21 different kinds of grains, vegetables, fruits, and meat.¹¹

On the average, seed producers who participated in the survey made \$43,366 in cash receipts from seed sales in 1983, and 1983 cash receipts from seed ranged up to \$360,000 for larger producers. Average 1983 cash receipts from sales to health-food markets were \$82,728, ranging up to approximately one million dollars for the largest seller; and farmers who sell directly to consumers made an average of \$42,011 in cash receipts for 1983 direct sales, with a maximum of \$500,000. These results indicate that sales of seed and health-foods and sales directly to consumers contribute substantially to these farmers' operations.

Effects of the Nuclear Waste Repository on Farming

Farm operators believe that construction of a nuclear waste repository in their county would hurt their farms and ranches. Farmers expressed greatest concern about the repository's effects on sales of agricultural products, land and mineral values, and water availability. Four out of five farmers said a nuclear waste repository would make it harder for them to sell their crops. Eighty-four percent said construction of a repository in their county would cause the value of their land to go down, 74 percent said their mineral values would go down, and 73 percent said the repository would mean a decrease in water for irrigation on their land. A majority of those surveyed expect construction of a repository to mean lower prices for farm products, decreased agricultural sales volumes, increased costs for insurance and farm labor, and greater difficulty in obtaining loans. Between 59 and 66 percent expect detrimental effects for these indicators, and between 14 and 21 percent were uncertain. A substantial minority of farmers believe the repository would mean decreases in agricultural production and increases in prices for farm supplies. Less than 10 percent of those surveyed think the repository would have no effect on farming in their area.

In addition, farmers are concerned about effects of the nuclear waste program now, even before a final repository site is selected. About two-thirds said that landowners next to the proposed repository sites have already been hurt financially, and the same proportion said uncertainty about whether Texas will be chosen for the repository makes it hard to plan for their own farms. Most farmers fear that DOE site characterization activities will be damaging: 63 percent said that drilling to study the proposed waste sites could contaminate soil and water in their area.

Many farmers also believe that consideration of their county as a possible site for a nuclear waste repository has already hurt the value of their own land and mineral rights. Forty-eight percent said their land value went down because of the repository, and 35 percent said their mineral value declined because of the repository. Farmers generally are not concerned about effects of the site-selection process on 1984 prices or sales volumes, irrigation water, production levels, or farm labor costs. At least three-fourths of those surveyed said consideration of their county as a possible repository site had no effect on these indicators. Although roughly

two-thirds said insurance rates and agricultural loans were not affected by the repository, 15 percent said the availability of loans decreased because of the repository, and 18 percent were uncertain about repository effects on farm credit. Similarly, 12 percent believe that insurance rates increased because of the repository, and 18 percent were unsure.

Most farmers said they had not yet made any changes in their personal or financial plans because of the repository, but 13 percent of those surveyed said they had made changes because of the repository. Farmers who indicated that they had already altered their plans because of the repository were asked to describe the changes they made. Most of these farmers had decided not to make new investments in their area as long as it remains on the list of possible repository sites. Twenty-five farmers said they had decided not to buy land in the site counties, and 23 said they had decided to delay further investments in their operation--including drilling new irrigation wells, buying equipment, and maintaining buildings and machinery. Thirteen farmers cited the repository as the reason that they were unable to find buyers for land they wanted to sell. Others said the repository led to their decision to buy land in another county, to lease out land instead of farming it themselves, to expand a nonfarm business, to make plans to move, or to leave farming. Several farmers indicated that they had decided not to build new homes, and several said negotiations for mineral leases on their land fell through because of DOE activities in the area.

A much larger group of farm operators expects to make future changes if their county is actually chosen as a repository site: 26 percent said they "definitely" would change their plans if their county is chosen, and 22 percent said they "probably" would change their plans. About a third were unsure how the repository would affect their future. Farmers who said they "definitely" or "probably" would alter their plans were asked what changes they expected to make. This item was an open-ended question with no responses suggested by the questionnaire. Among the 283 farmers who expect to make changes if the repository is located in their county, 102 (36 percent) spontaneously said they plan to move, and 19 more (7 percent) said they "might" move. In addition, 59 farmers (21 percent) plan to sell their land, many of them expecting to sell at a loss. Other farmers said they would quit farming, encourage their children to leave the area, buy land elsewhere, avoid all investments in

maintaining or expanding their operation, decrease production, drop plans for a food processing facility, or shift away from production of food crops. Several farmers said the repository would mean developing entirely new markets for their vegetables, grains, and livestock.

While farmers are concerned about the effect of the repository on their own operation, they are also dissatisfied with the decision-making process and the technical competence of the nuclear waste program. Nearly three-fourths of the farmers surveyed indicated that they do not trust the federal government to build a repository that is safe, and 83 percent do not believe that the site-selection process is fair.

Farmers' Comments

Farmers' responses to open-ended questions are consistent with statistical results. Many farmers expressed deep concern about the effects of a nuclear repository on farming and on their rural heritage, and they questioned the fairness and competence of the site-selection process.

A few farmers are unconcerned about the repository, and a few expect economic benefits if it is built in their county.

- I feel that a lot of the opposition to the waste dump has been emotional rather than reasoned. I would rather not have it in my area, but if people were adequately compensated for their rights and property I don't feel that it is a direct threat to me or my operation.
- It's pretty hard for me to be very concerned about this problem because at the present rate things are going, I won't be around to worry about them. I will be broke and out of business.
- I think the agricultural basis in Deaf Smith County is declining because of the lack of irrigation water, and I feel that if the communities of Hereford and Vega want to survive we need to promote any and all new industries regardless of whether or not they have a stigma attached to them such as "nuclear waste repository."
- If they build one [repository] here, please send me a job application. It's bound to pay better than farming.

However, most farmers oppose the repository. They find it difficult to believe that the federal government would seriously consider such rich farmland as a nuclear waste site.

- Deaf Smith County, where our family lives and farms, has the most productive, rich land whose vegetables, grain and beef, etc. feeds so many people in this nation and the world. To put in a nuclear waste site in this area is insane! This chancey thing should not even be thought about for this area, let alone put here.
- It is beyond me why the government would even consider placing the repository in one of the most agriculturally productive areas of the United States.
- This land has been in the family for four generation, since 1878. To ruin the productivity of this land and to possibly contaminate the water supply is not only heartbreaking for the family, but pure folly. Texas, help us prevent such a mistake!
- I believe common sense should take the effect here. Any person who has common sense can see it is foolish to contaminate land and then attempt to raise the very food you have to eat to survive over the contaminated place.
- This is a very productive area and is a nice place to make a home. It would be a waste and shame to turn it into a poison desert. There are too many unknowns about this nuclear waste and how to store it. We don't have nuclear power here--why should we be the cesspool for others?

Many farmers believe a nuclear repository would hurt them financially, reducing their land values, threatening their water supply, and stigmatizing their agricultural products; and some think the site-selection process has already had economic effects.

- We have worked hard and invested our profits in more land and now own 3,000 acres. It is all near...(the proposed site). We feel as if we are being punished for our hard work and investing in land. We had just bought land near...at \$500 per acre and now couldn't sell it at half that price.

