

APPENDICES

**A COUNTY AT RISK:
THE SOCIO-ECONOMIC IMPACTS
OF THE PROPOSED YUCCA MOUNTAIN
HIGH-LEVEL NUCLEAR WASTE REPOSITORY**

A Report to

THE COUNTY OF INYO, CALIFORNIA

From

**Gruen Gruen + Associates
*Urban Economists, Market Strategists
And Land Use/Public Policy Analysts***

C1285

September 29, 2010

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APPENDIX A

SUMMARIES OF LITERATURE REVIEW

- Title:** **Do Property Values Rebound from Environmental Stigmas?**
- Date of Study:** May 1999
- Author of Study:** Larry Dale, Senior Analyst, Law & Economics Consulting Group; James C. Murdoch, Professor, School of Social Sciences, University of Texas at Dallas; Mark A Thayer, Professor, Department of Economics, San Diego State University; Paul A Waddell, Associate Professor, Graduate School of Public Affairs, University of Washington
- Publication:** *Land Economics*, Vol. 75, No. 2, May 1999, pp 311-325
- Effect Studied:** Value drops following the stigmatization of a location and the changes in those values occasioned in time periods after a cleanup of the stigmatized location.
- Study Area:** Dallas, Texas, area surrounding a 50-year-old lead smelter
- Methodology:** Using a pooled time series and cross-sectional data set that covered all single family homes through the multiple listing service from 1979-1995 (over 200,000 observations), the results of value changes in the area were compared with what was expected under stigmatization initially, and then compared again to prices after the cleanup of the stigmatized location.
- Findings:** The literature on stigmatized locations predicted that property values around the smelter will be negatively affected, and their research findings were consistent with that expectation. They went further in their research to consider what happened after the stigmatized location, in this case the smelter, was cleaned up. They found that after a passage of time, the clean up did cause an increase in property values to nearby residences. The research suggested that while stigmatized locations definitely decrease the value of properties around the location as would-be buyers find the area less desirable, clean ups help reverse that procedure so that, in time, the locations may once again be found sufficiently desirable to see housing prices increase.
- Title:** **Does Hazardous Waste Matter? Evidence from the Housing Market and the Superfund Program**



**A County at Risk: The Socio-Economic Impacts of the
Proposed Yucca Mountain High-Level Nuclear Waste Repository**
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Date of Study:	August 2008
Author of Study:	Michael Greenstone, Massachusetts Institute of Technology, Brookings Institution and NBER and Justin Gallagher, University of California at Berkeley
Publication:	Quarterly Journal of Economics, Pg. 951 Vol. CXXIII No. 3
Effect Studied:	The housing market impacts of Superfund-sponsored cleanups of hazardous waste sites.
Study Area:	All 1,400 Superfund sites
Methodology:	<p>Methodological challenge is that factors that covary with the presence of hazardous waste sites and housing prices include lower population densities, lower household incomes, higher percentages of high-school dropouts, and a higher proportion of mobile homes. A feature of the National Priorities List (“NPL”) provides a solution to the omitted-variables problem, because the placement of sites was not manipulated and reflected assessment of risks, rather than expected costs or benefits of cleanup. Scores used are “noisy” measures of risk and could be similar above or below the threshold, and sites below the cutoff could also present significant health risks. “The selection rule that determined placement on the NPL is a highly nonlinear function of the (Hazardous Ranking System) (“HRS”) score.” Allows for design that compares outcomes of sites “near” the cut-off point for inclusion in the NPL.</p> <p>Associations between housing prices and environmental amenities have been estimated by economists since at least 1967 using the hedonic model. The gradient of the hedonic price schedule (“HPS”) with respect to local environmental quality gives the equilibrium differential that compensates consumers for accepting the increased health risk and aesthetic disamenities associated with lower local environmental quality. HPS can be used to infer welfare effects of a marginal change in a characteristic. From the suppliers’ perspective, the gradient of the HPS reveals the costs of supplying a cleaner local environment.</p> <p>Constructed the most comprehensive data file on the Superfund program, and data file includes housing price, housing characteristics and neighborhood demographic and economic information for areas surrounding the sites. Analysis covers 48,147 of the 65,443 year 2000 Census tracts and sample includes 985 of the 1,398 sites listed on the NPL before 2000. Second sample is the 1982 HRS Sample of 690 hazardous waste sites tested for inclusion in the initial NPL. Distance</p>



variable was measured using circles of two miles and three miles around each site.

Quasi-experimental approach that restricts sample to the Census tracts containing the 487 sites in the 1982 HRS Sample with complete housing price data; uses an instrumental variables strategy to account for endogenous rescoring of the sites; and a RD design.

Hypotheses: Impacts of an amenity improvement; i.e. clean-up of Superfund sites, includes price of land and housing near the cleaned up site; consumers will respond with taste-based sorting such that increased proportion of households living near the cleaned up sites value environmental quality highly; the supply of residential land and housing near the site will increase and the entire welfare gain accrues to landowners.

Findings: Superfund cleanups have small effects on the value of local housing services. Limited evidence that the NPL designation is associated with changes in wealth and income and related variables that proxy for shifts in demand for environmental quality. Limited indication of an increase in the supply of housing occurring near an NPL site. Local benefits of cleanups are lower than the mean cost of cleanups.

Conclusions: Segments of the population with a high willingness to pay to avoid exposure to hazardous waste do not live near such sites, and the population that does is usually unable to pay. Households may believe that cleanups do not appreciably alter the health risks of living near a Superfund site (epidemiological literature has not found persuasive evidence of substantial health benefits from the cleanups).

The main contribution of the paper is that it shows the feasibility of estimating the effects of a local amenity in the context of a hedonic model and adds to a growing body of research demonstrating that it is feasible to identify research designs that mitigate the confounding that has historically limited the conventional hedonic approaches to valuing nonmarket goods and that a “combination of quasi experiments and hedonic theory is a powerful method for using markets to value environmental and other non-market goods.”

Title: **The Effect of Power Plants on Local Housing Values and Rents:
Evidence from Restricted Census Microdata**

Date of Study: June 2008

Author of Study: Lucas W. Davis, Department of Economics, University of Michigan,



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	Special Sworn Status researcher of the U.S. Census Bureau at the Michigan Census Research Data Center
Publication:	Working paper published by Center for Energy and Environmental Policy Research, a Joint Center of the Department of Economics, MIT Energy Initiative, and Sloan School of Management
Effect Studied:	The effect of power plans on local housing values and rents
Study Area:	60 non-cogeneration fossil fuel plants larger than 100 megawatts opened between 1991 and 1999 throughout the U.S.
Methodology:	Hedonic price function to compare housing values and rents <u>before</u> and <u>after</u> plant openings to control for unobserved characteristics of affected neighborhoods. Analysis focuses on changes over time, exploiting power plant openings to control for unobserved neighborhood characteristics and relies on highly-localized comparisons across neighborhoods to control for omitted variables that vary over time. Measures marginal willingness to pay for homes located within two miles of plant and homes located within two to five miles of plant. The analysis makes use of restricted micro data from the Census, which identifies households at the census block level. This precision is important because of the highly-localized nature of the externalities. Dependent variable is reported housing value and reported monthly rent. Two time periods are used: 1990 and 2000. Also measured marginal willingness of households to pay to avoid power plants by subsets of plants: natural gas and other types of plants, large and small plants, base load and peaker plants, and upwind and downwind households.
Findings:	Household marginal willingness to pay to avoid living near a fossil fuel power plant ranged from 2.3-3.0 percent for housing values and from 4.4-5.5 percent for rents. Housing values decreased by three to five percent between 1990 and 2000 compared to neighborhoods further away. This implies an average loss of \$14.5 million of housing within two miles of a plant. The negative impact will be higher if also consider impact on proximity of commercial property and undeveloped property.
Title:	A Meta-Analysis of the Effect of Environmental Contamination and Positive Amenities on Residential Real Estate Values
Date of Study:	2006
Author of Study:	Robert A. Simons, Cleveland State University and Jesse D. Saginor.



Cleveland State University

- Publication:** Journal of Real Estate Research, Vol. 28, No. 1-2006
- Effect Studied:** How proximity to source influences environmental contamination effects on residential property values.
- Study Area:** Summarizes a literature review of 75 peer-reviewed journal articles and selected case studies.
- Methodology:** Data set of 230 observations about each study's dollar property value loss in 2003 dollars (the dependent variable) based on review of negatively impacted residential properties. Independent variables include distance from source of contamination, type of contamination (including nuclear power plant or manufacturing facility, land fill, hazardous waste site or Superfund site), urban or rural environment, information (the amount of media or other public exposure received about the source of contamination), local and national market conditions, information about the contaminative event, remediation, study type, and other variables. Hedonic regression methodology accounted for 72 percent of the observations. Ran the model using only negative amenity observations in three ways: overall; no outliers; and five observations maximum per study. Next ran the meta-analysis by including 62 observations from peer-reviewed articles that address the effect of positive amenities (beach frontage, water view, parks, golf courses, new housing construction). The data for negative amenities were checked for multicollinearity between independent variables and reported the VIF and TOL indicators along with model results. Wide range of distance variation ranging from 25 miles for a nuclear plant to 0 in cases of mold, asbestos, groundwater, or similar on-site contamination.
- Findings:** The results of the base model with all residential sales affected by negative proximity influences produced an F-Statistic of 23.9 and the adjusted R² of 0.75. The variables in the model explain 75 percent of the variation in the decrease in property values. Using only negative amenity observations, property *losses* due to proximity to environmental contamination were \$0.23 higher for every additional dollar in real unimpaired value, and were statistically significant at the 99 percent level of confidence. Nuclear power plants and manufacturing facilities had a negative loss of value of \$25,900 and were significant at the 95 percent level.
- The results of the residential model without outliers using the dependent variable the percentage reduction in property values resulted in the F-



Statistic decreasing to 4.9 with a decrease in the adjusted R² to 0.38. Despite the reduction in the goodness of fit, many of the variables significant in the base model become more significant, and variables not significant in the base model – rural location and the 30-year mortgage rate -- became significant.

