10 Rural Community Residents' Views of Nuclear Waste Repository Siting in Nevada

Richard S. Krannich, Ronald L. Little, and Lori A. Cramer

Introduction

The federal government's proposal to site the nation's first high-level nuclear waste repository at Yucca Mountain, Nevada, has created far-reaching political turmoil. Despite its remote and sparsely populated location, Nevada's congressional representatives, as well as state-level political leaders, have been virtually unanimous in their opposition to the project. Public opinion has also revealed widespread dissatisfaction with the proposal. Statewide opinion surveys have consistently indicated that nearly three-quarters of Nevada residents are opposed to having the repository built in Nevada (see chapter 3 of this volume by Slovic, Layman, and Flynn). Opposition to the repository appears to be linked to a variety of factors, including beliefs that it is unfair to force Nevadans to harbor all of the nation's nuclear waste, in addition to concerns about the safety of the storage and transportation of high-level nuclear waste (see chapter 7 of this volume by Desvousges, Kunreuther, Slovic, and Rosa).

Statewide responses to the proposed repository, reflected by both political opposition and public opinion polls, mirror the attitudes and opinions of Nevada's predominantly urban population, which is concentrated in or near Las Vegas and, to a lesser degree, Reno. As a result, such polls provide limited insight into the views of those rural Nevada residents who may be most directly affected by repository construction. While Yucca Mountain is located on federally controlled land about ninety miles northwest of the metropolitan Las Vegas area and is 376 miles southeast of Reno, there are several small rural communities which are relatively close to the proposed repository site. Several others are within reasonable commuting distance of Yucca Mountain. In addition, numerous rural communities in southern Nevada are located along probable waste transportation corridors.

To fully comprehend the consequences of constructing a high-level nuclear waste repository at Yucca Mountain for area residents, it is necessary to focus attention on the small rural communities which are proximate to the project site or major waste transportation corridors. These are the towns and villages which are especially likely to be at risk, that is, communities most likely to suffer any negative environmental and socioeconomic impacts stemming from the repository. The history of western energy developments over the past several decades suggests that, as with other large-scale facilities, repository construction and operation is likely to cause social, economic, and cultural disruptions (Cortese and Jones, 1977; Little, 1977; Davenport and Davenport, 1980; Elkind-Savatsky, 1986).

Typically, rapid population and economic growth associated with large-scale construction projects stimulates a wide array of social changes in nearby rural communities. These communities are vulnerable, primarily because of their small sizes, proximity to the site, and the limited ability of their infrastructures to handle potential inmigration (see Weber and Howell, 1982). Although previous literature generally suggests that rural residents look favorably on efforts that promise local employment and economic benefits, and therefore support most types of large-scale industrial or construction projects (see Little and Lovejoy, 1979), the potential for adverse socioeconomic impacts may result in less positive public views of projects such as the proposed repository.

The special nature of projects involving nuclear materials may also result in less positive responses by community residents (Albrecht, 1983; Williams, 1988). Rural communities, in particular, currently lack the trained emergency response personnel required in the event of a waste-handling accident. Consequently, rural residents living along potential waste transportation corridors may have a heightened perception of the risks associated with a repository. Finally, opposition to the siting of hazardous facilities, and especially nuclear facilities, often reflects a NIMBY ("not in my back yard") response on the part of area residents (Edelstein, 1988; Stoffel et al., 1989; Williams, 1988; Williams and Payne, 1985). For these and other reasons, the views of rural residents whose "back yards" are closest to the proposed repository site provide a particularly important focus for studies attempting to understand human responses to facilities which handle nuclear and other potentially hazardous materials.

The area of southern Nevada encompassing Yucca Mountain provides a unique social and cultural context for siting a high-level nuclear waste facility. Communities in this area have had forty years of experience with nuclear weapons testing programs, as well as with a variety of large-scale military operations and facilities in desert areas north and west of Las Vegas.

Nevada politicians and residents have generally been highly supportive of federal activities ever since the first atomic weapons test occurred at the Nevada Test Site (NTS) in 1951 (Titus, 1986). Despite increased recognition of harmful health effects experienced by military personnel and civilians exposed to radiation during the era of atmospheric testing and despite increasingly strident antinuclear protest activities, there remains widespread recognition of the importance of NTS and other defense programs to the economic vitality of southern Nevada and the state as a whole.

This unique social context, the NIMBY syndrome, the special nature of nuclear projects, and continuing effects of other federal projects and programs all suggest that rural residents' views about a nuclear waste repository may be quite different from those reflected by statewide surveys, such as the one reported in chapter 7 of this volume by Desvousges, Kunreuther, Slovic, and Rosa, or by surveys of urban residents, such as the Las Vegas survey reported in the preceding chapter by Mushkatel, Nigg, and Pijawka. Further, the views of rural southern Nevadans may differ considerably from what might be anticipated on the basis of studies focused on large-scale nonnuclear projects in other rural settings. This chapter addresses this issue by examining perceptions and attitudes toward the repository among residents of six rural communities in southern Nevada. Each of these communities is located relatively close to Yucca Mountain or probable waste transportation routes, and each could experience a variety of impacts from repository construction, operation, and waste transportation. Information on perceptions and attitudes held by residents of these communities concerning the repository provides an important supplement to information on the views held by urban and statewide residents reported in other chapters.

Study Area

The study communities include the towns of Beatty, Amargosa Valley, and Pahrump in Nye County, Indian Springs and Mesquite in Clark County, and Caliente in Lincoln County (see Figure 10-1). A brief description of these communities follows.

The unincorporated town of Beatty is located approximately 115 miles northwest of Las Vegas. The town is bisected by U.S. Highway 95, a potential waste transportation route, and is just eighteen air and forty-five highway miles from Yucca Mountain. Historically, the town has experienced boom-and-bust cycles associated with gold and silver mining. In the past decade or so Beatty has experienced modest growth as a result of employment opportunities linked to the Nevada Test Site (NTS) and other military programs. The town's other economic activities include a low-level nuclear