- I have paid as much as \$375.00/acre for some of my land. Since the repository site was announced, I have had adjoining land offered to me. I told the owner I wouldn't give \$50.00/acre until I knew where that hole was going to go in.
- We had been offered \$50 per acre for oil lease along with our neighbors...The oil company was to come to sign the contract but called and backed out because the DOE was in the area. We feel we have already been damaged financially by the DOE.
- This issue has destroyed many local life-long friendships. Our community has been kept on edge--not knowing the decision--and we are afraid that if they decide to put the site here, it will destroy our lives--income and way-of-life.
- We have seriously considered liquidation because the seed company that is our major cash crop buyer is in the proposed repository site.
- If you think nothing would happen to the Ogallala, just remember the length of time for nuclear waste to become safe and remember Murphy's law.

Uncertainty about whether Deaf Smith or Swisher county will actually be chosen as a repository site is a problem for farmers trying to plan for future investments; and family plans have been disrupted, too.

- We are afraid to expand our farm and buy new machinery because of not knowing whether the repository will be put here or not. The land may be worthless if the repository site is put here. Four families are provided a living from this farm of 1,000 acres.
- My wife and I had hoped to spend our last years on this land and leave it to our 4 children at death, but are undecided now for fear of being near the waste site.
- I would probably try to sell (my farm), even though we would have to take a great loss! I do not want to raise my children around this sewer. This farm has been in our family for 3 hard-working generations. It is a shame to have to sell everything you've worked all your life to pay for--for a big loss! Also, there is no legacy to give your children. I know this does not mean much to you--but it does to me!

- My husband just reached his 65th birthday and we want to turn the farm over to our grandson, but are reluctant at this time because of farming in this area so close to the repository. It is hard to make plans right now. We do not want our grand- children to live and work in an unsafe environment....If the repository is located in Deaf Smith, we don't think it would be a good idea (to give the farm to grandchildren) as we don't think it would be a safe place to work and raise a family.
- This hangs over us like a black cloud. We would have bought more land, but don't want to invest in something that is going to lose money.
- I have put any expansion plans on "hold" for now until we know where the site is going to be located.
- I did not buy a new combine because I was going to lease my land to an oil company for petroleum exploration when the news of the DOE came that this area was being considered for burial of high-level nuclear waste. The oil company postponed leasing my land until they found out what the government was going to do. Therefore, drilling for possible oil on our land has been squelched.
- I have ceased to repair and improve as in the past. If Swisher County is chosen I feel like my money and energy would be sacrificed.
- I'm being cautious about spending money for long-term improvements and am looking for a place out of state to move. We visited six states this summer with this possibility in mind. I have gone from neutral on nuclear issues to against use of nuclear energy of any form (except medicine). This is because in the last two years I have realized that the government has covered up, lied about health risks, safety and hazards. Farming and my land is more than dollars and cents--it is my heritage which I hope to pass on to my children.

Many farmers said they plan to move if their area is chosen for the repository, even if moving means selling their farms at a loss. Others will encourage their children to leave the area.

- Our family has been in farming since before our great-great-great grandfathers immigrated here at the turn of the century. If the DOE is foolish enough to

locate this here, we will encourage our children in different careers. I will not expose them to this. It can only lead to destruction of farming in this country.

- We have small children, and it concerns us as to what effect growing up so close to a nuclear waste site would have on their lives and their health.
- I'll leave Texas. Not only will the nuclear repository affect Deaf Smith and Swisher county, it will affect all of Texas. So wake up, Texas. The wind blows down on you, and the water underground flows your way also, so all of you will be affected. We don't want nuclear repositories here. Let them stop making the stuff! I sure plan to vote for the people that oppose using Texas for a nuclear dump.
- We have lived in Swisher County all our lives. Our farm has been in our family for three generations, and we plan to pass it on to our children and grandchildren. If the repository is put in our area, we will move elsewhere no matter what our roots are.
- If (the repository) comes here, we would probably sell our house. Since our seven years of marriage, this house is the first home we've ever bought, making it very important to us. I will not bring up my children around nuclear waste no matter how safe some congressman says it is.
- I will change areas if at all possible. I would probably take a lickin' on the farms I am presently paying on. However, I would not subject the health of my family of six to the danger of nuclear waste.

Some advocates of nuclear power and of the nuclear waste repository have encouraged local citizens to support the repository out of a sense of patriotic duty to help solve a national problem, but Deaf Smith and Swisher county farmers see their national duty quite differently. They feel a strong sense of responsibility to protect their farmland and their water as a resource to feed the nation and the world through future generations.

- I realize a waste dump is a national need. But this is some of the most fertile soil in the USA, and before we jeopardize this we need to think of feeding people further down the line in 100 or 200 years. Right now our nation has a surplus of food and this county or area's production may not be needed, but this situation will not last forever--think about it!

- We, the inhabitants of this country, do not have the right to invade and contaminate the soil and water of the earth, thus leaving for future generations the bleak likelihood of contamination.
- We need our farmland. If not, what are we going to be eating in 15 to 20 years?
- If this keeps up and more and more farmland is used for "sewers," our country could start to be a hungry--but a nuclear sufficient--country! Which is the less of the two evils?

Many farmers expressed anger and distrust towards the U.S. Department of Energy, and many believe that the site-selection process has been unfair. They resent being asked to dispose of wastes from distant states, and they question the decision to produce these wastes before disposal plans were developed.

- There have been so many discrepancies in dealing with the DOE. It makes it difficult to believe anything they say, and it is very disconcerting to think they will be in charge of a high-level waste repository in any area. It is completely ridiculous that the U.S. has a stockpile of nuclear waste and making more everyday--with nothing pre-designed to do with it.
- If this plant is put in, land will be worthless, the water supply could be contaminated, and a lot of good people ruined. Let the government build (the repository) in California on you-know-who's ranch! See how he would like it!
- I hope the people working on the solution (to the nuclear waste problem) are smarter than the ones they send to talk to us, as they can't answer your questions the same way twice. They contradict themselves and each other. They sure don't give us much confidence in the DOE.
- I am disgusted with the charade of DOE and provoked with the posturing of Washington generally regarding this nuclear waste matter. Because we are unable to muster clout at the polls we may very well get the shaft--which would force me to consider moving to another area.

- I do not believe the federal government should be trying to ship this waste to any area. If the waste is produced here, so as the economy receives the benefit of both ends, then under strict guidelines it could be deposited here. I just have a hard time accepting the fact that we should have to put up somebody else's waste.

Some farmers are determined to resist any federal efforts to build a repository in their area.

- They (federal government) may take our land, but they will know they had one hell of a fight. I am an old World War II vet, but I think I could still fight for my land.
- Our forefathers protected their land and families with firearms, and I think if it came to that we would do the same today. My land is very dear to me. My granddad farmed it with mules. I am not a violent or radical person. I am a Christian, and go to church every Sunday, but I think the government has no right to destroy my farmland and water. I would not hesitate to join with fellow farmers to protect what is ours and my family. I hope it does not come to this. Please help us.
- Words cannot express my anger and distrust with the DOE. If they expect us, the citizens of Texas, to set by and let them bring in the waste made by some private utilities without a fight, they are sadly mistaken. I'll fight them every legal way there is; and if that fails, we'll fight them in ways they never dreamed of.
- Everything is in limbo. I don't know what to do. The government will only take my land after one hell of a battle. I fought in World War II to save my land and will fight again if necessary.

These comments indicate the strength of public opposition to a nuclear waste repository in the Texas Panhandle.