The model run with 228 negative amenities observations plus 62 positive amenity observations had an F-Statistic of 14.8 and a R² of 0.63, substantially lower than the base model. Adding in the positive amenity observations, property *values* due to proximity to positive or negative environmental attributes were \$0.27 higher for every additional dollar of unimpaired value. This was statistically significant at the 99 percent level. Nuclear power plants and manufacturing facilities with substantial ongoing employment were positive at \$14,985 and significant at the 90 percent level. “This parameter estimate was somewhat lower than the -\$25,900 estimate in the negative model.”

The findings indicate that regression studies systematically show a lower level of losses compared with other methodologies. Author states that regression analysis may be more conservative, statistically accurate estimate of property value losses, but may show lower losses because information about source of contamination may be known to buyers and sellers. That is, respondents are likely to have better and more complete information than actual sales where information may not be complete. “Surveys also may have potential bias due to the subjectivity of the respondents, who may lack the expertise to make an accurate estimate of the impact of the contamination or hypothetically bias issues.”

Conclusions:

Authors cite Smith and Huang (1995) meta-analysis of 37 air pollution studies, and the hedonic meta-analysis validated the use of Ordinary Least Squares and related statistical techniques to estimate the marginal willingness to pay for reduction of pollution. Authors also cite Boyle and Kiel (2001), which reviewed 30 hedonic price studies. “The studies on undesirable land uses also consistently produce negative signs and statistical significance where theory would predict it.... Factors such as distance, information, neighborhood characteristics and visibility are important factors.”

Title:

Stigma: The Psychology and Economics of Superfund

Date of Study:

July 2004

Author of Study:

William Schulze, Project Director; Kent Messer, Katherine Hackett,



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Department of Applied Economics and Management, Cornell University; Trudy Cameron, Graham Crawford, University of Oregon; and Gary McClelland, University of Colorado

Publication: Report prepared for Environmental Protection Agency CR 824393-01-0, Project Officer Dr. Alan Carlin, National Center for Environmental Economics Office of Policy, Economics, and Innovation, U.S. Environmental Protection Agency

Effect Studied: Long-term impacts of Superfund cleanup on property values in six Superfund sites in four geographic areas: the Operating Industries, Inc. landfill site near the communities of Monterey Park and Montebello, California; the radium pollution in Montclair, Glen Ridge, and East/West Orange Townships in northern New Jersey; the Industri-Plex and Water Wells G & H in Woburn, Massachusetts, and the Eagle Mine outside Vail, Colorado

Methodology: “The key insights drawn from this work stem from our measurement of trends in both socio-demographic characteristics and housing stock characteristics at the neighborhood level. Taking advantage of the large data increment provided by the 2000 U.S. Census, we construct approximate time-series for the set of conformable Census-tract-level variables in order to span a 31-year time period, based on the 1970, 1980, 1990 and 2000 Censuses. We consider neighborhood change, both in terms of socio-demographics (ethnicity, age, and household composition) and the housing stock (owner versus renter occupancy and vacancy rates, as well as shifts over time and with distance from the Superfund site in the characteristics of homes in our large sample of transactions).”

“The main objective in this study is to determine whether there are statistically detectable effects on the selling prices of houses due to proximity to a Superfund site, and whether these effects, if any, vary over time as the site is identified and remediated. Before the incremental effects of such proximity can be isolated, it is necessary to control for other factors which might influence these prices. If any of these factors is correlated with distance from the site, or varies over time, or especially both, then the apparent timewise variations in prices due to proximity to the site could be distorted by omitted variables bias. In this study, we use four main classes of covariates to control for systematic variations in housing prices due to heterogeneity *other than* the effects of proximity to the Superfund site over time.”

“To the extent that housing prices vary over time independently of the



dwelling's distance from the local Superfund site, we control for all these implicit time-varying factors with a set of yearly dummy variables in each of our models. Our dependent variable in all cases is the log of the most recent selling price of the dwelling. The annual dummy variables associated with all but the earliest period (the omitted category) therefore bear coefficients that can be interpreted as the area-wide percentage difference in housing prices, relative to the first year of data, in each year of the sample. The dependent variable in all of our models is the logarithm of the selling price of the house. We define the neighborhood in which a house is located as synonymous with its Census tract. Since neighborhoods change over time, and might be expected to change as a result of the discovery and remediation of a Superfund site, it is important to distinguish between changes over time in the effect on housing prices of mere proximity to the site, versus the influence of changing local demographics on property values. Hedonic property value studies which ignore changing demographics are essentially estimating reduced form model, which confounds the proximity effects with the changing demographics. It is possible that the pure effects of proximity to a site are completely resolved with remediation, but the effects of changing demographics as a result of the experience are more permanent. We have been careful to collect Census data from all relevant decennial Censuses and interpolated all of the conformable socio-demographic characteristics. For some sites, we needed the 1970, 1980, 1990 and 2000 Census counts in order to interpolate a series between, for example, 1978 and 1997. Obviously, the decennial interval is problematic and these characteristics will inevitably be measured with some error. Errors-in-variables attenuation may lead to underestimates of the effect of neighborhood characteristics on housing prices. The 2000 Census will offer greater resolution for a number of these variables, but the complete 2000 Census data at the Census tract level are not yet available at the time of this writing. We strived to achieve comparability across the different Censuses in these data, subject to the constraints imposed by the available data in each year. Counts were collected for each Census tract in each of four Census years, and categories were aggregated until they conformed and the data could be pooled and used in an algorithm to interpolate approximate values for each variable in each year between Census years. This procedure resulted in a Census dataset that could be merged with housing transactions by Census tract and year, so that the approximate current neighborhood mix could be used to explain housing prices in each year. The Census variables we constructed that conformed across all four Census years and could be computed for each Census tract for each of our four sample areas. A smoothing algorithm was used to "connect the dots" in each Census year and to impute approximate



values for each inter-Census year. Over the time horizons involved in our different cases (which range from 11 years to almost 30 years), there is a substantial scope for demographic shifts. Initial decreases in housing prices due to the recognition of an environmental disamenity can make the neighborhood accessible to lower-income households, who may be prepared to accept the disamenity in exchange for more housing at the same price, or cheaper housing, than they can obtain elsewhere. Neighborhood characteristics are not independent of the “taint” due to a Superfund site. It is important to ascertain whether the observation that housing price gradients often tend to rise as one moves away from a Superfund site, even after remediation, may be due to filtering-down of this housing stock that occurs during the period when taint is maximum. It is entirely possible that, controlling for neighborhood changes that ensue from an episode of major environmental taint, the eventual effect of proximity to the site is actually positive (the price gradient moving away from the site is negative following remediation). Homeowners may value proximity to a cleaned up site more than they value proximity to other less-certifiably safe features. The fact that Census data are available only at ten-year intervals has been an impediment to addressing this research issue. It was necessary to wait for the availability of the year 2000 Census data to be able to interpolate between the 1990 Census tract information and the 2000 Census information in order to construct usable data for the last seven to nine years of housing sales in our various data sets.”

“Perceived risk is assumed to vary over time, and should also vary over space in a way that is approximately correlated with possible exposure....(A)ny assessment of market dynamics as a potential explanation for neighborhood change around a locally undesirable land use requires controlling both for the characteristics of the neighborhood before a siting decision and for changes in other neighborhoods. ... Here, we control for patterns in other neighborhoods by enlisting the broader area around the host tract as control tracts. Rather than looking for discrete differences in socio-demographic characteristics between a host tract and tracts that are greatly displaced in terms of distance, we look for patterns in demographics over time that differ continuously with distance from our Superfund sites. If the socio-demographic patterns near the site are indistinguishable from those farther away, the distance gradient relative to the site will be flat. Depending upon conditions at the beginning of our sample periods, there may be other reasons why we might observe a positive or negative distance gradient in socio-demographic characteristics. What matters, however, is how this gradient changes over time. If white residents tend to move out, and non-white residents to move in, in the wake of publicity about



Superfund designation and remediation, then the distance gradient for whites should be observed to become relatively more positively sloped (or less negatively sloped) with time. Likewise, the distance gradient for non-whites would be expected to become less positively sloped (or more negatively sloped) over time.”

“We assess the propensity for lower-income families, non-whites, and non-traditional families to ‘come to the nuisance,’ possibly attracted by lower housing prices brought about by taint from the Superfund site. The models we examine regress proportions for each sociodemographic and housing tenure characteristic, across Census tracts and over time, against a measure of distance, a time trend, and an interaction between distance and time. We use the log of distance, since this transformation is important in our main hedonic property value models. The log transformation allows any effect of proximity to the Superfund site to dissipate with distance until, in the limit, further increases in distance have very little effect on sociodemographic proportions. This is a reasonable maintained hypothesis, since the “reach” of influence of any particular Superfund site must be finite.”

Findings:

“(E)ndogenous neighborhood change can be precipitated by the identification and remediation of a Superfund site. While the objective or subjective risk associated with the site may initially account for decrements in housing prices around the site, these lower prices also make the neighborhoods more accessible to lower income groups, younger families, minorities, and non-traditional households. The increased presence of these groups can replace Superfund site risks as an explanation for systematically lower property values near the site over time, even after the site has been cleaned up.”