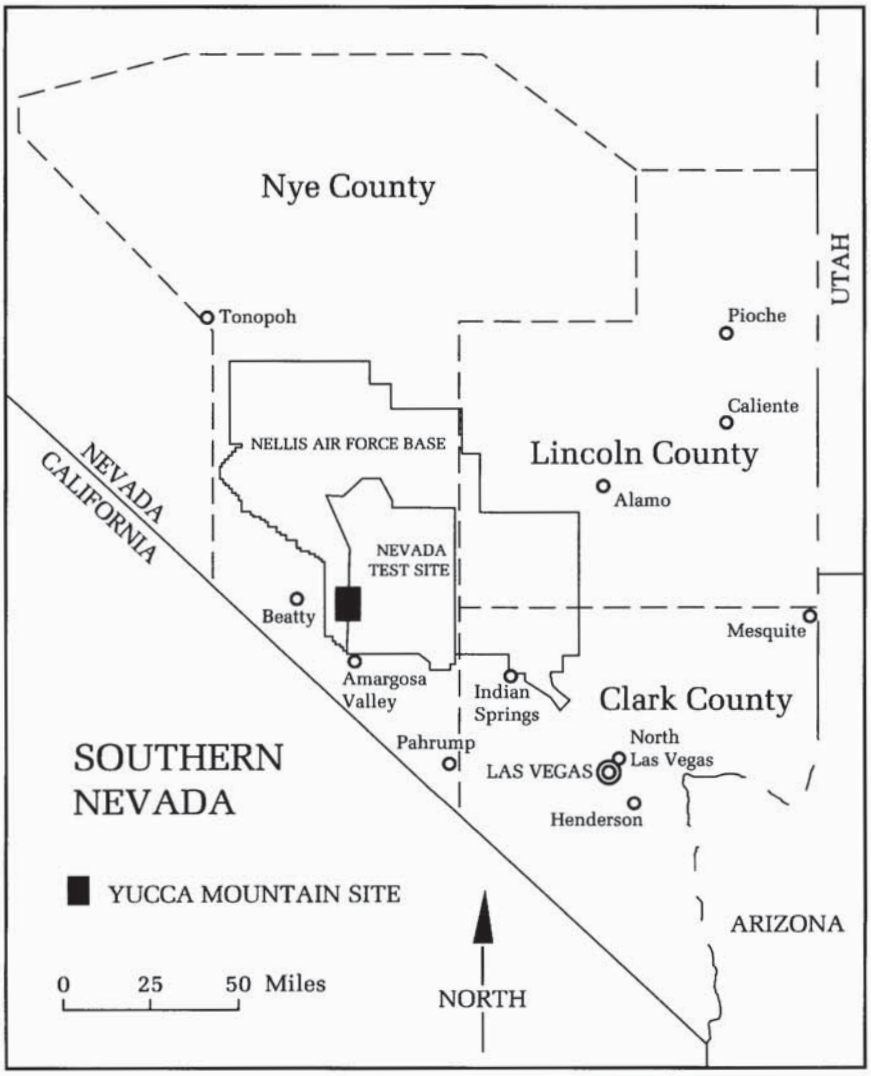

Figure 10-1 The study area.

waste landfill, which is located just a few miles south of town, and service industries oriented toward travelers and tourists visiting nearby Death Valley National Monument. By 1985 the estimated population of the town was approximately 925. However, rapid growth associated with new gold mining ventures began to occur in late 1987, causing the population to increase to approximately 1100 by early 1988.

Amargosa Valley, another unincorporated town, has approximately 600

to 650 residents spread over a 500-square-mile desert area. The northernmost sections of the town are adjacent to U.S. Route 95, and are located within sixteen miles of the proposed Yucca Mountain repository site. Thus Amargosa Valley, like Beatty, could be directly affected by the repository due both to its proximity to the site and its location along a probable waste transportation route. The settlement of Amargosa Valley occurred primarily during the 1950s as a result of homesteading stimulated by the Desert Entry Act. Additional growth occurred in the 1960s and 1970s, first as a result of NTS activity and subsequently due to the development of colemanite and bentonite mining and milling operations. However, NTS employment of local residents declined substantially by the mid-1980s, and the 1986 closure of a large milling operation resulted in the loss of nearly 50 percent of the resident population within a two-year period. The local economy is severely depressed, as evidenced by the closing of several businesses, decreased activity at others, and abandonment of homes and other property.

Located in the southernmost tip of Nye County, approximately fifty-five air miles and sixty-five highway miles from the proposed Yucca Mountain site, lies the unincorporated town of Pahrump. Although not located on a major highway likely to be used for nuclear waste transportation, Pahrump is adjacent to one of the alternative railroad spur routes under consideration for transporting wastes to the repository site. Originally a sparsely populated agricultural valley, in 1970 Pahrump had fewer than 1000 residents scattered over more than 200 square miles. However, rapid growth has occurred during the 1970s and especially the 1980s as a result of real estate speculation and housing construction. Agricultural land was subdivided for residential and commercial development, and by early 1988 the town's population had grown to approximately 6500 to 7000. Pahrump is now the largest community in Nye County.

Located forty-three miles northwest of Las Vegas in Clark County, Indian Springs is sixty-one miles southeast of the proposed Yucca Mountain site and, like Beatty, is bisected by U.S. Route 95. Impacts from the repository could result both from the town's proximity to the site and the potential for waste transportation through the community. Prior to World War II there were few people living in Indian Springs. With the war came construction of the Indian Springs Air Force Base and associated support facilities, which caused the community to grow rapidly. Growth continued through the 1950s as a result of weapons testing activities at NTS, the main entrance of which is just 20 miles to the northwest. In late 1987 there was a reduction in Indian Springs's population when responsibility for provision of air base services was shifted from the Air Force to a private contractor whose employees tended to live in Las Vegas. At the same time, the military support services

provided by Indian Springs Air Force Base were transferred to other military installations, adding to the loss of residents. However, Indian Springs has recovered from these population losses, largely as a result of NTS activities and in 1988 had approximately 1200 residents.

The city of Mesquite is located in the easternmost section of Clark County near the Utah and Arizona borders, approximately eighty miles northeast of Las Vegas. Although the town's distance from Yucca Mountain (142 air and 184 highway miles) reduces the likelihood of direct impacts associated with construction or on-site operations, Mesquite is bisected by Interstate Route 15, a likely waste transportation route. Mesquite was one of the "downwind"[1] communities most severely affected by radioactive fallout from atmospheric weapons testing during the 1950s and early 1960s (see Fuller, 1984). Consequently, the community's experience with southern Nevada's nuclear heritage has been much different from that of places such as Beatty, Amargosa Valley, Pahrump, and Indian Springs, which have benefitted from NTS employment opportunities and are located west and south of the test site. Originally settled as a Mormon agricultural village, Mesquite remained a quiet, slowly growing, predominantly Mormon rural town until the 1980s, when unprecedented population growth was stimulated by the construction of a large resort and casino complex. The population grew from 922 in 1980 to an estimated 1500 in early 1988. This growth contributed to the establishment of Mesquite as an incorporated city in 1984.

The incorporated city of Caliente is the largest community in Lincoln County and is located approximately 110 air miles and over 250 road miles east of the proposed Yucca Mountain site. The community is bisected by the main line of the Union Pacific railroad, which is likely to be a major route for shipping high-level nuclear waste to Yucca Mountain. Like Mesquite, Caliente was among the "downwind" communities and has not experienced major employment benefits from NTS. Originally developed as a railroad town, Caliente experienced severe economic decline beginning in the late 1940s and early 1950s as a result of the railroad's transition from steam to diesel technology (Cottrell, 1951). Continued deterioration of railroad employment during the past three decades has combined with declining agricultural and mining activities to create a context of persistent economic and demographic stagnation. By early 1988 the community's population was estimated to be 996, just 14 persons more than reported in the 1980 census.