SUMMARY OF RESULTS

Residents of the Texas Plains--both those who live near the proposed repository sites and those who live farther away--are overwhelmingly opposed to putting a high-level nuclear waste repository in Texas. They believe that a nuclear repository would lead to pollution of their water, soil and air and to health problems for Panhandle residents. They also expect the repository to have negative effects on the agricultural base of the local economy and on property values in general. A slim majority believe the number of jobs in their county will increase if a repository is built in Texas, but they do not expect increases in industrial or commercial development.

A substantial number of Deaf Smith and Swisher county residents have participated in government information meetings and public hearings about the repository and many are knowledgeable about the nuclear waste repository program. Some residents said they had already changed their financial plans because of the repository, and 44 percent said they have thought about moving away if the repository is built in their area. Only 8 percent of Deaf Smith and Swisher county residents who participated in the phone survey said they had spoken at public meetings about the repository, an indication that the survey succeeded in providing a forum for Panhandle residents who might not otherwise have been heard on this issue. Survey participants were broadly representative of residents of the counties studied, and the survey results indicate a strong consensus about the repository among diverse groups of residents of these areas.

Concern about health and environmental risks is the most important factor in overall opposition to the repository. Expectations about social and economic effects are also important elements in views of the repository. These socioeconomic expectations, together with knowledge about the nuclear waste program, are the most important factors associated with taking action because of the nuclear repository--for example, by participating in the DOE site-selection process. Results of these analyses are consistent with earlier research showing that overall attitudes towards nuclear facilities are formed by weighing the possibility of socioeconomic benefits against the possibility of health and environmental risks.

Potential effects of a nuclear waste repository on agriculture emerge as an important issue for both farm and nonfarm families. However, households that earn most of their income from farming are particularly strongly opposed to the nuclear waste repository. Farm families are more concerned than others about potential environmental hazards and more pessimistic about socioeconomic effects of the repository; and these expectations are associated, in turn, with stronger opposition to the repository.

The TDA poll of farm operators supplements information about farm families who participated in the telephone surveys. More than four-fifths of the farmers in the mail survey expect their land values to decline if their county is chosen for the repository. A substantial majority believe the repository would threaten irrigation water; and cause a drop in mineral leases and sales of farm products, an increase in insurance rates, and greater difficulty in obtaining credit. Production of hybrid seeds, health foods and crops sold directly to consumers is broad-based, so that any effects of a repository on these particularly vulnerable markets would be felt widely in the two site counties.

Nearly half of the farmers surveyed said their land values have already declined because their area is being considered as a possible repository site, and a third believe the value of their mineral rights dropped. Most farmers have not yet changed their financial plans because of the repository; but some say they have already limited their investment in agriculture, deciding not to buy new land or equipment because they believe the repository threatens the future of farming in their county. Many more expect to sell their farms and move away if their county is chosen for a repository. Department of Energy consideration of Deaf Smith and Swisher counties has already affected farm investment in this area, and future social and economic effects of building the repository in the High Plains could be quite profound.

NOTES

- ¹Deaf Smith and Swisher counties are considered together throughout this report, since the two sites had the same status in the DOE site-selection process at the time of this study. Combining results for the two counties allows for a larger sample size, which provides more stable statistical results.
- ²Phone listings for the following towns were included in the sample list for Deaf Smith and Swisher counties: Adrian, Dawn, Elkins, Frio, Gurley, Happy, Hereford, Kress, Milo Center, Redmon, Summerfield, Tulia, Vega, Vigo Park, Westway and Wildorado. Phone listing for the following towns were included in the sample list for the Moore and Crosby county areas: Acuff, Cactus-Etter, Cap Rock, Channing, Cone, Crosbyton, Dumas, Fritch, McAdoo, Ralls and Sunray.

Households in small towns neighboring on the study counties were included in the sample if their telephone exchanges are included in the study county listings.
- ³The USCEA study is proprietary, and results have not been released to the public.
- ⁴For the type of reliability measured here, a reliable scale is one that is internally consistent, indicating that the items measure a single underlying concept.
- ⁵This procedure was suggested by S. Kasl, personal communication, May 31, 1984.
- ⁶Differences between the two groups were tested using the chi square statistic for categorical variables and analysis of variance for continuous variables. $p \leq .05$ is the significance criterion for all statistical tests included in this report. A "statistically significant" difference between two groups is a difference that is unlikely to have occurred because of chance fluctuations in survey responses.
- ⁷The preliminary report of survey results (TDA, 1984) summarizes results of a series of t tests used to analyze differences among subgroups in average scores for overall attitudes towards the repository and for the other research scales. The t test results are not reported here because multiple regression analyses described later in this chapter offer more detailed

information about the relationship between demographic characteristics and attitudes towards the repository. Results summarized in the preliminary report are still valid, and additional information about these tests is available from TDA.

⁸Differences between Hispanics and non-Hispanics were tested using the chi square statistic. Differences discussed here are statistically significant ($p \leq .05$).

⁹Multiple regression analyses assume that the distribution of scores on the predicted variable approximates a normal, bell-shaped, curve. Because of widespread local opposition to the nuclear waste repository, the dependent variable used here--overall attitudes towards the repository--is not normally distributed. Cleary and Angel (1984) recently compared multiple regression with other techniques designed for non-normally distributed dependent variables. They found that ordinary least squares regression, discriminant analysis, and logit analysis provide very similar results unless sample sizes are small or the event predicted is extremely rare.

¹⁰This information is from William L. Arends, Assistant State Statistician, Texas Crop and Livestock Reporting Service, personal communication, May 2, 1985.

¹¹Barley, beef, cantaloupes, carrots, corn, green beans, green peppers, grapes, honey, milk, oats, okra, peas, pork, potatoes, pumpkins, rye, sheep, squash, tomatoes, watermelons.

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APPENDIX A

PILOT SURVEY OF DEAF SMITH AND SWISHER COUNTY RESIDENTS

A pilot survey was conducted in May 1984 to study Deaf Smith and Swisher county residents' responses to the high-level nuclear waste repository proposed for their area. The purpose of this pilot was to field-test interviewing procedures and survey scales in order to develop appropriate techniques for use in a larger survey of residents of the Texas Panhandle. Methods and results of the pilot survey are described in this appendix.

Participants

Participants in the pilot survey were chosen from residents of Deaf Smith and Swisher counties. Phone books for Hereford and Tulia provided a list of households, and 74 names were chosen randomly from this list. Among these 74 households, 70 percent completed the pilot interview, and 12 percent declined to participate in the survey. Telephone interviewers were unable to reach 7 percent of the homes after at least four attempts to contact them; and 12 percent of the listed phone numbers were no longer in service at the time of the survey. Among residents who were contacted by an interviewer, 85 percent completed the pilot survey.

The 52 Panhandle residents who completed the pilot interview included 25 women and 27 men; 27 of the survey participants lived closer to the Deaf Smith County site, and 25 were closer to the Swisher County site. Approximately 8 percent of the participants identified themselves as Hispanic.

Procedure

Panhandle residents were contacted during May 1984 by one of seven interviewers. Interviewers asked adult residents to participate in a 10-minute telephone interview about the high-level nuclear waste repository sites proposed for Deaf Smith or Swisher counties. Bilingual interviewers were available to speak to local residents who preferred to be interviewed in Spanish.

Instrument

The survey included measures of attitudes towards the high-level nuclear waste repository, knowledge about the repository and the site-selection process, actions taken in response to the repository, and demographic characteristics of survey participants. The average interview was 13 minutes long. The complete text of the interview form is available from TDA.