“It seems eminently clear that there is a strong tendency for fundamental neighborhood change in the wake of a Superfund identification and remediation process. The property prices we use from our analysis stem from house sales, and every time there is a house sale, the occupants of that dwelling typically change. Who moves out and where they choose to go, and who moves in, determines the change in the composition of the community in the vicinity of a site. If the negative price shock accompanying a Superfund designation and the cleanup process make housing in the vicinity of the site more affordable to lower income households, unconventional households, ethnic minorities, or absentee landlords, a sufficient number of sales can detectably alter the makeup of the community. There is a considerable literature in urban economics concerning the mechanisms of neighborhood change (invasion-succession, tipping). The precipitating



agent for the process, in our cases, seems likely to have been the identification of the Superfund site. Empirical models may fail to control for neighborhood change over time as a Superfund identification and remediation process takes place. This can lead to omitted variables bias that creates the impression that the Superfund process “taints” a neighborhood long after the site itself has been cleaned up. In reality, what accounts for the persistent negative price differential closer to the site could be the gradient in socio-demographic and income classes approaching the site. With site-induced neighborhood change, this “income-socio-demographic” gradient will masquerade as a persistent “Superfund site proximity” gradient. When the site is clean, it may be that nobody in the neighborhood or beyond is the least worried about any residual hazard. In fact, having been certifiably cleaned, the site may even appear safer and more environmentally attractive than competing uncertified areas elsewhere in the region. The true post-cleanup “environmental gradient” might even display higher property prices near the cleaned site. However, if one fails to control for the changed “income-socio-demographic gradient,” it is possible to misidentify the phenomenon as a persistent taint or perceived risk due to the site. In none of our examples does it appear that the housing stock nearest the Superfund site is being renewed and upgraded at the same rate as housing at locations further removed from the site. It may be the case that after a sufficient period of time has passed following a cleanup project, and the site is designated as “safe” that homeowners in the area will again undertake to accelerate maintenance of the housing stock to bring it back into line with the typical housing stock in the surrounding area. However, if lower-income homeowners have moved into the area, and if rental rates have increased, this may not set the stage for such accelerated renewal of the stock. Despite cleanup, housing price may remain lower than the surrounding area due to deferred maintenance and slower remodeling schedules or teardowns and replacements. As in the case of the “income-socio-demographic” gradient created by earlier price differentials due to the Superfund identification and cleanup process, we may see a “deferred maintenance” gradient come into being relative to the location of the Superfund site. To the extent that degradation of the housing stock accompanies a Superfund experience and the attendant income and socio-demographic changes, and persists beyond the end of the cleanup process, this factor may also masquerade as a persistent environmental taint. There is evidence that Superfund site identification and remediation may at first lower housing prices, but this impact in turn initiates a pattern of in-migration by socio-demographic groups that previously would have been unable to afford housing in this area. Traditional higher income groups will be inclined to buy elsewhere and lower-income groups will have an opportunity to move in.



However, their growing presence may then become the dominant factor keeping downward pressure on housing prices, even though the Superfund remediation takes place. The implicit experiment imbedded in an estimated distance effect is a change in the risk associated with increased distance from the site. At a great enough distance, the risk is presumed to go to zero, and so should the property value differential. When, over a long time horizon, property value distance profiles do not return to a zero slope when the risk is reduced essentially to zero, neighborhood change is a potential explanation for persistent price differentials with distance. It is not at all possible to conclude that perceived risk does not respond to cleanup. In some cases, especially the Woburn case, we find that controlling for timewise variation in neighborhood characteristics such as gender, ethnicity, the age distribution, family structures and housing tenure reveals very little in the way of a remaining distance profile, so that any inferences about persistent risk perceptions are difficult to make.”

“The possibility that stigma may cause large losses in property values has been noted by other researchers (e.g., Dale et al., 1999; Adams and Cantor, 2001) and the EPA (Harris, 2004). In contrast to the hedonic approach (Rosen, 1974; and for application to hazardous sites see Bartik, 1998; Harris, 2004; Harrison and Stock, 1984; Ketkar, 1992; Kolhase, 1991; Mendelsohn, et al., 1992; Michaels and Smith, 1990; etc.) where risk is treated as one of many attributes that contribute to a determination of sale price, stigma is likely to effect property values in a rather different and more direct manner. Upon learning of the contamination potentially affecting their community, some current home owners may simply be unwilling to continue to live in their home, and likewise, potential buyers will be unwilling to consider buying a home in that community. If some owners and buyers have lexicographic preferences, the standard hedonic model fails since it relies on a tradeoff between risk and home prices. Rather, shunning by both current owners and potential home buyers will reduce the total demand for housing for a neighborhood near a site....”

“The next question is, since a hedonic analysis is used to incorporate normal attributes for predicting property prices, how can downward sloping demand be incorporated into the analysis? The answer proposed here is that hedonic models predict an average price based on home and community attributes, but do not take into account individual buyer characteristics, including bidding errors, which will affect the willingness to pay for homes in a particular area. So, for example, relative to a predicted hedonic price, P_h , one particular individual will be willing to pay more because grandmother happens to live in the neighborhood and



another particular individual will be willing to pay less because of a random error in bidding strategy. Clearly no hedonic market can exist for such attributes since they are buyer specific, and these sale price deviations will appear as part of the error term in the estimated hedonic equation. Thus, for homes with a particular set of hedonic attributes in a homogenous neighborhood with a mean sale price of P_h , there exists an array of values for homes among potential buyers, V , with a cumulative distribution function of $Q(V)$. Presumably, the H buyers with the highest individual values will own homes in the area. The analysis across the three sites shows that discovery, cleanup itself, and the number of events all negatively affect property values by drawing attention to the site and possibly increasing the number of owners and potential buyers who shun the site thereafter. Thus, the effect of any events, publicity or site information, good or bad, appears to increase the fraction of the current home owners and potential buyers that stigmatize and consequently shun the communities neighboring the sites. In other words, at least within the observed period of the studies, all news is bad news and causes relatively permanent property value losses as an increasing fraction of original owners leave and more potential buyers shun the site. The only good news in the study is that property values did significantly recover for a short period after sites were listed on the NPL. But, it is likely that as soon as it was realized that EPA could not immediately clean up the sites, the process of stigmatization began with consequent reduction in property values. Given the small sample size, it is remarkable that all of these coefficients are significant at better than the 1% level.”

“Rather than property losses reversing immediately once cleanup begins, we see no permanent recovery in property values within the time period of our data and speculate that recovery will only occur as the local population gradually moves away, events cease, and perceptual cues and media attention disappear, so more buyers are uninformed. The positive intercept in the psychological model (significant at the 5% level) indicates that property values will increase at a linear rate of about 12% every three-years if no actions are taken and no news is generated by the site.”

“When cleanup is delayed for ten, fifteen, and even up to twenty years, the discounted present value of the cleanup is mostly lost, most likely because sites are stigmatized and the homes in the surrounding communities are shunned.”

Limitations on Demographic/Behavioral Shifts, Other Studies:
The authors note that past studies focusing “on the time pattern of



distance effects on property values around a locally undesirable land use controls for two or three Census tract level characteristics, if not in earlier papers from the project, then in later ones. But these earlier studies were hampered by the absence of the 2000 Census data needed to construct plausible trends over time in neighborhood characteristics beyond 1990. These researchers have been limited to extrapolations based on the 1980 and 1990 Census data sets. The present work was also delayed considerably in its completing while the authors awaited the release of the year 2000 Census results. None of the earlier papers addressing the time pattern of distance effects reports any exploration of whether population characteristics near the hazardous waste site also vary systematically with distance as well as with time. Concerns about omitted variables bias are acknowledged as justifications for including a few socio-demographic variables, but there are no reports of scrutiny of the correlations of these Census variables with distances over time. Why might we expect socio-demographics, potentially, to be correlated with distance in ways that change over time? Housing prices are expected to be lower, the closer a property lies to a newly identified Superfund site. These lower prices may result in dwellings being sold to new owners who differ systematically from the existing population. If neighborhoods with greater proportions of residents with the characteristics of these new arrivals are typically associated with lower housing prices, this transition in the neighborhood may result in property values in this area failing to completely recover their original trajectories over time.

The existing studies which control for time-varying neighborhood demographics when measuring the effect on property prices of distance from a hazardous waste site may conclude, from the estimated coefficient on distance that property values have rebounded from an episode of Superfund designation and cleanup. However, demographics may be endogenously determined by this process. The evolution of the neighborhood over this time period may leave it with a different socio-demographic mix than prior to the episode. If these socio-demographic shifts have a negative effect on housing prices, these prices may not fully recover. Most models attempt to make welfare inferences concerning the losses in capitalized housing values to preexisting owners based on the dynamics of the distance coefficient. What matters, however, is the actual effect on housing prices. In addition to localized demographic changes that differ from trends in the broader community, the housing stock in the area near the hazardous waste site may also be affected differentially. There may be a shift in tenure from owner occupancy to more rental occupancy, and there may be changes in vacancy rates. If homeowners are less inclined to remodel houses nearest the site during the Superfund identification and remediation process, and developers



are less inclined to replace older houses or construct new dwellings for sale in this area, or if new dwellings here are systematically different from new dwellings in areas beyond the influence of the hazardous waste site, then these changes in the housing stock in neighborhoods nearer the site can also contribute to sustained lower housing prices. It is appropriate to control for demographic and housing stock changes, but all these hedonic studies implicitly assume that these changes are exogenous, and therefore do not bother to scrutinize them. We provide evidence that these variables are endogenously determined, and changes in their levels are correlated with distance from the site and dynamically related to the identification and remediation process. The full effect on housing prices of ‘proximity to a hazardous waste site’ over time is captured not just by the simple distance coefficient, but also in part by the full complement of socio-demographic and housing stock variables whose values are also affected by the identification and remediation process.”

- Title:** Proximity Values in a Low Populated Area when Dual Noxious Facilities are Present
- Date of Study:** January 2003
- Author of Study:** Jeff Anstine, Assistant Professor of Management in the Department of Business Administration, North Central College
- Publication:** Growth and Change
- Effect Studied:** The impact on residential property values of a perceptible facility and non-perceptible noxious facility in a relatively rural community: one facility is a rubber-compounding manufacturer that emits an unpleasant odor and air pollution visible in the immediate area and the other a heavy metal manufacturing firm using depleted uranium, whose potential effects are less perceptible.
- Study Area:** Jonesborough, Eastern Tennessee
- Methodology:** Author checked for presence of other disamenities, for reports of local media about the facilities, and obtained assessed tax value data for 171 housing units located in Jonesborough for 1996. This data represented the dependent variable. The hedonic equation included the appraised value of each house as a function of its characteristics and locational characteristics including distance from and between the facilities. On average, homes used in the data set are two miles from the plants.