Table 10-1 Sample Size and Response Rates for Rural Nevada Community Surveys

Community	Number Delivered	Number Completed	Response Rate (%)
Beatty	150	111	74.0
Amargosa Valley	123	104	84.6
Pahrump	220	189	85.9
Indian Springs	152	122	80.3
Mesquite	152	110	72.3
Caliente	152	131	86.2
Combined Communities	949	767	80.8

Study Approach

Data Collection

The data for this study have been drawn from surveys administered to representative samples of the adult populations in each of the six study communities. In each community comprehensive sampling frames were developed using water or electric utility records.[2] Following two separate pretests of preliminary versions of the survey instrument, self-completion questionnaires were distributed in March, April, and May, 1988 to randomly selected households in each community. Field workers personally delivered and retrieved the completed survey instruments. Previous research has shown that this technique elicits relatively high response rates (Krannich, Greider, and Little, 1985).

Within each randomly selected household, an individual respondent was selected by identifying the person eighteen years of age or older whose birthday had occurred most recently. This method results in a randomized selection of adult household members, without the complexities or intrusiveness of more traditional respondent selection methods such as those developed by Kish (1949).

Information regarding sample size and the numbers of respondents for each of the study sites is summarized in Table 10-1. Overall, the rates of return for usable questionnaires were excellent, ranging from a low of 72.3 percent in Mesquite to over 86 percent in Caliente. The combined response rate for all six study sites was over 80 percent.

Variables

The questionnaire included a broad array of questions pertaining to respondents' perceptions of the nuclear waste repository program as well as other nuclear and technological programs, perceptions of community characteristics, trust in science and government, personal background characteristics,

and a variety of other social, psychological, and cultural dimensions. The analysis presented here focuses on only selected variables that help to identify and clarify the nature of rural residents' responses to several issues surrounding the siting of the repository at Yucca Mountain.

Two measures of respondents' perceptions of and attitudes regarding the repository program are analyzed as dependent variables. The first is an indicator of the degree to which people expressed concern that the repository program might have harmful health and safety effects on community residents.[3] The response scale for this question ranged from 0 to 10, with the extreme values labelled as "not at all concerned" (0) to "extremely concerned" (10). The second measure of attitudes toward the repository was a question asking respondents whether they would build the repository at Yucca Mountain if the decision were theirs.[4] Responses were measured on a five-point scale which ranged between "definitely yes" and "definitely no." Although these two variables were highly correlated ($r = .73$), they appear to address two important and distinct dimensions of respondents' views concerning the repository and its possible effects.

In order to account for the variation in respondents' views of the proposed Yucca Mountain repository, several questions were treated as independent variables in this analysis. First, respondents' community of residence was considered, since preliminary analyses have indicated very substantial differences in attitudes regarding the repository across the study communities (Krannich and Little, 1988).

Another independent variable included in the analysis was a measure of the degree of local economic harm or benefit which respondents anticipated could result from repository development.[5] This variable, measured on a scale ranging from 0 ("entirely harmful effects") to 10 ("entirely beneficial effects"), provides a means of determining the degree to which anticipated economic opportunities may attenuate risk perceptions or repository opposition.

Since individuals' attitudes about other analogous activities may influence perceptions concerning proposed facilities (see Stoffel et al., 1988, 1989), an index measuring perceptions of health and safety risks of nuclear weapons testing was developed by summing responses to two questions. The first addressed the perceived likelihood of past harmful effects from atmospheric testing,[6] and the second involved the perceived likelihood of future harmful effects from current underground testing at the NTS.[7] Both questions were measured on the same scale of 0 to 10, with responses ranging between "not at all likely" (0) and "extremely likely" (10); the correlation between the two items was very high ($r = .76$). The resulting summed index has a potential response range from 0 to 20.

In addition, a measure of trust in science was included as an independent variable, because attitudes about science and technology are likely to influence views about specific technological projects such as a nuclear waste repository. This variable was measured as a summed index comprising responses to five related questionnaire items.[8] Interitem correlations for these questions ranged between .20 and .61, and item-to-corrected total correlations ranged between .38 and .63. The internal consistency of the index is substantial, as reflected by a value of .72 for Cronbach's alpha coefficient of reliability (Cronbach, 1951).

Trust or distrust of organizations viewed as being responsible for management of hazardous projects appears to play a key role in attitudes and opinions about such projects (Edelstein, 1988; Stoffel et al., 1989). Therefore, a question addressing respondents' trust in the federal government to provide accurate information on nuclear programs was also used.[9] Responses to this question were recorded on a 0-to-10 scale ranging from "not at all confident" (0) to "extremely confident" (10).

In addition, several questions pertaining to respondents' sociodemographic characteristics were incorporated as control variables, since prior research has indicated potentially important relationships between sociodemographic characteristics and attitudes toward nuclear facilities (Nealey, Melber, and Rankin, 1983; Freudenburg and Rosa, 1984). Such research suggests that women tend to express greater concern than men about the risks of nuclear facilities as well as the risks of other hazardous events and toxic episodes (Harris and Associates, 1976; Hamilton, 1985; Mitchell, 1984; Mushkatel and Pijawka, 1989; Nealey, 1990; Nealey, Melber, and Rankin, 1983) and are generally more likely to express concern about the environment (McStay and Dunlap, 1983; Van Liere and Dunlap, 1980). Therefore, respondent gender was included in the analysis. Previous research has also suggested that being a parent affects attitudes and perceptions about potential hazards (Hamilton, 1985); thus the number of living children reported by respondents was included. Years of residence in the present community was included in order to reflect differences in the degree to which residents have shared experiences with nuclear weapons testing. That is, the longer respondents have resided in one of these communities, the more they are likely to be sensitive to ways in which the community may have been affected, either positively or negatively, by NTS programs, especially early atmospheric testing activities. Finally, respondent age was included in the analysis, since age has previously been demonstrated to influence general environmental attitudes (Van Liere and Dunlap, 1980).[10]

Results

Response distributions for both of the dependent variables vary substantially across the six study communities. As shown in Table 10-2, levels of concern about harmful health and safety effects stemming from a repository are lowest in Amargosa Valley and Beatty, the two communities located nearest to Yucca Mountain. In Beatty over 66 percent of responses were on the "not concerned" end of the scale (values 0 through 4), while slightly more than 60 percent of Amargosa Valley responses were in this same range. Levels of concern were higher in Indian Springs and Pahrump, both of which are located somewhat farther from the proposed project site. In Indian Springs approximately 53 percent of responses were below the scale midpoint, while only about 36 percent of Pahrump respondents indicated a similar lack of health and safety concern. Concern was highest in Caliente and Mesquite, the two communities which are furthest from Yucca Mountain. Only 24 percent of Mesquite responses and 28 percent of Caliente responses were in the range of scores falling below the scale midpoint that represent low concern about harmful effects.