Attitudes towards the nuclear waste repository. Two pre-coded questions measured attitudes towards the proposed nuclear waste repository: (1) If it were up to you, would you allow construction of a high-level nuclear waste repository in your county? Would you say definitely yes, probably yes, not sure, probably no, or definitely no? (2) Do you think construction of the nuclear waste repository would be a good thing for your county or not? Would you say definitely yes, probably yes, not sure, probably no, or definitely no? Following these two questions, survey participants were asked, "Why do you feel that way about the repository?"

The two pre-coded items are closely similar to questions used by Sundstrom, et al. (1977) in a study of community attitudes towards a proposed nuclear power plant. These authors found the two items were highly correlated ($r = .84$; $p \leq .01$), and they formed a composite attitude score by averaging responses to the two questions ($M = 2.31$, $SD = 1.38$).

Knowledge about the nuclear waste repository. Survey participants were asked whether they had heard about the proposed repository before being contacted about the survey. In addition, twenty true-false statements measured knowledge about the nuclear waste repository. Half of the statements were worded to be true, and half were false. Statements were selected to represent a broad variety of aspects of the nuclear waste repository program. The accuracy of these items is verified in documents published by the U.S. Department of Energy. In addition, the Texas Nuclear Waste Programs Office and leaders of citizen groups in Deaf Smith and Swisher counties reviewed these items to assure broad consensus about their accuracy.

Action taken in response to the proposed repository. Eleven items asked survey participants what actions, if any, they had taken because of a concern about the

possibility that a high-level nuclear waste repository might be built in their county. For example, residents were asked whether they had attended a public hearing about the repository, or whether they had joined a community group to deal with the repository. Folkman and Lazarus (1985) and Bachrach (1983) have shown that self-reports of actions taken in response to a problem agree closely with observations from independent sources.

Results

In considering pilot survey results, it is important to remember that the purpose of the pilot study is to develop appropriate measures for use in a larger survey of residents of the Texas Panhandle. The pilot sample size is adequate for assessing the range and consistency of survey responses, analyses that are useful in planning survey questions for future use (Nunnally, 1967). However, the pilot sample is not large enough to serve as a basis for generalizations about how Deaf Smith and Swisher county residents feel about the nuclear waste repository. Consequently, the following description of pilot results focuses on scale characteristics and other methodological issues.

Attitudes towards the repository. Responses to the two items asking about residents' attitudes towards the nuclear waste repository show consistent opposition to the repository. The mean score for the question asking whether residents would allow construction of the repository was 4.48 ($SD = .87$), and the mean score for the question asking whether the repository would be good for the county was 4.27 ($SD = .97$). The correlation between these two items is $.72$ ($p \leq .01$).

In response to an open-ended question asking Deaf Smith and Swisher County residents why they favored or opposed the repository, survey participants were most likely to mention specific concerns about water contamination or more general concerns about health and safety. Approximately one-third of the survey participants who opposed the repository mentioned each of these factors as a reason for their views. About a fourth of those who opposed the repository mentioned negative effects on agriculture. Survey participants also mentioned concerns about other negative economic effects and about the future of their communities as a good place for their children and grandchildren to live. Those few participants who favored the nuclear repository listed new employment opportunities as the reason for their opinions.

Knowledge about the repository. Local residents contacted in the pilot survey were universally aware that their county was being considered for a high-level nuclear waste repository. All 52 of the pilot survey participants said that they had heard about the possibility of a high-level nuclear waste repository in their county before telephone interviewers contacted them to participate in the study. In addition, the 9 residents who were contacted by phone, but declined to complete the survey, also said that they had heard about the repository.

Twenty true-false questions assessed survey participants' knowledge about the nuclear repository in more detail, and these items form a consistent scale (Chronbach's $\alpha = .81$). The average survey participant answered 11 of the questions correctly ($SD = 4.15$).

Shorter scales were also created from these questions to test whether knowledge about the repository could be measured adequately in a shorter section of the final survey. Items were chosen for the shorter scales on the basis of three criteria: (1) to achieve balance of positively- and negatively-worded statements, (2) to reflect diverse aspects of the nuclear waste repository program, and (3) to maximize the internal consistency of the scale, as measured by item-total correlations. A 12-item scale (item numbers 16 to 21, 24, 26 to 28, 31, 35) was nearly as reliable as the full 20 items ($\alpha = .80$, $M = 6.42$, $SD = 3.17$). A 6-item scale (item numbers 16, 20, 24, 27, 28, 31) also showed adequate reliability ($\alpha = .67$, $M = 3.08$, $SD = 1.69$).

Actions taken in response to the repository. A scale of ten questions asking what actions, if any, survey participants had taken was also internally consistent ($\alpha = .77$). The mean number of actions taken was 2.17 ($SD = 4.54$).

Summary and Discussion

Results of the pilot survey indicate that a larger-scale survey of Panhandle residents is feasible, and that such a survey would be likely to provide meaningful information about local residents' views about the nuclear waste repository. The very strong response-rate demonstrates that Deaf Smith and Swisher county residents are interested in the nuclear waste repository issue and are willing to discuss their views in telephone interviews conducted by the State of Texas.

Phone numbers that were not in service and households where no one was home to answer the phone were not a major problem.

The pilot survey also indicates broad awareness of the nuclear waste repository among residents of Deaf Smith and Swisher counties. Residents who were contacted about the survey universally reported that they had already heard about the repository. Previous studies of opinions about nuclear-related issues have been criticized for asking respondents to give opinions about nuclear projects that they had not previously heard anything about (Mitchell, 1980). This concern about respondents' awareness about survey issues is not a problem for studies of Deaf Smith and Swisher county residents' views of the nuclear waste repository.

Scales tested in the pilot study provide internally consistent measures of knowledge and attitudes concerning the repository, and of actions taken in response to the proposed repository. Questions asking residents whether they favor or oppose the repository showed markedly skewed response distributions, indicating strong opposition to the repository.

Earlier research using these items indicates that the skewed response distributions reported here are not due to methodological problems with the wording or format of these questions. Studies conducted by Sundstrom et al. (1977) for Oak Ridge National Laboratories support the validity of these items as measures of community attitudes towards proposed nuclear facilities. Specific concerns about water quality and general concerns about health and safety topped the list of survey participants' reasons for opposing the nuclear repository. Earlier studies have similarly identified water quality and health as the most important concerns in communities facing potentially hazardous development.

APPENDIX B: TELEPHONE SURVEY QUESTIONS AND RESPONSES

Deaf Smith and Swisher counties, in the Texas Panhandle, are being considered by the U.S. Department of Energy as possible sites for the first national high-level nuclear waste repository. The Texas Department of Agriculture, in cooperation with the Governor, surveyed residents of the Texas Plains to document their views about potential socioeconomic effects of a repository in Texas. The wording of the survey questions is shown here along with the percent of survey participants who chose each answer. Percentages are based on 605 completed surveys for Deaf Smith and Swisher counties and 236 completed surveys for Moore and Crosby counties, except where otherwise noted. The margin of error is approximately ± 3 to 4 percent for Deaf Smith and Swisher counties, and 5 percent for Moore and Crosby counties. Some questions were asked only in the Deaf Smith and Swisher county interviews, and a few others were asked only in the Moore and Crosby county interviews.