- Findings:** When information is readily perceptible, the presence of the disamenity is capitalized into the assessed value of the homes. When information is not readily available, home values are not affected by the presence of the noxious facility. While the signs of the coefficients on distance from the heavy metal facility are as predicted, neither the distance from the plant nor its distance squared are statistically significant. The presence of the heavy metal facility does not affect housing values near the plant. The rubber compounding plant, however, affects housing units close to the plant. The impact on housing values decreases as a function of distance further away from the plant. Housing prices increase at a decreasing rate up to 1.2 miles from the rubber compounding plant, holding all other factors constant. The marginal price of houses located near the rubber compounding plant is \$5,457 less than those located further away. Homes located between the two plants were negatively affected. The marginal prices were significant lower for homes located east of the heavy metals plant and west of the rubber compounding plant.
- Title:** **Externality Effects of Small-Scale Hazardous Waste Sites: Evidence from Urban Commercial Property Markets**
- Date of Study:** August 2002
- Author of Study:** Keith R. Ihlanfeldt, Department of Economics, Florida State University; and Laura O. Taylor, Department of Economics, Andrew Young School of Policy Studies, Georgia State University
- Publication:** Journal of Environmental Economics and Management 47 (2004)117-139
- Effect Studied:** The impact on nearby commercial and industrial values of proximity to hazardous waste sites
- Study Area:** Fulton County, Georgia
- Methodology:** Used hedonic price model to estimate price gradient for apartments, retail, office, and industrial properties and vacant land (non single-family zoned) before and after the hazardous waste sites are listed on the Georgia Environmental Protection Division's Hazardous Site Inventory. Also tested price gradient impact of sites that had been delisted because either no contamination was found or contamination was quickly removed or not serious enough to require federal action. Sales price data was obtained for the period 1981-1998. Control variables include property characteristics, location-oriented variables, and census tract variables and distance as measured in quarter mile segments but no



further than three miles. The authors also estimated the aggregate loss in property values surrounding each hazardous waste site and compared the loss to estimate clean up costs in order to evaluate tax increment financing as a funding option for cleaning up the contaminated sites.

Findings:

Pre-listing gradients are estimated to be positive for the five land uses, but none of the estimated coefficients are statistically significant at the 10 percent level. All five post-listing gradients are positively sloped and statistically significant at the 10 percent level or better. For apartments and office buildings, the difference between pre- and post-listing gradient is statistically significant at the five percent level, while for the other land uses the difference is not statistically significant. For office buildings, increasing distance from a listed site from 0.5 miles to 2.0 miles causes a 36 percent increase in price. The price of the average industrial property increases only three percent with additional distance from a listed site. Price increases in apartments, vacant land, and retail are 23 percent, 16 percent, and 12 percent, respectively. The price spillover effects of sites that were delisted were weaker, and with one exception are not statistically significant. None of the pre-discovery or post-delisting gradients are statistically significant. The post-discovery (but prior to delisting) gradient for apartments was statistically significant at the 10 percent level. The post-discovery gradient for apartments is also significantly different from the pre-discovery and post-delisting gradients, suggesting that the listing of a site creates a negative spillover effect on nearby properties but the effect dissipates once the site is de-listed. According to the authors, the magnitude of the total value of property loss the authors estimate suggests that tax increment financing is a viable option for funding clean up of the sites.

Title: Externalities of Nuclear Power Plants: Further Evidence

Date of Study: April 2000

Author of Study: Sherman Follard, Department of Economics, Oakland University, Rochester, Michigan; and Robbin Hough, Department of Decision and Information Sciences, Oakland University, Rochester, Michigan

Publication: Journal of Regional Science, Vol. 40, No.4, 2000, pp 735-753

Effect Studied: Effect of nuclear power plants on land price and whether land prices altered over time

Study Area: 494 market areas for agricultural land based on the trading areas developed in Rand McNally's Commercial Atlas



Methodology: Asset-depreciation approach that describe the change in value of a location-specific property “because the owner of a real asset may not respond in the area studied but may nevertheless respond to nuclear announcements.” Data in the linear and loglinear model, applying the Box-Cox approach include agricultural data including value of land per acre, the dependent variable, total land in agriculture, the value of agricultural product per acre, data on nuclear plant location and date of installation and demographic data, population density data to account for the encroachment of urban development on the supply and pricing of agricultural land and distance from “Basic Trading Areas” (BTA) for farming to the “Major Trading Center.” BTA are approximately 40 miles in radius. Panel survey covers 1945, 1950, 1954, 1959, 1964, 1969, 1974, 1978, 1982, 1987, and 1992.

Hypotheses Tested: The installation of a nuclear power facility in the area causes a permanent decrease in the level of agricultural land prices;

The installation of a nuclear power facility introduces a new negative trend in land prices;

The inverse statistical relation of land prices to nuclear facilities reported in some studies is only an apparent one and is due to the energy firms’ preference for choosing cheap, undeveloped land;

The installation effect of a nuclear facility is countered over time by the introduction of a new positive time trend (due to economic growth and broadening of the tax base).

Findings: The nuclear externality is supported consistently by negative coefficients for the *nuclear dummy*, which are each significant given the one-tail test of confidence at the 95 percent level. A negative effect around 10 percent of land value and given a 60-mile radius is quite large.

The added hypothesis that the installations will slow the rate of land price growth is contradicted by the basic version of the model, but the alternative hypothesis, that the installation stimulates land-price growth, does not attain significance in the appropriate two-tail test (although it is positive). Even eliminating the negative impact on land prices due to the announcement effect, the negative nuclear effect on land price is revealed more strongly. However, the panel reveals that newer installations generally show positive effects.

Conclusions: “The preponderance of significant, negative estimated effects across all



varieties of models strongly suggests a negative nuclear externality and one that appears throughout the major portion of the nuclear area.” A one-time downward adjustment in land asset values reflects introduction of the perceived nuclear risk. Land prices continue downward after installation. The results reveal that a public perception of nuclear risk causes a change in land prices and that the reduction continues after installation, although largely associated with non new reactors.

- Title:** **Property Value Impacts of an Environmental Disamenity: The Case of Landfills**
- Date of Study:** April 2000
- Author of Study:** Diane Hite, Assistant Professor, Department of Agricultural Economics, Mississippi State University; Wen Chen, Fred Hitzhusen and Alan Randall, each Professors, Department of Agricultural, Environmental and Development Economics, Ohio State University
- Publication:** Journal of Real Estate Finance and Economics
- Effect Studied:** The effects of proximity to landfills on residential property values
- Study Area:** 3.25 mile radii of four different landfill areas in Franklin County, Ohio
- Methodology:** Spatial aspects of the standard urban-amenities model are combined with the hedonic model to consider the spatial effects of disamenities and landfill life expectancy. Data for 2,913 real estate transactions in 1990 for Franklin County, Ohio were used, as well as 1990 Census block group micro data for demographic variables and to create a proxy for buyer information about local disamenities, and data from maps and other sources were used to include environmental and neighborhood characteristics, including proximity to the airport, and to railroads, freeways, parks and country clubs, distance to each landfill, the Columbus municipal trash burning power plant and the CBD. Locations were also used to match properties with indices of neighborhood crime rates and quality of local school districts. The complete data set captures the marginal price effects of structural housing and environmental characteristics and neighborhood and locational impacts. In addition, the data set includes landfills with both positive and negative life expectancies. The marginal willingness to pay for individual characteristics of a property and its neighborhood is governed by both the marginal price and marginal contribution of the characteristic to property taxes, so that a simultaneous equations model in which prices and taxes are jointly determined.



Box-Cox model was not an effective tool to find the best functional form of the hedonic price function. Instead, a mixed log-linear function based on the notion that distance to the CBD, price and lot size are log-linearly distributed, while other variables may follow normal distribution. The final model incorporates a degree of market segmentation and then was reformulated as a simultaneous equations model. The model was estimated using nonlinear 3-stage Least Squares.

Findings:

Estimated coefficients of neighborhood characteristics follow the correct signs and are statistically significant at the five percent level. Among segmented variables, proximity to a park is significantly positive in the most urban areas, but significantly negative in most suburban areas. Presence of a nearby freeway is positive influence on prices in suburban areas, but negative in urban areas. The percentage of households that moved into a neighborhood from out of state increases the price of a house and reflects the role of information. Less knowledgeable households will pay more for comparable properties near disamenities. Estimated coefficients related to distance to landfill show that for all four landfill areas, property values are negatively impacted by proximity to both open and closed landfills. Average annual welfare increase for a household would range from \$955.59, or 19.08 percent, as a result of a move to 3.25 miles from a landfill, to \$1837 or 19.9 percent. Tax differences relate more to public goods provision while property values are more sensitive to disamenities.

Conclusions:

Welfare losses that result from decreased property values near landfills can be of a significant magnitude. Negative impacts remain after the landfill closes. The presence of a “public bad” in a community undermines the tax base in the long run but lowers property value. Policy implications include provision of public goods, schools and law enforcement may eventually be negatively impacted by the presence of the disamenity. Because the external cost of landfills is reflected more markedly in housing prices than in property taxes, disadvantaged socioeconomic groups may tend to migrate into those areas to take advantage of lower housing prices. This would exacerbate the problem of unequal distribution of environmental quality.

Title:

Spent Nuclear Fuel and Residential Property Values: the Influence of Proximity, Visual Cues and Public Information

Date of Study:

1999

Author of Study:

David E. Clark, Department of Economics, Marquette University; and



**A County at Risk: The Socio-Economic Impacts of the
Proposed Yucca Mountain High-Level Nuclear Waste Repository
APPENDICES
September 29, 2010**

Tim Allison, Policy and Economic analysis Group, Decision and Information Systems Division, Argonne National Laboratory

- Publication:** Papers in Regional Science, 78, 403-421
- Effect Studied:** Whether public knowledge about spent nuclear fuel storage activities at nuclear power plants and any adverse risk perceptions and stigmatization lead to measurable effects on the sales price of single-family residential properties
- Study Area:** Area 25 miles southeast of Downtown Sacramento, California
- Methodology:** Rancho Seco nuclear plant began operation in 1975, but ceased operation in 1989. The Sacramento Municipal Utility District applied for license to construct and operate a dry storage facility. Analysis covers the five-year period 1990 through 1994. Property sales data for 758 transactions between 1990 and 1994 within 15 miles of the plant were used along with structural characteristics, including age, number of bedrooms, number of baths, presence of air conditioning, square footage of the unit and lot size. Also included were neighborhood factors related to income and school quality, ethnicity, and property tax. The local newspaper was used as a proxy for information about the plant. Model estimated using a semi-log functional form.
- Hypothesis:**
- Is there a relationship between housing prices and distance from the Rancho Seco plant and is that relationship stable over time?
- Do visual cues about the Rancho Seco plant influence the relationship between the sales price and distance from the plant?
- Have announcements about spent nuclear fuel affected the price-distance relationship?
- Has newspaper coverage in the period between 45 and 120 days prior to the sale affected the sales price of the property either inside or outside the visual range?
- Findings:** The models explained 83 percent of the variation in the log of the real estate sales price. Not all neighborhood characteristics were correctly signed. Housing prices vary significantly with distance from the plant. Real housing prices rise by about 4.3 percent per mile (i.e., \$7,476 in 1998 dollars evaluated at the mean housing price). Over the 1990-1994 period, the distance gradient flattens by approximately 0.7 percent per year (i.e., \$1,208 per year in 1998 dollars). A surprising result of higher



prices inside compared to outside the range. This could relate to multicollinearity with site specific amenities. The authors consider the visual range of the plant might be a proxy for “openness” amenity but conclude that this is not the case because the “geographic area is relatively flat.” It is not stated whether other factors such as open space, lower densities, recreational amenities or other factors explain the result, and the authors admit the reasons for the result are “unclear.”