A similar pattern emerges when the distribution of responses to the

Table 10-2 Distribution of Perceived Repository Health and Safety Risks for Six Study Communities (percent)

Response	Beatty	Amargosa Valley	Pahrump	Indian Springs	Mesquite	Caliente
"Not at all concerned"						
0	25.7[a]	26.2	14.9	18.8	7.5	7.4
1	15.2	14.6	8.6	11.1	2.8	5.7
2	12.4	11.7	6.3	11.1	3.8	2.5
3	10.5	4.9	2.9	6.8	6.6	7.4
4	2.9	2.9	2.9	5.1	3.8	4.9
5	14.3	11.7	14.9	5.1	8.5	10.7
6	1.9	5.8	2.3	4.3	4.7	5.7
7	0.0	2.9	5.1	6.0	12.3	6.6
8	4.8	5.8	9.7	6.8	13.2	8.2
9	1.0	1.9	7.4	3.4	5.7	4.9
10	11.4	11.7	25.1	21.4	31.1	36.1
"Extremely concerned"						
N	105	103	175	117	106	122
Mean	3.3	3.6	5.6	4.7	6.7	6.6

[a]Percentages may not total to 100 due to rounding.

$F = 18.91$, d.f. = 5, 722, $p < .0001$

Table 10-3 Distribution of Support/Opposition for Construction of Repository (percent)

Response	Beatty	Amargosa Valley	Pahrump	Indian Springs	Mesquite	Caliente
Definitely yes (1)	45.3[a]	47.1	20.0	25.9	7.8	12.8
Probably yes (2)	28.3	28.4	23.9	28.4	16.7	20.8
Uncertain (3)	13.2	10.8	21.1	18.1	24.5	24.8
Probably no (4)	6.6	4.9	7.2	9.5	16.7	11.2
Definitely no (5)	6.6	8.8	27.8	18.1	34.3	30.4
Combined percent "yes"	73.6	75.5	43.9	54.3	24.5	33.6
Combined percent "no"	13.2	13.7	35.0	27.6	51.0	41.6
N	106	102	180	116	102	125
Mean	2.0	2.0	3.0	2.7	3.5	3.3

[a]Percentages may not total to 100 due to rounding error.

$F = 23.27$, d.f. = 5, 725, $p < .0001$

question regarding opposition to and support for a repository is examined. Almost 74 percent of the Beatty respondents would definitely or probably construct the repository at Yucca Mountain if the choice were theirs, while 75.5 percent of Amargosa Valley respondents gave similar responses (see Table 10-3). Analogous to the pattern observed with health and safety issues associated with the proposed repository, Pahrump (43.9 percent) and Indian Springs (54.3 percent) respondents were slightly less supportive, and Mesquite (24.5 percent) and Caliente (33.6 percent) respondents were the least supportive.

These results contrast sharply with findings from the Las Vegas urban area survey reported in the preceding chapter by Mushkatel, Nigg, and Pijawka. Response patterns in all of the rural communities except Mesquite and Caliente reflect much higher levels of repository support than is evident from the Las Vegas data. Even in Mesquite and Caliente, respondents were considerably less likely to express opposition than was the case among urban area residents, tending instead to report higher levels of uncertainty about a repository. These differences may be attributable in part to rural-urban differences in economic development levels and needs and to a related tendency for rural area residents to view a repository as a potentially important source of future economic growth opportunities.

Insofar as all of the study communities face potential impacts from the transportation of nuclear wastes to Yucca Mountain, the obvious differences in repository orientations held by residents of the six study communities must be linked to some other factors. Therefore, an attempt to account for intercommunity variation in the dependent variables requires an examina-

Table 10-4 Means, Standard Deviations, and ANOVA Results Comparing Response Patterns on Measures of Anticipated Economic Effects, Trust in Science, Trust in Government, and Perceptions of NTS Health Effects

Variable	Beatty	Amargosa Valley	Pahrump	Indian Springs	Mesquite	Caliente	F
Effects on economy[a]							
Mean	7.79	8.06	6.91	7.27	4.84	5.91	20.16**
Std. dev.	2.20	2.43	2.91	2.63	2.80	2.88	
Trust in science[b]							
Mean	32.19	31.24	30.92	31.97	29.82	28.83	2.51*
Std. dev.	9.04	7.62	8.80	8.93	7.42	8.51	
Trust in government[c]							
Mean	5.67	5.32	4.03	4.82	3.30	3.22	13.23*
Std. dev.	2.84	3.10	3.22	3.22	2.62	2.94	
Perceived NTS health effects[d]							
Mean	6.85	7.40	10.36	8.37	14.67	13.16	29.38**
Std. dev.	5.73	6.14	6.68	6.38	5.57	5.98	

[a]Values range between 0 (entirely negative effects) and 10 (entirely positive effects)

[b]Values range between 0 (no trust) and 50 (total trust)

[c]Values range between 0 (not at all confident) and 10 (extremely confident)

[d]Values range between 0 (health effects not at all likely) and 20 (health effects extremely likely)

*$p < .05$, **$p < .0001$

tion of additional variables. As noted previously, some of the differences can be attributed to anticipated local employment and other economic benefits, which are more likely to be significant in the communities located nearer to Yucca Mountain. Moreover, the economic decline experienced in Amargosa Valley and the boom-and-bust history of Beatty may help to account for the more supportive orientations observed in those two communities. Residents of Beatty and Amargosa Valley tend to place a high priority on the need for economic growth and a stable employment base (Trend, Little, and Krannich, 1988a, 1988b).

Response distributions to a question concerning anticipated economic effects of the repository lend support to an explanation based on anticipated economic benefits. As reported in Table 10-4, residents of Amargosa Valley and Beatty were on average more likely to expect beneficial economic impacts from the proposed repository than residents of the other four communities. Pahrump and Indian Springs have the next highest mean expectations, while the anticipation of beneficial economic effects is lowest in Caliente and Mesquite. Furthermore, the standard deviations suggest that

Beatty and Amargosa Valley have greater intracommunity consensus on this question than the other study sites.

Table 10-4 also indicates that there are important differences across the study communities for several other variables that may influence repository perceptions. Trust in science, a four-item index which could explain intercommunity differences, yielded mean scores which suggest a moderate amount of trust in science in all six communities. Even though differences in mean responses on this variable were statistically significant ($p \leq .05$), the magnitude of intercommunity differences was substantively insignificant. Nevertheless, it should be noted that the downwind communities of Mesquite and Caliente, while generally trusting of science, nonetheless demonstrated the least trust in science of any of the study communities.