Deaf Smith and Swisher residents were asked about their views of construction of a repository in their own county. Crosby and Moore residents were asked about construction of a repository in the Texas Plains. All interviews were introduced with a brief factual statement saying that the two Texas sites now being considered by the U.S. Department of Energy for construction of a high-level nuclear waste repository are located in Deaf Smith and Swisher counties.

Q. If it were up to you, would you allow construction of a high-level nuclear waste repository in _____ county/the Texas Plains?

	Deaf Smith/Swisher	Moore/Crosby
DEFINITELY YES	4	5
PROBABLY YES	8	4
NOT SURE	7	7
PROBABLY NO	8	17
DEFINITELY NO	73	66

Q. Do you think construction of the nuclear waste repository would be a good thing for your county/the Texas Plains?

	Deaf Smith/Swisher	Moore/Crosby
DEFINITELY YES	4	3
PROBABLY YES	9	5
NOT SURE	9	13
PROBABLY NO	7	12
DEFINITELY NO	68	67

Q. How likely do you think it is that a high-level nuclear waste repository will actually be built in _____ county/the Texas Plains?

	Deaf Smith/Swisher	Moore/Crosby
VERY LIKELY	22	15
SOMEWHAT LIKELY	38	13
SOMEWHAT UNLIKELY	14	29
VERY UNLIKELY	16	29
DON'T KNOW/NO OPINION	11	14

Q. If a nuclear waste repository is built in the Texas Plains, do you think that the repository would affect you or your family personally?

	Moore/Crosby
DEFINITELY YES	23
PROBABLY YES	26
NOT SURE	24
PROBABLY NO	20
DEFINITELY NO	8

The next series asks about what you think will happen **in your county** during the next 15 years if _____ county/Texas is chosen as the site for the nuclear repository.

Q. The first item is local tax rates. If _____ county is chosen as the repository site, do you think your local tax rates will go up, stay the same, or go down because of the repository?

	Deaf Smith/Swisher
GO UP	46
STAY THE SAME	29
GO DOWN	13
DON'T KNOW	11

Q. How about the value of your own home? Do you think the value of your home home will go up, stay the same, or go down because of the repository?

	Deaf Smith/Swisher
GO UP	19
STAY THE SAME	16
GO DOWN	60
DON'T KNOW	5

Q. How about your household income?

	Deaf Smith/Swisher
GO UP	13
STAY THE SAME	52
GO DOWN	29
DON'T KNOW	6

Q. The next one is the quality of schools in your county. Will that go up, stay the same, or go down because of the repository?

	Deaf Smith/Swisher
GO UP	13
STAY THE SAME	39
GO DOWN	39
DON'T KNOW	9

Q. How about the amount of traffic in your county?

	Deaf Smith/Swisher
GO UP	60
STAY THE SAME	17
GO DOWN	18
DON'T KNOW	5

Q. Do you think the number of people in your county will go up, stay the same, or go down because of the repository?

	Moore/Crosby
GO UP	11
STAY THE SAME	48
GO DOWN	35
DON'T KNOW	6

Q. How about the value of land in farms and ranches in your county?

	Deaf Smith/Swisher	Moore/Crosby
GO UP	8	4
STAY THE SAME	8	27
GO DOWN	80	68
DON'T KNOW	4	2

Q. What about crime rates in your county?

	Deaf Smith/Swisher
GO UP	40
STAY THE SAME	47
GO DOWN	4
DON'T KNOW	9

Q. Next is the cost of living in your county?

	Deaf Smith/Swisher	Moore/Crosby
GO UP	57	38
STAY THE SAME	32	50
GO DOWN	5	4
DON'T KNOW	6	8

Q. How about the number of jobs available in your county?

	Deaf Smith/Swisher	Moore/Crosby
GO UP	52	27
STAY THE SAME	15	42
GO DOWN	27	23
DON'T KNOW	6	8

Q. What about the quality of local services, like police, fire, and sewage, and so on.

	Deaf Smith/Swisher
GO UP	21
STAY THE SAME	54
GO DOWN	20
DON'T KNOW	5

Q. How about the quality of your life in general?

	Deaf Smith/Swisher
GO UP	6
STAY THE SAME	44
GO DOWN	45
DON'T KNOW	5

Q. How about the number of stores and businesses in your county?

	Deaf Smith/Swisher	Moore/Crosby
GO UP	33	14
STAY THE SAME	24	49
GO DOWN	38	32
DON'T KNOW	4	5

Q. How about the amount of industry in your county?

	Deaf Smith/Swisher	Moore/Crosby
GO UP	22	17
STAY THE SAME	26	43
GO DOWN	47	34
DON'T KNOW	5	6

Q. How about the amount of agricultural production in your county?

	Deaf Smith/Swisher	Moore/Crosby
GO UP	3	2
STAY THE SAME	21	43
GODOWN	72	53
DON'T KNOW	4	2

Q. How about the number of places to go for fun or entertainment--like bowling, restaurants, movies, and so on?

	Deaf Smith/Swisher
GOUP	25
STAY THE SAME	50
GODOWN	21
DON'T KNOW	4

These questions are about health and safety. We know that some people are concerned about problems they think could develop if a nuclear waste repository is built in the Texas Panhandle. Other people are not concerned about the repository. I'm going to ask you for your opinion about it.

Q. The first question is about accidents involving trucks or trains bringing nuclear wastes to the repository. How likely do you think it is that there would be accidents involving trucks or trains bringing nuclear wastes to the repository?

	Deaf Smith/Swisher	Moore/Crosby
VERY LIKELY	48	27
SOMEWHAT LIKELY	33	50
SOMEWHAT UNLIKELY	10	14
VERY UNLIKELY	7	6
DON'T KNOW	1	2

Q. How concerned would you be about an accident involving trucks or trains bringing wastes to the repository if it did happen?

	Deaf Smith/Swisher	Moore/Crosby
EXTREMELY CONCERNED	68	55
VERY CONCERNED	21	33
SLIGHTLY CONCERNED	8	6
NOT AT ALL CONCERNED	2	3
NO OPINION/DON'T KNOW	0	2

Q. The next question is about radioactive wastes escaping into the air. How likely do you think it is that radioactive wastes would escape into the air outside the repository?

	Deaf Smith/Swisher	Moore/Crosby
VERY LIKELY	38	32
SOMEWHAT LIKELY	31	36
SOMEWHAT UNLIKELY	14	15
VERY UNLIKELY	11	8
DON'T KNOW	6	8

Q. How concerned would you be if radioactive wastes did escape into the air?

	Deaf Smith/Swisher	Moore/Crosby
EXTREMELY CONCERNED	73	57
VERY CONCERNED	18	35
SLIGHTLY CONCERNED	6	6
NOT AT ALL CONCERNED	2	1
NO OPINION	0	1

Q. How about radioactive wastes escaping into the soil? How likely do you think it is that radioactive wastes would escape into the soil outside the repository?