Contrary to the consistent literature findings about other negative environmental externalities, the authors find “no evidence to support a significant detrimental influence of the announcement of a dry storage facility on sales prices.” However, the individual coefficients are statistically insignificant. No information appears to be given or considered about the newspaper subscription rates in the study area. In addition, it is not clear whether households believed the announcement would come to fruition and no information is provided on whether the license was obtained. The Smollen et al study, among others, indicates that when proposed facilities are cancelled or are not expected to be approved, the negative impacts become insignificant.

The “volume of coverage does appear to steepen the distance gradient” and “increase the aversion to the plant” but the media variable is not robust.

Title:	Undesirable Facilities and Property Values: A Summary of Empirical Studies
Date of Study:	1998
Author of Study:	Stephen Farber, Graduate School of Public and International Affairs, University of Pittsburg
Publication:	Ecological Economics 24, 1-14
Effect Studied:	Whether undesirable land uses have observable negative effects on adjacent property values
Study Area:	Various
Findings:	Studies have shown that negative attitudes toward facilities which pose nuisance, health or environmental risks are strong and geographically extensive and that these attitudes are frequently translated into reduced likelihoods of economic activities such as tourism, accepting employment or locating a business in area with such facilities. Both



objective and subjective risk factors are reflected in property markets' reactions to risky land uses such as a nuclear waste disposal facility. One challenge relates to the extent that the undesirable use may be locally job enhancing, and elevate housing values because of positive wage impacts. A hedonic study that does not allow for labor market effects would underestimate the adverse amenity effect.

Studies cited include the Michaels and Smith study, "Market Segmentation and Valuing Amenities with Hedonic Models: The Case of Hazardous Waste Sites," published in the *Journal of Urban Economics* (1990, 28, 223-242), which showed that property values increase with distance from hazardous waste sites in suburban Boston, both before and after the announcement that the sites would be on the National Priority List. In describing the results of the Smolen et al Toledo study summarized below, the author notes the larger effect for a smaller community is consistent with Greenberg and Hughes' (1992) conclusion that Superfund sites had greater negative impacts on property values in rural communities than in urban areas. In citing the Smolen study and others, the author notes the consistency in the direction and magnitudes of observed effects of hazardous waste facilities and the higher negative impacts in smaller, rural communities.

The author cites a study of the Three Mile Island nuclear facility prior to the incident at that facility (Nelson, 1981, "Three Mile Island and Residential Property Values: Empirical Analysis and Policy Implication." *Land Economics* 57 (3) 363-372). A finding of a positive, but very small distance effect was attributed to the area being economically depressed prior to the construction of the facility; the study, however, does not consider whether the nuclear facility further depressed the local housing market. The incident at the Three Mile Island nuclear facility did not depress housing market prices as expected. Nelson hypothesized that any potential effects of the incident could have been offset by government assurance programs; the market may have been slow to react and effects would not be observed within the short post incident study period. In addition, the negative amenity affect could have been confounded with the costly facility cleanup and job and wage impacts.

Title: **The Effect of an Incinerator Siting on Housing Appreciation Rates**

Date of Study: 1995

Author of Study: Katherine A. Kiel, Department of Economics, Northeastern University; and Katherine T. McClain, Department of Mineral Economics,



	Pennsylvania State University
Publication:	Journal of Environmental Economics and Management, 28, 241-55
Effect Studied:	The effect of an incinerator on housing prices
Study Area:	North Andover, Massachusetts
Methodology:	Differences in appreciation rates capture the speed of adjustment to new price levels and are evidence of disequilibrium in the housing market due to the presence of an environmental negative externality. Using an income capitalization approach and a repeat sales technique, sales data of single-family house sales in North Andover between January 1974 and May 1992 are used to evaluate the effect of the incinerator during five distinct stages: the pre-rumor stage before any mention of plant construction (1974-1978), the rumor state (1979-1980), the construction stage (1981-1984), the online stage when operations commenced (1985-1988), and the ongoing operation state (1989-1992). The dependent variable was the natural log of the sales price divided by an index for the median sales price of single-family homes in the Boston MSA. Independent variables include distance from the incinerator (North Andover has an area of 27.85 miles), dummy variables for the five phases studied, and variables for interaction between the log of the distance from the incinerator and the phase dummies. Several house and neighborhood characteristics are also included.
Findings:	The impact of the incinerator was insignificant until the construction phase, when the change in nominal sales price was \$2,283 per mile from the incinerator. This value increased to \$8,100 per mile when the plant went online and then dropped to \$6,607 during ongoing operations. Even after seven years of operation, the local housing market had still not fully adjusted to the presence of the facility.
Conclusions:	When the full cost of the siting and operation of a locally undesirable facility is estimated, both the short-run and long-run impacts need to be considered. A decline in house values takes place as early as the first rumors of the facility and values are again affected as additional information becomes known.
Title:	The Effects of Refineries on Neighborhood Property Values
Date of Study:	May 1994
Author of Study:	Patrick C. Flower; and Wade R. Ragas, Department of Economics and



Finance, University of New Orleans, New Orleans, Louisiana

- Publication:** The Journal of Real Estate Research
- Effect Studied:** The effects of proximity to oil refineries on residential property values
- Study Area:** St. Bernard Parish, located below New Orleans on the east bank of the Mississippi River with two refineries spaced 1.5 miles apart.
- Methodology:** Used 1,999 observations which include all sale transactions in St. Bernard between 1979 and 1991. In Model 1, ten proximity areas based on distances calculated from reference points in the refineries and a dummy variable were defined for each of these areas. Model 1 pools observations in the proximity areas with those not included in these areas. The coefficients of the proximity areas are interpreted as the premium or discount required for locating in a proximity area, as compared to the average of those properties not in a proximity area. Model 2 replaced these dummy variables for the ten proximity areas with a variable of the actual distance from the refinery as the environmental variable. Data used sales prices for 1,999 transactions from 1979 through 1991, housing characteristics and neighborhood attributes, and environmental effects. Sales price was used as a dependent variable in both models, but in the second model, regressions were also estimated with the log of the sales price, adjusted sales price and log of adjusted sales price as the dependent variable. No neighborhood attributes were used, but a large number of house characteristics were used.
- Findings:** The results of Model 1 indicate that the area closest to the Mobil refinery was priced above the more distant area in all time periods except 1982-1983, during which a tank explosion and adverse publicity occurred. Houses in the area closest to the west side of the Murphy refinery sold for less than those in the second-closest area in 1979-81, 1982-1983, and 1989-1991. The two areas closest to the east side of the Murphy refinery showed a significant negative effect in 1979-1983. Model 2 results for the area west of the Murphy refinery were consistent with those in Model 1. For the Mobil area, results were also similar to those of Model 1, with prices declining rather than increasing with distance. While not incorporated into the analysis because of the absence of neighborhood variables, the findings reflect that attractive buffer areas separating the processing area of the Mobil refinery were larger than those separating the Murphy refinery, and enclaves near the Mobil refinery were considered exclusive and prestigious neighborhoods.



- Title:** Economic Effects of Hazardous Chemical and Proposed Radioactive Waste Landfills on Surrounding Real Estate Values
- Date of Study:** February 1992
- Author of Study:** Gerald E. Smolen, Gary Moore, Lawrence V. Conway, each of Department of Finance, University of Toledo, Toledo, Ohio
- Publication:** The Journal of Real Estate Research
- Effect Studied:** Effects of landfills containing hazardous waste on local housing values
- Study Area:** Toledo Metropolitan Area, Ohio
- Methodology:** A series of regression models were computed using housing sales data as the dependent variable to examine the marginal price-distance impact on housing values of locating a regional hazardous waste site in the City of Oregon, on the east side of the Toledo Metropolitan Area, permitted to accept hazardous wastes from throughout the eastern United States. A second hazardous waste (radioactive) disposal facility was announced by the State of Michigan. The proposed site is on the northwest side of Toledo. Actual real estate sales prices for 1,312 transactions in the area were used to establish benchmarks of housing prices before and after the announced location of the proposed hazardous (radioactive) site, while 1,237 transactions were used for the operating landfill. A hedonic price model was used to establish an equilibrium condition among housing units at varying distances from hazardous waste sites.
- A neighborhood centroid scheme was used to estimate the impact. Linear distances between each house sold and the nearest landfill were recorded, and the sales sample was divided into concentric circles each containing about one-third of the sales observations, to take into account a nonlinear distance relationship. A control sample was selected in terms of income, age and housing size characteristics, located far south of the landfills. Multiple regression models were specified, using the dependent variable sales prices of housing units from 1986 through mid-1990, and independent variables including distance from site, housing unit and lot characteristics. Statistical tests were used to measure extent of multicorrelation and a more concise model was specified that showed a higher R².
- Hypotheses Tested:** The establishment of a nuclear/toxic waste dump does not decrease housing values in the surrounding neighborhoods of the dump site;



The establishment of a toxic waste dump does not significantly decrease housing prices;

The establishment of a nuclear waste dump does not significantly decrease housing prices for more than a three-month post-announcement period; and

The establishment of a toxic waste dump does not significantly decrease housing prices for more than a three-month post-commencement period of operation.