Another variable with the potential to explain intercommunity differences was the respondents' trust in the federal government to provide honest information on nuclear program safety. The mean community scores for this variable hovered about the midpoint of the scale (5.0), indicating neither great trust nor great mistrust of the federal government on this issue. The F test revealed statistically significant ($p \leq .0001$) differences among the communities. Caliente and Mesquite exhibited the greatest distrust of the federal government, Amargosa Valley and Beatty the greatest trust.

The last attitudinal variable examined to explain community differences was perceptions of the health effects of nuclear testing activities at the NTS. Residents of the downwind communities of Caliente and Mesquite were substantially more likely than residents of other communities to believe that nuclear weapons testing programs result in adverse health effects for area residents. In contrast, responses from Beatty and Amargosa Valley residents reflect very low average concern levels over the consequences of activities at the NTS.

An examination of bivariate correlations between the two dependent variables and the several independent variables reveals a number of potentially important relationships (see Table 10-5). Aggregating the combined responses from the six communities, the relationship between perceived economic effects and concern about health and safety effects was moderate. The correlation ($r = -.49$) demonstrates that respondents who believe the repository will bring beneficial economic effects have lower levels of concern over health and safety issues. The relationship between the measure of anticipated economic effects and the measure of support/opposition was even stronger ($r = -.60$). Thus, the greater the anticipation of economic benefits, the less the opposition to repository construction. Statistically and substantively significant correlations were also observed between each of

Table 10-5 Zero-Order Correlations Between Dependent and Independent Variables for Combined Communities

	Dependent Variables	
Independent Variables	Health/Safety Concern	Repository Support/Opposition
Effects on economy	−.49*	−.60*
Perceived NTS effects	.65*	.61*
Trust in science	−.28*	−.27*
Trust in government	−.61*	−.64*
Sex	.10*	.10*
Number of children	−.01	.05
Age	−.03	.08
Length of residence	.02	.05

*$p < .01$

the dependent variables and the perception of NTS-related health risks, indicating a tendency for levels of repository concern and opposition to be highest among rural residents who believe that there are health risks associated with nuclear testing. Levels of concern and opposition also tend to be higher among those who express low trust in science and low trust in government. While the correlations for the former are somewhat meager (−.28 and −.27 respectively), the trust in government question explains approximately 36 percent of the variation for each of the two dependent variables.

There is also a statistically significant but relatively weak correlation between both dependent variables and respondents' gender, which reflects a tendency for women to express somewhat higher levels of concern over and opposition to a repository than men. Length of residence in the local community, number of children, and age exhibited virtually no linear relationships with either of the dependent variables.

Although the bivariate relationships examined to this point indicate some potentially important interrelationships, a multivariate approach is required to sift out the interplay between community differences and the influence that respondents' perceptions and sociodemographic characteristics may have on attitudes toward repository siting. For each of the dependent variables, a multiple classification analysis (MCA) was undertaken, using *community* as a six-category independent "factor" and the measure of anticipated economic effects, NTS risk perceptions, trust in science, trust in government, respondent gender, number of living children, length of residence, and age as control variables. The MCA approach allows us to determine the extent to which observed differences among the study communities in attitudes

toward siting a repository at Yucca Mountain are due to differences in the control variables, e.g., perceptions of the effects on the economy and the health risks, trust in science and government, and selected demographic characteristics (gender, number of children, age, and length of residence).

Considering first the measure of perceived health and safety risks from the repository, the results summarized in Table 10-6 indicate that the cross-community differences noted in Table 10-2 persist but are less substantial after the effects of covariates (control variables) are taken into account. Overall, the value of eta, which reflects the bivariate correlation between the community factor and the risk perception measure, is moderate, at .33. After taking into account the influences of the eight covariates, however, the partial correlation (beta) for the community factor is substantially smaller, at .12.

By examining the coefficients listed in the columns labelled "unadjusted deviation" and "adjusted deviation," it is possible to determine the degree to which community differences are evident both before and after the effects

Table 10-6 Multiple Classification Analysis of Health and Safety Concerns Regarding the Repository

	N	Unadjusted Deviation	Adjusted Deviation	*F*	Significance
Health and Safety Concern[a] (Grand mean = 5.01)					
Main factor (community)				25.57	.000
Amargosa Valley	83	−1.37	−0.35		
Beatty	84	−1.76	−0.64		
Pahrump	128	0.53	0.60		
Indian Springs	94	−0.42	0.19		
Mesquite	75	1.30	−0.31		
Caliente	92	1.47	0.13		
Eta and beta		.33	.12		
Covariates				66.20	.000
Effects on economy				13.88	.000
Perceived NTS health effects				89.84	.000
Trust in science				0.40	.525
Trust in government				65.91	.000
Sex				1.17	.280
Number of children				8.30	.004
Age				3.21	.074
Length of residence				0.36	.548
$R^2 = .55$					

[a]Values range between 0 ("not at all concerned") and 10 ("extremely concerned")

of covariates are taken into account. The grand mean for the risk perception variable (e.g., the mean obtained when responses from all communities are pooled together) was 5.01. The unadjusted deviations from the grand mean indicate that, ignoring the influence of the control variables, the mean response values on this scale are lowest (reflecting low levels of concern) in Beatty (−1.76), and only slightly higher in Amargosa Valley (−1.37). In contrast, concern levels were highest in Caliente (+1.47) and Mesquite (+1.30). After controlling for the effects of the covariates, the remaining community differences, reflected by the adjusted deviation values, still indicate that levels of concern were lowest in Beatty (−0.64) and Amargosa Valley (−0.35). However, the highest adjusted deviation value was for Pahrump (+0.60), indicating a tendency for levels of concern to be greater in that community after controlling for the covariates. In contrast, the very high concern levels initially observed in Caliente and Mesquite appear to be largely attributable to the influence of the covariates, since the adjusted deviations for these communities are rather small.

Among the covariates, or control variables, the variables of primary importance in accounting for variation in the measure of repository risk perceptions are the measures of anticipated economic effects, perceptions of NTS health effects, trust in government agencies responsible for nuclear program management, and respondents' number of children. When all of the independent variables are considered simultaneously, the results reflect a tendency for perceptions of repository health and safety risks to be higher among those who anticipate few economic benefits for their community, believe that nuclear testing activities at NTS are associated with adverse health effects, believe that federal agencies fail to deal honestly with the public regarding nuclear program safety, and are parents. The relationship between health and safety concerns and the covariates representing trust in science, respondent gender, age, and length of residence are all statistically insignificant. In combination, the community factor and the eight covariates account for a substantial 55 percent of the variation in this dependent variable (multiple $R^2 = .55$).