	Deaf Smith/Swisher	Moore/Crosby
VERY LIKELY	54	52
SOMEWHAT LIKELY	22	26
SOMEWHAT UNLIKELY	9	8
VERY UNLIKELY	10	6
DON'T KNOW	4	8

Q. How concerned would you be if radioactive wastes did escape into the soil?

	Deaf Smith/Swisher	Moore/Crosby
EXTREMELY CONCERNED	73	59
VERY CONCERNED	21	30
SLIGHTLY CONCERNED	4	8
NOT AT ALL CONCERNED	2	1
NO OPINION	0	2

Q. How likely do you think it is that radioactive wastes would escape into the water outside the repository?

	Deaf Smith/Swisher	Moore/Crosby
VERY LIKELY	61	56
SOMEWHAT LIKELY	20	26
SOMEWHAT UNLIKELY	6	7
VERY UNLIKELY	11	5
DON'T KNOW	2	6

Q. How concerned would you be if radioactive wastes did escape into the water?

	Deaf Smith/Swisher	Moore/Crosby
EXTREMELY CONCERNED	81	71
VERY CONCERNED	15	26
SLIGHTLY CONCERNED	2	3
NOT AT ALL CONCERNED	1	0
NO OPINION/DON'T KNOW	0	0

Q. How likely do you think it is that salt dug out of the repository during construction would escape into the soil outside the repository?

	Deaf Smith/Swisher
VERY LIKELY	49
SOMEWHAT LIKELY	24
SOMEWHAT UNLIKELY	10
VERY UNLIKELY	11
DON'T KNOW	7

Q. How concerned would you be if salt dug out of the repository did escape into the soil?

	Deaf Smith/Swisher
EXTREMELY CONCERNED	55
VERY CONCERNED	27
SLIGHTLY CONCERNED	15
NOT AT ALL CONCERNED	3
NO OPINION/DON'T KNOW	1

Q. How likely do you think it is that salt dug out of the repository during construction would escape into the water outside the repository?

Deaf Smith/Swisher

VERY LIKELY52
SOMEWHAT LIKELY23
SOMEWHAT UNLIKELY10
VERY UNLIKELY12
DON'T KNOW4

Q. How concerned would you be if salt dug out of the repository did escape into the water?

Deaf Smith/Swisher

EXTREMELY CONCERNED62
VERY CONCERNED25
SLIGHTLY CONCERNED11
NOT AT ALL CONCERNED1
NO OPINION/DON'T KNOW0

Q. How likely do you think it is that the repository would lead to contamination of food grown in your county?

Deaf Smith/Swisher

VERY LIKELY57
SOMEWHAT LIKELY20
SOMEWHAT UNLIKELY10
VERY UNLIKELY10
DON'T KNOW4

Q. How concerned would you be if there was contamination of food grown in your county because of the repository?

Deaf Smith/Swisher

EXTREMELY CONCERNED78
VERY CONCERNED19
SLIGHTLY CONCERNED3
NOT AT ALL CONCERNED1
NO OPINION/DON'T KNOW0

Q. How likely do you think it is that there would be a nuclear explosion because of the repository? *

Deaf Smith/Swisher

VERY LIKELY26
SOMEWHAT LIKELY24
SOMEWHAT UNLIKELY17
VERY UNLIKELY24
DON'T KNOW8

Q. How concerned would you be if there was a nuclear explosion because of the repository? *

Deaf Smith/Swisher

EXTREMELY CONCERNED82
VERY CONCERNED14
SLIGHTLY CONCERNED2
NOT AT ALL CONCERNED2
DON'T KNOW0

Q. How likely do you think it is that there would be sabotage or terrorism because of the repository? *

	Deaf Smith/Swisher
VERY LIKELY	36
SOMEWHAT LIKELY	30
SOMEWHAT UNLIKELY	14
VERY UNLIKELY	15
DON'T KNOW	5

Q. How concerned would you be if there was sabotage or terrorism because of the repository? *

	Deaf Smith/Swisher
EXTREMELY CONCERNED	73
VERY CONCERNED	21
SLIGHTLY CONCERNED	4
NOT AT ALL CONCERNED	2
NO OPINION/DON'T KNOW	0

Q. The next question is about health problems for workers at the repository. How likely do you think it is that there would be health problems for workers at the repository?

	Deaf Smith/Swisher	Moore/Crosby
VERY LIKELY	52	49
SOMEWHAT LIKELY	25	27
SOMEWHAT UNLIKELY	8	11
VERY UNLIKELY	11	7
DON'T KNOW	4	6

Q. How concerned would you be if there were health problems for workers at the repository?

	Deaf Smith/Swisher	Moore/Crosby
EXTREMELY CONCERNED	62	45
VERY CONCERNED	29	44
SLIGHTLY CONCERNED	7	8
NOT AT ALL CONCERNED	2	2
NO OPINION/DON'T KNOW	0	1

Q. How about health problems for people living in your county? How likely do you think it is that the repository would lead to health problems for people living in your county?

	Deaf Smith/Swisher	Moore/Crosby
VERY LIKELY	50	40
SOMEWHAT LIKELY	25	29
SOMEWHAT UNLIKELY	11	13
VERY UNLIKELY	12	14
DON'T KNOW	2	4

Q. How concerned would you be if the repository did lead to health problems for people living in your county?

	Deaf Smith/Swisher	Moore/Crosby
EXTREMELY CONCERNED	77	63
VERY CONCERNED	20	34
SLIGHTLY CONCERNED	3	2
NOT AT ALL CONCERNED	1	0
NO OPINION/DON'T KNOW	0	0

* Starred questions were asked of a subsample of about 400 survey participants. They were omitted from other surveys to shorten the overall length of the interview.

Q. More specifically, how about cancer rates? How likely do you think it is that the repository could increase the number of people in your county who get cancer?

Deaf Smith/Swisher

VERY LIKELY48
SOMEWHAT LIKELY20
SOMEWHAT UNLIKELY10
VERY UNLIKELY14
DON'T KNOW9

Q. How concerned would you be if there was an increase in cancer because of the repository?

Deaf Smith/Swisher

EXTREMELY CONCERNED75
VERY CONCERNED20
SLIGHTLY CONCERNED4
NOT AT ALL CONCERNED1
NO OPINION/DON'T KNOW0

Q. And here's the last one in this section. How likely do you think it is that the repository would increase the number of miscarriages or birth defects in your county? *

VERY LIKELY40
SOMEWHAT LIKELY27
SOMEWHAT UNLIKELY10
VERY UNLIKELY16
DON'T KNOW8

Q. How concerned would you be if there was an increase in miscarriages or birth defects because of the repository? *

Deaf Smith/Swisher

EXTREMELY CONCERNED73
VERY CONCERNED20
SLIGHTLY CONCERNED5
NOT AT ALL CONCERNED1
NO OPINION/DON'T KNOW0

Now I'm going to read you some statements about some technical aspects of the nuclear waste repository. Some of the statements are true and some are false.

Q. High-level nuclear wastes are radioactive for thousands of years. From what you've heard, would you say that's true or false, or would you say that you don't know?

Deaf Smith/Swisher

TRUE (CORRECT)70
FALSE7
DON'T KNOW22

Q. Drilling for oil and gas will be allowed on land over the repository.

Deaf Smith/Swisher

TRUE6
FALSE (CORRECT)70
DON'T KNOW25

Q. More than a thousand people will be needed to build the repository.

Deaf Smith/Swisher

TRUE (CORRECT)50
FALSE20
DON'T KNOW30

Q. The repository will be big enough for all the wastes from nuclear power plants for the next century.

Deaf Smith/Swisher
TRUE16
FALSE(CORRECT)57
DON'T KNOW27

Q. Once the repository is built, it will permanently employ 1,000 workers.

Deaf Smith/Swisher
TRUE16
FALSE(CORRECT)56
DON'T KNOW27

Q. There is no evidence that radiation can cause birth defects.

Deaf Smith/Swisher
TRUE7
FALSE(CORRECT)77
DON'T KNOW16

Q. The government has already done some drilling in Deaf Smith and Swisher counties as part of the site selection program for the repository.