Findings:

The results of a control sample of home sales occurring in 1989 and 1990 located seven or more miles south of the landfills indicate that the distance variable proved non-significant. For houses within 2.6 miles of the sites, for each mile the house was located away from the landfill, the sales price of the house increased \$12,061, all else held constant. A house located two miles away compared to a house located adjacent to the landfill would sell for \$24,133 more. The results show a strong statistical relationship between proximity to a landfill and sales prices of residential real estate, extending out to between 0 and 5.75 miles from the landfill site. For all years 1986-1990, the distance coefficient is significant with a positive sign, indicating that over time, the proximity to the landfill did not become “less of a problem.”

The results of the model concerning the proposed radioactive landfill site show a direct relationship between house prices and distance from the location of the proposed landfill. The real estate market reacted to “bad news quickly and decisively but the time frame for the adjustment process tends to be longer reflecting the relatively lower liquidity of residential real estate.” After the proposal was defeated, housing prices rebounded.

Conclusions:

The first hypothesis listed above is rejected and the remaining hypotheses are partially rejected because sales prices were negatively impacted in each of the five years of the study within 2.6 miles of the site of the operating landfill. The announcement of a potentially dangerous waste landfill adversely affects housing prices in the proximity to the site, and well beyond the sight of the landfill site (from the site to 5.75 miles). The analysis “found distance coefficients much larger and more significant than most prior research studies, largely because of the toxic nature of the landfills.”



**A County at Risk: The Socio-Economic Impacts of the
Proposed Yucca Mountain High-Level Nuclear Waste Repository
APPENDICES
September 29, 2010**

Title:	Nuclear Power Plants and Residential Property Values: A Comment on Short-Run vs. Long-Run Considerations
Date of Study:	1986
Author of Study:	George C. Galster, Associate Professor of Economics, College of Wooster
Publication:	Journal of Regional Science, Vol. 26, No. 4
Effect Studied:	Impact on single-family residential property values of proximity to a nuclear power point
Study Area:	Vicinity of four Northeast nuclear power plants and Three Mile Island nuclear plant
Methodology:	<p>Author refers to controversial finding in 1992 article by Gamble and Downing published in the Journal of Regional Science of no significant impact on property values due to proximity to a nuclear plant. The study related to the 1975-1977 period for four plants and the 1977-1979 period for the Three Mile Island plant. While others have criticized the statistical grounds, the author challenges the findings on the basis that Gamble and Downing failed to consider potentially short-run impacts. The theory of the determinants of housing values indicates that a land use which imposes negative externalities on some proximate residents will produce distinct short- and long-run impacts, depending upon the extent of the externality, the nature and distribution of household preferences and the degree of household mobility.</p> <p>Households adverse to introduction of a nuclear facility would bid up prices of housing outside the externality zone “until inside-zone and outside-zone price differentials for homes occupied by this group would exactly compensate them for their externality cost.” Indifferent households will tend to outbid risk adverse households which remain in the zone of externality so that risk adverse households will be replaced by indifferent households. As a result, the price differential would be eroded over time. In the new long-run equilibrium, if the number of housing units within the externality zone is larger than the number of indifferent households which could occupy them, proximity to the plant will be associated with lower prices.</p> <p>Under the theory, a short-run impact on property values can be expected to wane over time, assuming sufficient number of indifferent households. Given that the plants began operations in the early 1970s,</p>



but the property values were not analyzed until 1975-1977 and 1977-1979, the dynamic adjustments stemming from sizeable price differentials occurring at the time of the start-up had already eroded these differentials by the time of the observations; considering that the announcements of the locations occurred in 1967 or earlier, risk adverse households likely sorted themselves out in the decade before the sales observations were evaluated, and therefore the market re-equilibration had already occurred. This dynamic would explain why neither Gamble and Downing nor Nelson (1981) observed any price impacts following the Three Mile Island incident. The basis for this inference is suggested by Gamble and Downing's analysis, which found from 1966 to 1970, the annual mean sales values of homes within five miles of Three Mile Island rose slower than those homes in the five to 25 mile range, which in turn rose slower than those in a comparable control area well beyond the influence of any announced or operational nuclear plant.

- Title:** **The Value of Avoiding a LULU: Hazardous Waste Disposal Sites**
- Date of Study:** September 1985
- Author of Study:** V. Kerry Smith, Vanderbilt University; and William H. Desvousges, Research Triangle Institute
- Publication:** The Review of Economics and Statistics
- Effect Studied:** The value households place on avoiding living near a landfill containing hazardous waste
- Study Area:** The Town of Acton, Massachusetts and remainder of suburban Boston
- Methodology:** A hedonic, partial equilibrium model is used to describe the demand for distance from a disposal site. Distance represents an attribute reflecting both the disamenities associated with the landfill and the risk of exposure to hazardous wastes. A survey of households asked household respondents to choose between two identical homes but the price of the homes differed as a function of distance from a hazardous waste landfill. Household respondents were asked to estimate the average price of homes in their neighborhood first as a basis for the question related to distance selected from a hazardous waste landfill. A total of 609 interviews were completed representing nearly 85 percent of the housing units. Responses were interpreted as providing a set of points along a partial equilibrium demand function for distance.
- Findings:** The average household would realize a consumer surplus of \$330 to



\$495 annually for each mile between its residence and a landfill containing hazardous waste. Because the price measure is defined in terms of the change in asset price, the consumer surplus measure was analyzed using the semi-log demand estimates based on an interest rate of 14 percent and terms of 15 and 30 years. Results “confirm nuclear power plants and hazardous waste disposal sites as the most undesirable land uses. The estimated parameters for the marginal price of distance and housing are significant.”

Conclusions:

The size of the empirical estimates of the value of avoiding LULUs explains the observed resistance of homeowners of the siting of such land uses in or near their neighborhoods.



APPENDIX B

FINDINGS

APRIL 10-11, 2010 DEATH VALLEY NATIONAL PARK SURVEY

The Demographics of the DVNP Survey Respondents

On April 10 and 11, 2010, surveys were conducted at The Furnace Creek Visitor Center, Death Valley National Park (DVNP), between 9:00 a.m. and 3:00 p.m. Three hundred eighty-eight questionnaires were satisfactorily completed. Questions that were not answered, or missing from the system, were questions that participants either refused to answer or specifically asked the survey team not to record. Of these 388 respondents, 178 or 45.9% were male, 203 or 52.3% were female, and 7 were missing from the system. With respect to ethnicity, Caucasian respondents dominated. Over 80% of the sample was Caucasian; 64, or 16.5% were “other” ethnic groups, and 11 were not recorded. Older visitors (over 45 years of age) were dominant. Of the 382 persons who responded to this question, 52 or 14% were below the age of 30; 96 or 25% were between the ages of 30-45; 179 or 46% were 46-65 years of age; and 55 or 14% were over 66 years.

The DVNP respondents indicated a wide range of educational achievement. Six, or approximately 1.5%, had not graduated from high school. We know from the age frequencies that six of these respondents were too young to be high school graduates. Five percent, or 19, respondents were high school graduates. An additional 89, or 23%, indicated they had some college education. Thirty-three percent, or 126 respondents, graduated from college, and the remaining 143, or approximately 37% of the respondents had post-graduate degrees. Five respondents did not provide information as to their highest level of education. These statistics include both foreign born and U.S. respondents.

Table 1 below presents the household income of the 348 respondents who provided this information. Forty, or 10%, did not provide this information, which is standard for an income survey question.

Table 1 Respondents' Household Income		
Income \$	Number of respondents	Percentage
Under \$39,999	53	15.2
\$40,000 – 79,999	98	28.2
\$80,000 – 119,000	93	26.7
\$120,000 – 159,999	43	12.4
\$160,000 and above	60	17.2
Total	347	99.7
Source: Urban Environmental Resources (UER) April Survey		



The Visitor Respondents' Place of Residence

Visitor respondents were asked to provide their zip codes if they were U.S. residents or the name of the country in which they live if they were not. Table 2 below identifies the primary locations from which the visitor respondents originated. The largest percent of trips originated from Southern California (29%), followed by the State of Nevada (19%). The lowest number of DVNP visitors reside in the Northwest U.S. and the South and Southwest sections of the country. Approximately 14 percent of the total respondent sample resides outside the U.S. We are anticipating this number and percent to increase in the summer DVNP survey when foreign visitation is anticipated to significantly increase.

Table 2 Place of Residence of DVNP Sample		
Location	Number of respondents	Percentage
Nevada	72	19
Northeast and Midwest U.S.	39	10
Northern California	60	16
Northwest U.S.	19	5
Outside the U.S.	53	14
South and Southwest U.S.	25	6
Southern California	114	29
Total	382	99
Source: Urban Environmental Resources (UER) April Survey		

DVNP respondents were asked how many people were in their travel group, including themselves. Table 3 below indicates the number of 1-person, 2-person, 3-person, 4-person and 5+-person travel parties. Only 15, or 4 percent, of the respondent sample consisted of one person; 150 or 39 percent consisted of two persons; 62 or 16 percent three persons; 80 or 21 percent four persons; and 78 or 20 percent travel parties of five or more.

Table 3 Number of Persons in Travel Party		
	Number of respondents	Percentage
One	15	4
Two	150	39
Three	62	16
Four	80	21
Five or More	78	20
Total	385	100
Source: Urban Environmental Resources (UER) April Survey		

The two-person travel party is the dominant pattern, followed by larger travel groups, i.e. 21 percent four-person and 20 percent five or more person groups.



Respondents were asked the nature of their travel group. Of the 386 DVNP visitors who responded to this question, 6 percent traveled by themselves, 58 percent with family members, 22 percent with friends, 11 percent with both friends and family, and only 2 percent with a tour group. Once again, we anticipate the latter tour group percentage to increase in our forthcoming summer survey. There were so few visitors (8) on a tour group we have not summarized from which locations the tours organized or the nature of the tours.

Table 4 below indicates whether DVNP was the primary destination – whether the visitor respondent included DVNP along with a number of other places or whether some other destination was primary. The specific wording of the question was, “How did Death Valley National Park fit into your travel plans?” The three options to answering this question were:

- *DVNP was the primary destination.*
- *We planned on visiting a number of places, including DVNP.*
- *Our primary destination is somewhere other than DVNP and we stopped along the way.*

For 242 respondents, or 63 percent of the visitor sample, DVNP was indeed the primary destination. Twenty-nine percent included Death Valley along with other locations, and approximately 8 percent indicated that some other location was their primary destination.