Turning to the measure of support for or opposition to construction of a repository at Yucca Mountain, results of the multiple classification analysis indicate a similar tendency for community differences to become less pronounced after the effects of the covariates are taken into account (Table 10-7). The bivariate correlation between the community factor and the support/opposition variable is moderate, as indicated by an eta value of .36. However, the partial association (beta) after inclusion of the covariates drops to .11, reflecting a considerable attenuation of the differences across communities. After adjusting for the influence of the covariates, levels of repository sup-

Table 10-7 Multiple Classification Analysis of Support/Opposition to the Repository

	N	Unadjusted Deviation	Adjusted Deviation	F	Significance
Support/Opposition to Repository[a] (Grand mean = 2.69)					
Main factor (community)				35.05	.000
Amargosa Valley	83	−0.71	−0.27		
Beatty	84	−0.65	−0.20		
Pahrump	129	0.16	0.10		
Indian Springs	93	−0.13	0.10		
Mesquite	73	0.72	0.12		
Caliente	92	0.57	0.09		
Eta and beta		.36	.11		
Covariates				77.00	.000
Effects on economy				78.09	.000
Perceived NTS health effects				28.48	.000
Trust in science				0.02	.901
Trust in government				99.52	.000
Sex				2.44	.119
Number of children				4.32	.038
Age				0.74	.389
Length of residence				0.70	.402
R^2 = .59					

[a]Values range between 1 ("definitely yes") and 5 ("definitely no")

port are highest in Amargosa Valley and Beatty (adjusted deviations of −0.27 and −0.20 from the grand mean, respectively). Although responses from Mesquite yielded a rather high unadjusted score (0.72), the adjusted deviation score (0.12) is virtually indistinguishable from the remaining three communities. This suggests that most of the differences observed initially among these four communities (Pahrump, Indian Springs, Caliente, and Mesquite) are attributable to variations in community distributions for the control variables.

The relationships between support/opposition and the eight covariates examined in Table 10-7 indicate that the variables of primary importance in accounting for variation in this dependent variable are, in order of relative magnitude, trust in government, the measure of anticipated economic effects, perceptions of NTS health effects, and number of children. These are the same variables that exhibited significant partial relationships with the measure of perceived health and safety risks. Once again, the partial relationships involving trust in science, respondent gender, age, and length of residence are statistically insignificant. The multiple R^2 of .59 indicates that,

Table 10-8 Multiple Classification Analysis of Support/Opposition to the Repository, with Risk Perception as a Covariate

	N	Unadjusted Deviation	Adjusted Deviation	*F*	Significance
Support/Opposition[a] (Grand mean = 2.68)					
Main factor (community)				41.40	.000
Amargosa Valley	83	−0.70	−0.20		
Beatty	84	−0.67	−0.10		
Pahrump	127	0.14	0.05		
Indian Springs	95	−0.11	0.09		
Mesquite	76	0.73	0.11		
Caliente	94	0.55	0.03		
Eta and beta		.36	.07		
Covariates				106.54	.000
Effects on economy				62.74	.000
Perceived NTS health effects				2.85	.092
Trust in science				0.27	.601
Trust in government				44.80	.000
Sex				1.57	.211
Number of children				0.66	.417
Age				2.28	.132
Repository risk perceptions				118.81	.000
$R^2 = .66$					

[a]Values range between 1 ("definitely yes") and 5 ("definitely no")

in combination, the community factor and the covariates are able to account for 59 percent of the variation in levels of repository support/opposition.

As a final step in the analysis we reexamined the possible predictors of repository support or opposition by replacing the length of residence variable, which, as discussed above, provided little explanatory power in predicting levels of support or opposition, with the measure of perceived health and safety risks associated with the repository. This resulted in an even greater attenuation of cross-community differences, as indicated by adjusted deviation values which are relatively small for all communities (see Table 10-8). The partial association (beta) between the community factor and support/opposition was relatively small (.07), indicating that most of the observed bivariate association between these variables is accounted for by variation in the control variables. With the risk perception variable incorporated as a covariate in the analysis, the variables of primary importance in accounting for variation in levels of support/opposition are, in order of relative magnitude, perceptions of repository health and safety risks, anticipated

economic effects, trust in government agencies responsible for nuclear programs, and community of residence. Neither perceived NTS health effects nor number of children exhibited a significant relationship with support/opposition when the measure of perceived repository health and safety risks was included as a covariate. None of the other covariates exhibited statistically significant partial relationships with the dependent variable. Overall, the community factor and these covariates accounted for a very substantial amount (66 percent) of the variation in this measure of support/opposition.

Discussion

The results of this analysis demonstrate that several factors influence rural community residents' views of the proposed Yucca Mountain high-level nuclear waste repository. First, the substantial differences across communities in perceived health and safety risks and in levels of support/opposition suggest that attempts to assess local attitudes and perceptions as components of overall social impacts (Albrecht and Thompson, 1988) must take into account the unique sociocultural contexts of individual community settings.

The results also clearly indicate that attitudes about a potentially hazardous facility such as a nuclear waste repository are linked to expectations about project-related benefits. Not surprisingly, the extent to which survey respondents anticipated positive economic effects of the repository for their communities exerted an important influence on both perceptions of health and safety risks and overall support/opposition regarding the repository program. Like many rural areas, these six communities have all experienced some degree of economic instability and uncertainty as a result of fluctuations associated with dependence on a single major economic activity (Krannich and Luloff, 1991). Such dependence includes Caliente's reliance on now-obsolete railroad technologies, boom-bust mining cycles in Amargosa Valley and Beatty, fluctuating levels of defense-related programs in Indian Springs, and shifts from agricultural enterprise to low-wage service industries based on tourism and retirement in Mesquite and Pahrump.

Although the extent of economic difficulties has varied widely across the study sites, they all share a general concern about the need for more economic stability and increased local economic opportunities, a concern that is common to many other rural areas. The economic context results in a greater willingness of many rural residents to accept potentially dangerous or noxious facilities than is likely to occur with most urban residents (Krannich and Luloff, 1991). Under such circumstances, the willingness to accept potentially harmful facilities increases dramatically when project

proponents promise that local residents will obtain high-paying jobs and that there will be a concomitant increase in area business activity.

Repository perceptions and attitudes are also influenced by experience with and perceptions of other, possibly analogous, projects and programs. To a substantial degree, the different views expressed by residents of these rural communities appear to be linked to their beliefs about the public health effects of past and present nuclear testing programs. The "downwinder" experiences of some southern Nevada residents, especially those living in Caliente, Mesquite, and other communities that are northeast of the Nevada Test Site, contrast sharply with those in Amargosa Valley, Beatty, Indian Springs, and Pahrump. These latter communities are not only upwind of NTS but have also experienced the economic benefits of NTS employment as well as jobs related to the operation of a nearby low-level nuclear waste repository, which, to date, has generally been problem-free. Thus, the "risk perception shadows" (Stoffel et al., 1988, 1989) cast by NTS and other nuclear projects in southern Nevada may be quite different for area residents, depending upon past experiences with things nuclear. Those experiences account for important differences in community views of the potential consequences of storing high-level nuclear waste at Yucca Mountain.