Deaf Smith/Swisher
TRUE(CORRECT)82
FALSE5
DON'T KNOW14

Q. Your area is being considered as a possible repository site because of its underground salt deposits.

Deaf Smith/Swisher
TRUE(CORRECT)84
FALSE4
DON'T KNOW12

Q. If a nuclear waste repository is built in Texas, it will be located above the underground water of the Ogallala aquifer.

Deaf Smith/Swisher
TRUE44
FALSE(CORRECT)24
DON'T KNOW32

Q. All of the salt dug out of the repository during construction will be put back into the repository eventually.

Deaf Smith/Swisher
TRUE19
FALSE(CORRECT)38
DON'T KNOW44

Q. The nuclear repository will not be finished for at least 10 years.

Deaf Smith/Swisher
TRUE(CORRECT)52
FALSE18
DON'T KNOW30

Q. The President of the United States is personally responsible for approving the site for the nuclear waste repository.

Deaf Smith/Swisher
TRUE (CORRECT)37
FALSE38
DON'T KNOW25

For the next two statements I'd like you to tell me whether you strongly agree, somewhat agree, feel neutral, somewhat disagree, or strongly disagree.

Q. When I think about the possibility that Deaf Smith or Swisher county might be chosen as a site for a nuclear waste repository, I feel that this is a situation that doesn't really affect me personally. Would you say that you strongly agree, somewhat agree, feel neutral, somewhat disagree, or strongly disagree with that statement?

Deaf Smith/Swisher
STRONGLY AGREE6
SOMEWHAT AGREE8
NEUTRAL4
SOMEWHAT DISAGREE9
STRONGLY DISAGREE74

Q. When I think about the possibility that Deaf Smith or Swisher county might be chosen as a site for a nuclear waste repository, I feel that this is a situation that I can change or do something about. Would you say that you strongly agree, somewhat agree, feel neutral, somewhat disagree, or strongly disagree?

Deaf Smith/Swisher
STRONGLY AGREE20
SOMEWHAT AGREE24
NEUTRAL8
SOMEWHAT DISAGREE22
STRONGLY DISAGREE.....26

Q. When I think about the possibility that Deaf Smith or Swisher county might be chosen as a site for a nuclear waste repository, I feel that this is a situation that must be accepted or gotten used to. Do you strongly agree, somewhat agree, feel neutral, somewhat disagree, or strongly disagree?

Deaf Smith/Swisher
STRONGLY AGREE12
SOMEWHAT AGREE23
NEUTRAL7
SOMEWHAT DISAGREE10
STRONGLY DISAGREE.....48

Q. When I think about the possibility that Deaf Smith or Swisher county might be chosen as a site for a nuclear waste repository, I feel that I need to know more before I can act.

Deaf Smith/Swisher
STRONGLY AGREE46
SOMEWHAT AGREE22
NEUTRAL5
SOMEWHAT DISAGREE7
STRONGLY DISAGREE20

Q. When I think about the possibility that Deaf Smith or Swisher county might be chosen as a site for a nuclear waste repository, I feel that I have to hold myself back from doing what I want to do.

Deaf Smith/Swisher

STRONGLY AGREE17
SOMEWHAT AGREE13
NEUTRAL12
SOMEWHAT DISAGREE18
STRONGLY DISAGREE.....41

Next I have a list of things that some people may have done because of the repository. You might have done some or all of these things, or you might not have done any of them. For each one, please tell me whether you have or haven't ever done it.

Q. First, have you ever written a letter about the repository to the editor of a newspaper?

Deaf Smith/Swisher

YES3

Q. Have you ever read any reports or pamphlets or other information from a government agency telling about the repository?

Deaf Smith/Swisher

YES60

Q. How about attending a government-sponsored meeting or public hearing about the repository? Have you ever done that?

Deaf Smith/Swisher

YES28

Q. Have you ever testified or spoken up to ask a question at a government meeting or public hearing about the repository?

Deaf Smith/Swisher

YES8

Q. Have you ever contacted a public official by letter, telephone, or in person about the repository?

Deaf Smith/Swisher

YES22

Q. Have you ever gone to a meeting of a community group (such as POWER or STAND or FAD) about the repository?

Deaf Smith/Swisher

YES26

Q. Have you joined a community group (such as POWER, STAND, or FAD) to deal with the repository?

Deaf Smith/Swisher

YES7

Q. Have you ever signed a petition about the repository?

Deaf Smith/Swisher

YES27

Q. Have you ever thought about moving out of the area because of the repository?

Deaf Smith/Swisher

YES44

Q. Have you changed financial plans for your family or for your farm, ranch, or business because of the repository?

Deaf Smith/Swisher

YES8

The next questions ask your opinion about several different kinds of energy projects and businesses. I'd like to know how you would feel about having these projects move into your county.

Q. First, a coal-burning power plant. How would you feel about a coal-burning power plant moving into your county? Would you be strongly in favor, somewhat in favor, neutral, somewhat opposed, or strongly opposed to having a coal-burning power plant move into your county?

	Deaf Smith/Swisher	Moore/Crosby
STRONGLY FAVOR	23	28
SOMEWHAT FAVOR	28	32
NEUTRAL	18	22
SOMEWHAT OPPOSED	15	9
STRONGLY OPPOSED	13	8
DON'T KNOW/NO OPINION	2	2

Q. Next is a manure-burning power plant. How would you feel about a manure-burning power plant in your county?

	Deaf Smith/Swisher	Moore/Crosby
STRONGLY FAVOR	25	21
SOMEWHAT FAVOR	27	25
NEUTRAL	19	24
SOMEWHAT OPPOSED	13	13
STRONGLY OPPOSED	14	12
DON'T KNOW/NO OPINION	1	5

Q. How would you feel about a power plant that burned other agricultural byproducts, such as corn cobs, in your county?

	Deaf Smith/Swisher	Moore/Crosby
STRONGLY FAVOR	34	34
SOMEWHAT FAVOR	32	32
NEUTRAL	18	20
SOMEWHAT OPPOSED	8	7
STRONGLY OPPOSED	6	4
DON'T KNOW/NO OPINION	2	2

Q. How would you feel about a nuclear power plant moving into your county?

	Deaf Smith/Swisher	Moore/Crosby
STRONGLY FAVOR	4	6
SOMEWHAT FAVOR	9	16
NEUTRAL	10	9
SOMEWHAT OPPOSED	12	15
STRONGLY OPPOSED	63	51
DON'T KNOW/NO OPINION	2	2

Q. How would you feel about a large number of windmills for electric power generation in your county?

	Deaf Smith/Swisher
STRONGLY FAVOR	56
SOMEWHAT FAVOR	29
NEUTRAL	11
SOMEWHAT OPPOSED	1
STRONGLY OPPOSED	1
DON'T KNOW/NO OPINION	0

Q. How would you feel about a large number of solar cells for electric power generation in your county?

	Deaf Smith/Swisher
STRONGLY FAVOR	43
SOMEWHAT FAVOR	26
NEUTRAL	18
SOMEWHAT OPPOSED	4
STRONGLY OPPOSED	3
DON'T KNOW/NO OPINION	0

Q. How would you feel about a new feedlot moving into your county?

	Deaf Smith/Swisher	Moore/Crosby
STRONGLY FAVOR	43	34
SOMEWHAT FAVOR	25	28
NEUTRAL	16	16
SOMEWHAT OPPOSED	7	12
STRONGLY OPPOSED	8	10
DON'T KNOW/NO OPINION	0	0