Table 4		
The Way in Which DVNP Fit into Respondents' Travel Plans		
	Number of respondents	Percentage
DVNP Primary Destination	242	63
Plan to visit a number of places	114	29
Primary destination elsewhere	30	8
Total	386	100
Source: Urban Environmental Resources (UER) April Survey		

Table 5 ranks the other destinations that 29 percent, or 112, of the respondents indicated they were either visiting along with DVNP or that were primary destinations. All Other U.S. is a grouped response category, which has a 12 percent response. California is ranked second with 5.4 percent, and Nevada third with 4.4 percent. Together, North and South Inyo attract 3.3 percent and other locations within DVNP 3.6 percent. This table further substantiates that DVNP was the primary destination for the April DVNP sample.



Table 5 Other Trip Destinations*		
	Number of Respondents	Percentage
All Other U.S.	47	42
California	21	19
Nevada	17	15
Northern Inyo County	9	8
Southeast Inyo County	4	3
Within DVNP	14	12
Total	112	99.0
*Only 78% of the respondents provided an answer to this question. This number was created by adding the Plan to Visit (114) and the Other Primary (30) numbers and dividing 112 by that number (144)		
Source: Urban Environmental Resources (UER) April Survey		

Respondents were then asked specifically whether on their current trip they expected to visit or had already visited Manzanar, Lone Pine, and/or Mammoth. Table 6 below presents the responses to this question.

Table 6 Locations Visited or To Be Visited				
	Yes		No	
	#	%	#	%
Manzanar	45	11.6	343	88.4
Lone Pine	92	23.7	296	76.3
Mammoth	58	14.9	328	84.5
Source: Urban Environmental Resources (UER) April Survey				

The majority of respondents have not, nor do they plan to, visit these three locations, but of the three, Lone Pine attracts the highest number (92) and percent (24%). Only 45, or approximately 12 percent, have visited or will visit Manzanar, and 58 respondents (15%) plan to visit Mammoth, on their current trip.

Time Spent on DVNP Visit

DVNP visitors were asked to identify how many hours (if less than one day) or how many days (if 24 hours or more) they plan to spend in the park. Approximately 39% of those visitors who answered this question were planning to spend less than a day in DVNP, while approximately 61 percent planned to spend at least one night in the park.

Of the 39 percent of the visitor sample indicating less than a full day visit, 45 percent anticipated a 7-10 hour stay, and 36 percent a 4-6 hour visit. Only 6 percent indicated they would be in DVNP three hours or less, and 12 percent more than ten hours. Of the 61 percent of the visitor sample anticipating at least a one day stay, 35 percent indicated a 1 to 2 day visit; 46 percent a 3 to 4 day visit; and 19 percent five or more days.



The respondent sample was then asked,

“How many nights did you or do you expect to stay in an area outside of the park, within a 1-hour drive of the park, on this visit?”

Sixty-three percent indicated no nights outside the park within a 1-hour drive. But 18 percent indicated 1 night; 11 percent 2 nights; and 8 percent three or more nights. The importance of this question relates to the fact that, to the extent visits to DVNP are curtailed by the proposed nuclear waste repository at Yucca Mountain, approximately 61 percent of the visitor sample would not be spending lodging and other travel-related dollars outside the park. Table 7 below presents the anticipated nights spent within a 1-hour drive of DVNP.

Table 7 Nights Spent Within 1-Hour Drive of DVNP		
	Number of Respondents	Percentage
None	233	63
1 night	65	18
2 nights	40	11
5 or more nights 3 or more nights	31	8
Total	369	100
Source: Urban Environmental Resources (UER) April Survey		

The following section summarizes the respondents’ type of lodging, both inside and outside DVNP. This section also discusses the visitor respondents’ anticipated or past expenditures for lodging, travel-related expenses like gas and rental cars, restaurant food and/or groceries, and other expenses such as film and souvenirs.

Expenditure Patterns Inside and Outside DVNP

Respondents were asked to specify their per person expenditures for lodging, including motel and camping; travel, including gas and car rental; food, including restaurant and groceries; and other, i.e. film and souvenirs. Expenditures for the above categories were obtained for both inside DVNP and locations within a 3-hour drive of DVNP.

Table 8 presents this information for lodging expenditures both inside and outside DVNP. Sixty-two percent of the respondent sample provided lodging expenditures for inside the park and 63 percent for lodging expenditures outside the park. Some respondents provided answers to both. Others, who are day trippers, would not have responded to either. A higher percentage of less than \$25.00 per person was noted for lodging inside the park – no doubt camping facilities. The median per person lodging expenditure is under \$50. The median per person expenditure for outside the park was \$99.99.



Table 8				
Per Person Lodging Expenditures Inside and Outside DVNP*				
Expenditures per Person Per Day	Inside DVNP		Outside DVNP	
	#	%	#	%
Less than \$25.00	98	41	56	23
\$25.00 – 49.99	33	14	49	20
\$50.00 – 74.99	25	10	53	22
\$75.00 – 99.99	21	9	30	12
\$100.00 +	64	26	57	23
Total	241	100	245	100
Median	\$50.00		\$99.00	
*62% of the respondents indicated they were lodging inside DVNP and 63% outside the park. Some respondents were planning to stay at facilities both inside and outside the park. Many of those respondents who indicated neither are day trippers – many living in Nevada.				
Source: Urban Environmental Resources (UER) April Survey				

A greater number of respondents either stayed at a campground or RV campground if staying inside the park. Table 9 shows the number and percentages by type of facility inside and outside the park.

Table 9				
Lodging Facilities Inside and Outside DVNP				
	Inside DVNP		Outside DVNP	
	#	%	#	%
Motel/Lodge	54	29	88	67
RV Campground	49	26	24	18
Tent Campground	69	37	8	6
Other	15	8	12	9
Total	187	100	132	100
Source: Urban Environmental Resources (UER) April Survey				

As shown in Table 9, a much higher percent of those who spend the night outside DVNP (67%) stay at a motel or lodge within a 3-hour drive time of the park. Only 6 percent of those indicating where they stay outside the park indicate tent camping, while 37 percent of those spending the night inside the park stay at a tent campground.

Table 10 shows the per capita travel expenditures for those both inside and outside DVNP, but within a 3-hour time radius. The median travel expenditure is \$50 for both, and note there is little different between the two in Table 10.



Table 10 Per Person Travel Expenditures (Gas, Car Rental, etc.) Inside and Outside DVNP*				
Expenditures per Person Per Day	Inside DVNP		Outside DVNP	
	#	%	#	%
Less than \$25.00	61	23	75	29
\$25.00 – 49.99	86	33	85	33
\$50.00 – 74.99	52	20	40	16
\$75.00 – 99.99	20	8	13	5
\$100.00 +	39	15	42	16
Total	258	99**	255	99**
Median	\$50.00		\$50.00	
*Some respondents provided travel expenditures for both inside and outside DVNP. Approximately 66% of the sample responded to per person travel expenditures inside and outside DVNP.				
**Percentage totals do not equal 100% due to rounding.				
Source: Urban Environmental Resources (UER) April Survey				

Table 11 presents the per capita expenditures for food purchased inside or outside the park. The food may be purchased from restaurants and/or groceries. Once again, respondents may provide answers to both. Similarly to travel expenditures shown in Table 10, there is very little difference in per person food expenditures whether inside or outside DVNP.

Table 11 Per Person Food Expenditures Inside and Outside DVNP*				
Expenditures per Person Per Day	Inside DVNP		Outside DVNP	
	#	%	#	%
Less than \$25.00	85	34	84	36
\$25.00 – 49.99	65	26	58	25
\$50.00 – 74.99	52	21	49	21
\$75.00 – 99.99	12	5	9	4
\$100.00 +	36	14	34	14
Total	250	100	234	100
Median	\$50.00		\$50.00	
*Sixty-four percent responded to the question of per person/per diem food expenditures inside DVNP and 60% to the per person/per diem food expenditures outside the park. Some respondents provided answers to both.				
Source: Urban Environmental Resources (UER) April Survey				

Finally, Table 12 presents the per capita expenditures for other items, such as film, souvenirs, etc. These expenditures are higher for locations outside the park than they are for inside the park. The median per person expenditure inside the park is less than \$25.00, and outside the park is \$25.00 for other items.



Expenditures per Person Per Day	Inside DVNP		Outside DVNP	
	#	%	#	%
Less than \$25.00	113	55	174	46
\$25.00 – 49.99	36	17	82	22
\$50.00 – 74.99	22	11	53	14
\$75.00 – 99.99	8	4	28	7
\$100.00 +	27	13	41	11
Total	206	100	378	100
Median	Less than \$25.00		\$25.00	
*There is a major per person/per diem expenditure percentage for “other goods” purchased inside as compared with outside the park. 53% of the respondent sample indicated they purchased an item inside DVNP, while 97% indicated such purchases outside the park.				
Source: Urban Environmental Resources (UER) April Survey				

DVNP Expenditure Patterns by Point of Origin and Respondent’s Demographic Characteristics

The previous section has shown and discussed frequency data, the number and percent of the sample per capita expenditure estimates for lodging, travel, food and other items.

In order to ascertain if there are important differences based on the respondents’ point of origin or demographic characteristics, we ran a series of cross tabulations. A cross tabulation, for example, puts the point of origin on one axis and their lodging expenditures on the other. For almost all of the crosstabs, we combined categories to obtain a clearer statistical picture. If we used age of respondent as one of our cross tabulation variables, we combined the bottom two categories: Under-18 and 18-29 into one Under-30 category; 30-45 remained as is, but 46-65 was combined with the over-65 respondents, so instead of having five age categories we now had three. We did not collapse the income categories nor, of course, gender. The reason for combining demographic characteristics like age and education is to reduce the degrees of freedom and thereby ascertain if a demographic characteristic was likely to be statistically significant.

Statistically significant Table 13 below shows per person lodging expenditures, irrespective of whether the respondent lodged inside or outside DVNP, by the respondent’s point of origin.