Also linked to these experiences is the extent to which residents believe that the federal government can be trusted to provide honest information about the safety of nuclear programs. Nevadans share a general antigovernment orientation common throughout the rural West. In addition, many residents are convinced that the government has been dishonest in its dealings with the public over such events as the nuclear contamination from atmospheric weapons testing, nuclear contamination from improperly contained underground nuclear tests, and attempts to site MX missiles in rural areas of Nevada and Utah. Moreover, public controversy erupted in early 1988 over the alleged suppression by the Department of Energy of government scientists' reports questioning the geological suitability of Yucca Mountain as a repository site. These circumstances have created a context of increased hostility and distrust of the federal government that appears to have strongly influenced rural Nevadan's views about the repository program.

The prospect of a high-level nuclear waste repository also creates a context in which many residents are confronted with the question of cross-generational risks. Some individuals may be willing to expose themselves to risks or to accept trade-offs between risks and economic opportunities that may benefit them as individuals or that can improve general community economic conditions. Even in the case of a project characterized by the potential for radiation releases, some persons may express fairly low levels of concern because they assume that they are relatively immune to

the health risks posed by future accidents or the long-term nature of health threats from low levels of radiation exposure. The perceptions of parents, however, are influenced not only by concerns about personal health consequences but also by concerns about the well-being of their children and grandchildren. Such concerns are likely to be especially important in determining responses to a facility such as the proposed nuclear waste repository, which would not become operational until after the turn of the century and which would be required safely to isolate highly toxic radioactive materials for more than 10,000 years.

Although cross-generational risks appear to have some influence on residents' attitudes and risk perceptions, more general perceptions of health and safety risks are among the strongest predictors of rural residents' attitudes about the proposed Yucca Mountain repository. Respondents who reported high risk-perception levels were much more likely to express opposition to repository construction than were those who reported low risk-perception levels. Clearly, perceptions of health and safety risks are among the important "special" effects of nuclear projects that must be considered when assessing the human impacts of such facilities.

Although the observed community differences in repository attitudes and perceptions were substantially attenuated when other variables were included in the multivariate analysis, significant cross-community differences remained unaccounted for by the control variables. These remaining community differences may involve a variety of factors not considered here. For example, variations in the extent to which local populations are geographically mobile may be a factor, since residents who anticipate moving away from the area may believe that they will not be exposed to any of the long-term risks associated with repository operations. This could help to explain the low levels of concern expressed by respondents from Beatty, where a mining boom has attracted a more transient population. Also, the desperation which forces economically depressed communities to support virtually any growth opportunity (see Gallaher and Padfield, 1980; Krannich and Luloff, 1991) may help to account for the high levels of repository support in Amargosa Valley. Perhaps there is some underlying community or regional ethos which determines, at least in part, the manner in which residents of different communities respond to federal government projects in general or the nature of local views about the acceptability of risk.

In any event, the importance of community differences clearly necessitates a focus on the unique characteristics of individual communities rather than on an undifferentiated rural impact area. Our findings suggest that it is very important to understand how responses to nuclear and other hazardous projects may differ across various settings and local contexts. In sharp

contrast with some other studies of response to proposed nuclear facilities (e.g., Stoffel et al., 1989), our results indicate that opposition and concern are strongest in the communities farthest from Yucca Mountain, and lowest among those located nearest to the repository site. These findings fly in the face of the oft-cited NIMBY syndrome and suggest that the relationship between proximity and opposition is not universal and probably far more complex than previously suggested.

In sum, the responses of rural Nevada residents to the proposed high-level nuclear waste repository at Yucca Mountain appear to be influenced by a complex set of factors, ranging from the unique sociocultural settings of specific local communities, to the widely divergent experiences and perceptions which are linked to past and present nuclear testing, to the cross-generational concerns and risk perceptions that appear to be uniquely important when addressing the long-term toxicity of hazardous and radioactive materials. Residents of these rural study communities, particularly those nearest to Yucca Mountain, generally express lower levels of concern over, and greater support for, a repository than has been observed among urban Nevadans. However, such positive views about a repository are far from universal. The differences in views that are evident among communities, and among individuals who exhibit different perceptions and personal characteristics, suggest that the social and psychological costs stemming from repository development will not be borne evenly by all area residents.

Notes

This research was supported in part by a research contract with Coopers and Lybrand, Inc. (formerly Mountain West Research) for the Nevada Nuclear Waste Projects Office. Additional support was provided by the Utah Agricultural Experiment Station.

1 *Downwind* refers to the fact that the prevailing winds move eastward from NTS toward Mesquite, Caliente, and other rural areas of southern Nevada and Utah. *Downwinders* are those people who were in the path of the radioactive fallout from atmospheric testing of thermonuclear weapons at NTS.

2 Employees of the public utility companies went through customer lists with members of the research team to certify that no service connections had been added or deleted since the list was printed. Additionally, these same employees noted instances where multiple families occupied a dwelling with only a single utility hookup. If the number of households was not known with certainty, an on-site inspection by a team member resolved the question. Whenever it was suspected that utility records were inaccurate, team members mapped the locations of all housing units in areas of question. In one instance the entire community was mapped by team members.

3 The question asked, "If the repository is built at Yucca Mountain, how concerned are you that it might have harmful effects on public health and safety in this area?"

4 The question asked, "If you were able to make the final decision regarding the location of the nuclear waste repository at Yucca Mountain, would you build it there?"

5 The question asked, "How likely do you think it is that the repository would affect the economic well-being of residents or businesses in this area?"

6 The question asked, "How likely do you think it is that above-ground nuclear weapons testing activities at the Nevada Test Site have in the past caused harmful health problems for people who live in this area?"

7 The question asked, "How likely do you think it is that underground nuclear weapons testing activities at the Nevada Test Site will in the future cause harmful health problems for people who live in this area?"

8 The items were as follows:

(a) "Scientists generally work for the well-being of the public."
(b) "Scientists often make sensational announcements just to get publicity."
(c) "Science attempts to increase the knowledge we can apply to our everyday lives."
(d) "Science creates more problems than it solves."
(e) "Scientists can almost always be trusted when they say something like a product or procedure is safe."

For purposes of index construction, the responses to items (b) and (d) were reverse coded.

9 The question asked, "How confident are you that federal agencies have provided the public with honest and accurate information about the safety of the government's nuclear programs?"

10 Preliminary analyses also examined respondents' education and employment experience at NTS as possibly important independent variables. However, the SPSS-PC statistical package used to analyze the data restricted the multivariate analysis to a maximum of eight independent variables in addition to the variable representing community of residence. Since neither education nor NTS employment experience exhibited meaningful relationships with the dependent variables, they were not included in the final analysis.