Q. How would you feel about a food processing plant moving into your county?

	Deaf Smith/Swisher	Moore/Crosby
STRONGLY FAVOR	68	55
SOMEWHAT FAVOR	22	29
NEUTRAL	6	12
SOMEWHAT OPPOSED	2	2
STRONGLY OPPOSED	2	1
DON'T KNOW/NO OPINION	1	0

Q. How would you feel about a low-level nuclear waste disposal site moving into your county?

	Deaf Smith/Swisher	Moore/Crosby
STRONGLY FAVOR	3	3
SOMEWHAT FAVOR	7	6
NEUTRAL	10	7
SOMEWHAT OPPOSED	11	14
STRONGLY OPPOSED	67	67
DON'T KNOW/NO OPINION	3	2

Q. How would you feel about an oil refinery moving into your county?

	Moore/Crosby
STRONGLY FAVOR	46
SOMEWHAT FAVOR	29
NEUTRAL	10
SOMEWHAT OPPOSED	9
STRONGLY OPPOSED	5
DON'T KNOW/NO OPINION	0

Q. And how would you feel about a project for secondary recovery of oil and gas moving into your county?

	Moore/Crosby
STRONGLY FAVOR	41
SOMEWHAT FAVOR	28
NEUTRAL	18
SOMEWHAT OPPOSED	6
STRONGLY OPPOSED	4
DON'T KNOW/NO OPINION	3

Q. And how would you feel about a high-level nuclear waste repository moving into your own county?

	Moore/Crosby
STRONGLY FAVOR	2
SOMEWHAT FAVOR	5
NEUTRAL	6
SOMEWHAT OPPOSED	8
STRONGLY OPPOSED	78
DON'T KNOW/NO OPINION	0

APPENDIX C: FARM OPERATOR SURVEY QUESTIONS AND RESPONSES

Figures below indicate the percentages of farm operators who chose each response. Percentages are based on 564 completed surveys. The margin of error is approximately ± 3 to 4 percentage points.

If your county is chosen for building the high-level nuclear waste repository, what changes would you expect for your farm/ranch over the next 15 years because of the repository? Please circle the number for the column closest to your views.

	GO UP	STAY THE SAME	GO DOWN	DON'T KNOW
1. Value of your land	2	7	84	6
2. Prices you receive for crops or livestock	--	18	66	16
3. Volume of sales	1	22	62	14
4. Availability of water for irrigation	--	14	73	12
5. Number of acres planted	--	40	43	17
6. Number of livestock	2	33	49	17
7. Availability of loans	2	15	62	21
8. Insurance rates	66	12	4	18
9. Wages for farm labor	59	18	5	18
10. Prices for farm supplies	42	26	12	20
11. Value of mineral rights	2	11	74	13

Up to now, has consideration of your county as a possible site for a high-level nuclear waste repository already caused any changes for your farm or ranch in the areas listed below? Please circle the number for the column closest to your views.

	WENT UP	STAYED THE SAME	WENT DOWN	DON'T KNOW
1. Value of your land	1	35	48	16
2. Prices you receive for crops or livestock	--	75	13	12
3. Volume of sales	--	78	12	10
4. Availability of water for irrigation	--	76	14	9
5. Number of acres planted	1	86	6	8
6. Number of livestock	2	83	7	8
7. Availability of loans	1	65	15	18
8. Insurance rates	12	69	1	18
9. Wages for farm labor	11	75	2	12
10. Prices for farm supplies	20	67	3	10
11. Value of mineral rights	1	43	35	21

If your county is actually chosen as a site for the high-level nuclear waste repository, will you change your plans for your farm/ranch, or for your business or personal finances because of the repository?

- DEFINITELY YES26
- PROBABLY YES22
- NEUTRAL/DON'T KNOW34
- PROBABLY NO16
- DEFINITELY NO2

Have you **already** made any changes in your personal or financial plans because of the nuclear waste repository?

- YES13

This section asks for your opinions about issues affecting the future of farming in your area. Please circle the number of the column that best represents your views for each statement in the list below.

	STRONGLY AGREE	SOMEWHAT AGREE	NEUTRAL	SOMEWHAT DISAGREE	STRONGLY DISAGREE
1. If a nuclear repository is built in my county, it will be harder for me to sell my crops.	58	22	10	6	3
2. The process for choosing a site for the high-level nuclear waste repository is fair.	3	4	10	14	69
3. If irrigation water runs out, dryland farming would be profitable on the land I operate.	14	21	10	19	35
4. I would rather leave farming if I could.	25	11	15	8	40
5. When water for irrigation runs out, there just won't be much farming in my county.	24	23	7	22	25
6. I trust the federal government to build a nuclear waste repository that is safe.	7	10	10	19	54
7. I'm worried that drilling to study the proposed nuclear waste sites could contaminate the soil or water in my county.	44	19	15	12	10
8. Building a nuclear waste repository in my county would have no effect on farming.	4	5	4	16	70
9. Landowners next to the proposed nuclear waste repository site have already been hurt financially.	50	19	17	7	6
10. A nuclear waste repository would not use a significant amount of water.	3	3	17	14	62
11. It's hard to make plans for my farm/ranch because I don't know whether a nuclear waste repository will be built here or not.	48	19	19	9	6

This section asks about crops and livestock produced on the land you operate. This information will help show how a nuclear waste repository could affect the economy of your area.

Please check the list below to indicate all of the agricultural products grown for sale on your farm/ranch.

FIELD CROPS

BARLEY	16	OATS	20	SUGARBEETS	12
CORN FOR GRAIN	30	RYE	6	SUNFLOWERS	5
COTTON	40	SORGHUM	69	WHEAT	87
HAY	51	SOYBEANS	25		

VEGETABLES AND FRUITS

CABBAGE	2	CUCUMBERS	4	ONIONS	7
CANTALOUPE	3	LETTUCE	3	POTATOES	6
CARROTS	6				

LIVESTOCK

CATTLE	75	MILK	2	WOOL	2
HOGS	8				

Do you sell seed produced on the land you operate?

YES 37

Do you sell any agricultural products directly to consumers (for example, at farmers markets or roadside stands)?

YES 6

Do you sell any agricultural products to "health food" or "organic food" buyers?

YES 7

The U.S. Department of Energy has chosen two 9-square-mile sites to consider as locations for building the proposed nuclear repository. Do you operate land **within** either of these two sites?

YES 11

How far is the land you operate from the closer one of the 9-square-mile sites?

LESS THAN 5 MILES	20
5 TO 10 MILES	26
11 TO 20 MILES	36
MORE THAN 20 MILES	13
I DON'T KNOW	5

How much of the land you now operate in Deaf Smith or Swisher county is owned by you or a member of your family?

ALL	54
SOME	36
NONE	10

How likely do you think it is that future generations of your family will operate this land in years to come?

VERY LIKELY	49
SOMEWHAT LIKELY.....	22
SOMEWHAT UNLIKELY	11
VERY UNLIKELY	18

Did you irrigate your farm/ranch this year?

YES	76
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What percent of your household income came from the farm/ranch you operate?

LESS THAN 25 PERCENT	11
26 TO 50 PERCENT	9
51 TO 75 PERCENT	13
76 TO 100 PERCENT	66

Are there children under 18 years old living in your household?

YES	42
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