References

Albrecht, Stan L. 1983. "Community Response to Large-Scale Federal Projects: The Case of MX." In Steve H. Murdock, F. Larry Leistritz, and Rita R. Hamm, eds., *Nuclear Waste: Socioeconomic Impacts of Long-Term Storage*. Boulder: Westview. 233–50.

Albrecht, Stan L., and James G. Thompson. 1988. "The Place of Attitudes and Perceptions in Social Impact Assessment." *Society and Natural Resources* 1:69–80.

Center for Survey Research. 1988. *Public Opinion in Nevada: The Future*. Las Vegas: University of Nevada.

Cortese, Charles, and Bernie Jones. 1977. "The Sociological Analysis of Boom Towns." *Western Sociological Review* 8:76–90.

Cottrell, William F. 1951. "Death by Dieselization: A Case Study in the Reaction to Technological Change." *American Sociological Review* 16:358–65.

Cronbach, Lee J. 1951. "Coefficient Alpha and the Internal Structure of Tests." *Psychometrika* 16:297–334.

Davenport, Judith, and Joseph A. Davenport, eds. 1980. *The Boom Town: Problems and Promises in the Energy Vortex*. Laramie: University of Wyoming Press.

Edelstein, Michael R. 1988. *Contaminated Communities: The Social and Psychological Impacts of Residential Toxic Exposure*. Boulder: Westview.

Elkind-Savatsky, Pamela D., ed. 1986. *Differential Social Impacts of Rural Resource Development*. Boulder: Westview.

Freudenburg, William R., and Eugene A. Rosa, eds. 1984. *Public Reactions to Nuclear Power: Are There Critical Masses?* Boulder: Westview/American Association for the Advancement of Science.

Fuller, John G. 1984. *The Day We Bombed Utah*. New York: New American Library.

Gallaher, Art, and Harland Padfield, eds. 1980. *The Dying Community*. Albuquerque: University of New Mexico Press.

Hamilton, Lawrence C. 1985. "Who Cares About Water Pollution: Opinions in a Small-Town Crisis." *Sociological Inquiry* 55:170–81.

Harris, Louis, and Associates, Inc. 1976. *A Second Survey of Public and Leadership Attitudes Toward Nuclear Power Development in the U.S.* New York: Ebasco Services.

Kish, Leslie. 1949. "A Procedure for Objective Respondent Selection Within the Household." *Journal of the American Statistical Association* 44:380–87.

Krannich, Richard S., Thomas Greider, and Ronald L. Little. 1985. "Rapid Growth and Fear of Crime: A Four Community Comparison." *Rural Sociology* 50:193–209.

Krannich, Richard S., and Ronald L. Little. 1988. "Differential Orientations of Rural Community Residents Toward Nuclear Waste Repository Siting in Nevada." Presented at the Annual Meetings of the Rural Sociological Society, Athens, GA, August.

Krannich, Richard S., and Albert E. Luloff. 1991. "Problems of Resource Dependency in U.S. Rural Communities." In Andrew Gilg, David Briggs, Robert Dilley, Owen Furuseth, and Geoff McDonald, eds., *Progress in Rural Policy and Planning*, Vol. 1. London: Bellhaven. 5–18.

Kunreuther, Howard, William H. Desvousges, and Paul Slovic. 1988. "Nevada's Predicament: Public Perceptions of Risk From the Proposed Nuclear Waste Repository." *Environment* 30:16–33.

Little, Ronald L. 1977. "Some Social Consequences of Boom Towns." *North Dakota Law Review* 53:401–25.

Little, Ronald L., and Steven B. Lovejoy. 1979. "Energy Development and Local Employment." *Social Science Journal* 6:27–49.

McStay, Jan R., and Riley E. Dunlap. 1983. "Male-Female Differences in Concern for Environmental Quality." *International Journal of Women's Studies* 6:291–301.

Mitchell, Robert Cameron. 1984. "Rationality and Irrationality in the Public's Perception of Nuclear Power." In William R. Freudenburg and Eugene A. Rosa, eds., *Public Reactions to Nuclear Power: Are There Critical Masses?* Boulder: Westview/American Association for the Advancement of Science. 137–79.

Mushkatel, Alvin, and K. David Pijawka. 1989. *The Analysis of the Las Vegas Urban Survey Data—Final Report*. Prepared for the Nevada Nuclear Waste Projects Office. Las Vegas: Mountain West Research.

Nealey, Stanley M. 1990. *Nuclear Power Development: Prospects in the 1990s*. Columbus, OH: Battelle.

Nealey, Stanley M., Barbara D. Melber, and William L. Rankin. 1983. *Public Opinion and Nuclear Energy*. Lexington, MA: Lexington Books.

Stoffel, Richard W., Michael W. Traugott, Camilla L. Harshbarger, Florence V. Jensen,

Michael J. Evans, and Paula Drury. 1988. *Perceptions of Risk From Radioactivity: The Superconducting Super Collider in Michigan*. Ann Arbor: Institute for Social Research, University of Michigan.

Stoffel, Richard W., Michael Traugott, Carla Davidson, Florence V. Jensen, John Stone, Gail Coover, and Paula Drury. 1989. *Social Assessment of Siting a Low-Level Radioactive Waste Isolation Facility in Michigan: A Summary of Two Studies*. Ann Arbor: Institute for Social Research, University of Michigan.

Titus, A. Constandina. 1986. *Bombs in the Backyard: Atomic Testing and American Politics*. Las Vegas: University of Nevada Press.

Trend, Michael G., Ronald L. Little, and Richard S. Krannich. 1988a. *Summary Ethnographic Report: Amargosa Valley*. Prepared for the Nevada Nuclear Waste Projects Office. Las Vegas: Mountain West Research.

———. 1988b. *Summary Ethnographic Report: Beatty*. Prepared for the Nevada Nuclear Waste Projects Office. Las Vegas: Mountain West Research.

Weber, Bruce A., and Robert E. Howell. 1982. *Coping with Rapid Growth in Rural Communities*. Boulder: Westview.

Williams, R. Gary. 1988. "Perceived Knowledge and Perceived Risk." Presented at the Second Symposium on Social Science in Natural Resource Management, Urbana, IL, June.

Williams, R. Gary, and Barbára A. Payne. 1985. "Emergence of Collective Action and Environmental Networking in Relation to Radioactive Waste Management." Presented at the Annual Meetings of the Rural Sociological Society, Blacksburg, VA, August.

Van Liere, Kent D., and Riley E. Dunlap. 1980. "The Social Bases of Environmental Concern: A Review of Hypotheses, Explanations and Empirical Evidence." *Public Opinion Quarterly* 44:181–97.