Table 13 Per Capita Lodging Expenditures by Point of Origin						
Point of Origin	Under \$50		\$50 to \$100		Over \$100	
	#	%	#	%	#	%
Nevada	45	29	12	15	15	10
Northeast & Midwest U.S.	15	10	4	5	20	14
Northern California	20	13	16	20	24	17
Northwest U.S.	7	4	6	7	6	4
Outside U.S.	21	13	6	7	26	18
South and Southwest U.S.	6	4	9	11	10	7
Southern California	43	27	28	35	43	30
Total	157	100	81	100	144	100
$X^2 = 34.048$ with 14 DF = .002						
Source: Urban Environmental Resources (UER) April Survey						

The three points of origin associated with the highest (\$100+) per capita expenditures for lodging include Southern California, Outside U.S. and Northern California respondents. The point of origin associated with the lowest per capita lodging expenditures is Nevada, seconded by Southern California.

The age of respondent was also statistically significant at the .001 level, with 38 percent of the youngest respondents, under 30 years of age, most likely to spend between \$50 and \$100 on their lodging, as compared with 18 percent of the 30-45 age group and 20 percent of the over-45 group. Almost half (48%) of the 30-45 group indicated a per capita lodging expenditure of over \$100. Forty-six percent of the oldest respondents (over 45) were most likely to spend under \$50 for their lodging.

Income was the only other demographic statistic that achieved statistical significance with respect to per capita lodging expenditures. Interestingly, the under-\$39,999 income group had a higher percentage of over \$100 per capita expenditures (36%) than did the next highest income group, \$40,000-\$79,999. Only 26 percent of the latter spent over \$100 per capita on lodging. As would have been expected, the highest income group (over \$120,000) also had the highest percent (52%) of over \$100 per capita lodging expenditures.

Cross tabbing total per capital travel costs with the respondent's point of origin and demographic characteristics yielded only one statistically significant variable, and that is the age factor. The younger the respondent, the higher the amount of per capita expenditures. For this travel cost variable, the two categories are under and over \$50.00. Seventy-nine percent of the under-30 group, as compared with 72 percent of the 30-45 group and 59 percent of the over-45 group spent over \$50 per person for travel-related expenditures, i.e. gas, rental car. The reader will note that it would appear unusual that the younger visitors tend to spend more than the older, wealthier age groups. There are many studies which show that Generation Y spends more of their income on experiential activities than do older age groups, whether these expenditures are for food and clubbing or vacations.



We next looked at the statistical relationships between per capita food expenditures and the respondents' point of origin and demographic characteristics. Three demographic characteristics were found to be statistically significant: age, education and income. With respect to age, those respondents between 30 and 45 years of age were found to have the highest percent (60%) who spent more than \$50 per capita for food.

With respect to education, over half of the post-graduates (51%) spent over \$50 per capita for food. Since this variable is highly correlated with income, it is not surprising to find that 68 percent of those in the over-\$120,000 income bracket spent over \$50 per person for food.

The final expenditures cross tabulations were those that looked at the relationship between "other" expenditures (souvenirs, film, etc.) per capita and the respondent's point of origin and demographic characteristics. For the first time, gender was found to be statistically significant. Eight-four percent of the females, as compared with 74 percent of the males, spent over \$25 per person for other goods.

Number of Visits to DVNP

All respondents were asked to specify how many times they had visited DVNP, including their present visit. For half of the sample (50%), this was their first visit. Approximately 13 percent of the sample indicated two visits, 10 percent three visits, 5 percent four visits and 20 percent five or more visits. In fact, nine visitor respondents had made fifty or more trips to DVNP.

As would be expected, point of origin was statistically significant despite the larger number of degrees of freedom, which decreases the likelihood of achieving statistical significance. Residents of Nevada (33%) are far more likely to have made three or more trips, followed by those residing in Southern California (41%) and Northern California (16%). On the other hand, of all those making their first trip to DVNP, 87 percent of visitors from outside the U.S. are making their first trip to DVNP. These data are shown on Table 14 below.

Point of Origin	One		Two		Three or More	
	#	%	#	%	#	%
Nevada	18	9	10	20	43	32
Northeast & Midwest U.S.	28	15	4	8	6	4.5
Northern California	26	14	9	18	22	16
Northwest U.S.	3	2	5	10	9	7
Outside U.S.	46	24	1	2	6	4.5
South and Southwest U.S.	14	7	4	8	6	4.5
Southern California	55	29	17	34	41	31
Total	190	100	50	100	133	99.5

Source: Urban Environmental Resources (UER) April Survey



The other statistically significant variable with respect to repeat visits is the age of the respondent. As would be expected, the older respondents were far more likely to have made more frequent visits. Forty-four percent of the over-45, 29 percent of the 30-45 year olds, and 13 percent of the under-30 visitor respondents indicated they had visited DVNP three or more times.

The Potential Impacts of a Nuclear Waste Repository at Yucca Mountain on Future Visitor Behavior

The primary purpose for conducting visitor surveys at DVNP is to ascertain the potential impacts of a nuclear waste repository being located at Yucca Mountain. Yucca Mountain is located approximately 15 miles away from the Inyo County border. We tested three scenarios in our DVNP survey:

1. Likely visitation if the respondent knew a nuclear waste repository was to be located at Yucca Mountain;
2. Likely visitation if the repository had been opened ten years and had operated safely, without any problems; and
3. If a transportation incident occurred, such as a truck carrying high level nuclear waste to the repository, resulting in a “minor” release of radiation.

The three tables below show the likely visitation patterns under the three scenarios. The first question asked was:

“If a nuclear waste repository were currently located at the Yucca Mountain site (which is located about 30 miles from DVNP, and shipments of this waste occur on US Hwy. 95 or CA 127), would you have still visited DVNP?”

Table 15		
Visitation if a Nuclear Waste Repository were to be Located at Yucca Mountain		
	Number of respondents	Percentage
Definitely	175	45
Probably	87	22
Probably not	59	15
Definitely not	34	9
Don't know	33	9
Total	388	100

Source: Urban Environmental Resources (UER) April Survey

The second question asked was:

“What if the repository had been open for ten years and had operated safely without any problems. Would you still have visited DVNP?”



Table 16		
Visitation if a Nuclear Waste Repository had been Operating Ten Years Without Incident		
	Number of respondents	Percentage
Definitely	185	48
Probably	115	30
Probably not	37	9
Definitely not	18	5
Don't know	33	8
Total	388	100
Source: Urban Environmental Resources (UER) April Survey		

The third question asked was:

“What if there had been a transportation incident in which a truck carrying high level nuclear waste to the repository resulted in a “minor” release of radiation? Would you still have visited DVNP?”

Table 17		
Visitation Pattern if Transportation Incident Occurred		
	Number of respondents	Percentage
Definitely	76	20
Probably	86	22
Probably not	103	27
Definitely not	97	25
Don't know	25	6
Total	387	100
Source: Urban Environmental Resources (UER) April Survey		

If one looks at those who definitely and probably would continue to visit DVNP, there is a clear pattern. Sixty-seven percent are likely to still visit DVNP even with knowledge of the existence of the Yucca Mountain Nuclear Waste Repository. This percentage would increase to 78% if the repository operated safely for ten years. However, if there were to be a transportation incident, this visitation could be expected to drop, at least for the time period the incident receives publicity, to 42 percent. This suggests a potential drop in visitation of 25 percent. Further, under the above scenario, 27 percent indicate they definitely would not visit; 25 percent probably would not visit; and 6 percent indicated they didn't know what their response might be.

We ran a series of cross tabulations, cross tabbing point of origin and the respondents' demographic characteristics to ascertain whether we could identify the characteristics of those visitors most likely to reduce their visitation. Our findings suggest that gender is the most telling indicator of visitors who would be more and less likely to visit DVNP under the above three scenarios.

Under the first scenario, 59 percent of the male respondents, as contrasted with 33 percent of the females, indicated they definitely would still visit DVNP if a nuclear repository would be



operated at Yucca Mountain. Under the assumption that the repository were to be open safely for ten years, the male visitation rate stayed the same (59%), but the female rate increased to 39 percent. Under the third scenario of a transportation incident, 28 percent of the male visitors indicate they would still visit DVNP, but only 13 percent of the female respondents would. In addition, 17 percent of males and 32 percent of females indicated they definitely would not visit and 8 percent of the males and 5 percent of the females indicated they did not know which they would do.

Nuclear incidents elsewhere show a pattern of a deep drop in visitation for at least several years. Over time, visitation begins to slowly increase, but many regions never regain where visitation was at its height.

Ethnicity was also found to be statistically significant. Caucasians accounted for 83 percent of the sample, and almost half (48%) indicated a willingness to visit DVNP under the scenario of a nuclear waste repository being located at Yucca Mountain, as compared with 31 percent of the other combined ethnic category. Both of the ethnic categories indicated an increased willingness to visit if the repository experienced no safety problems for ten years. Under this scenario, 51 percent of the Caucasian and 33 percent of the other ethnic group categories indicated the likelihood they would visit DVNP. Under the third scenario, there was no statistical difference between the two ethnic groups. Fifty-one percent of both groups indicated they were not likely to visit DVNP if there were to be an incident, with 20 percent of the Caucasian and 14 percent of other ethnic groups still indicating they would visit. Six percent of Caucasians and 11 percent of the other ethnic groups indicated they didn't know what they would do should there be a transportation incident.

In addition to gender, age was the other demographic characteristic that was statistically significant under the scenario of a transportation incident. With respect to age, the oldest respondents (over 45) were more willing to visit DVNP (26%) than were either the 30-45 year olds (10%) or the under-30's (8%). Fifty-four percent of the under-30's stated they definitely or probably would not visit DVNP, in addition to 61 percent of the 30-45 year olds. Only 47 percent of the over-45 indicated such an incident would prompt them not to visit DVNP. This finding is likely to relate to the fact that environmental concerns are most strongly held by younger Americans.

The Relationship Between Responses to a Global Warming Question and Attitudes Toward the Yucca Mountain Nuclear Waste Repository

A question obtaining the respondents' attitudes toward global warming was inserted in the questionnaire in order to ascertain whether behavioral changes likely to be induced by the operations of a nuclear repository at Yucca Mountain are correlated with respondents' broader attitudes toward environmental issues. The specific words of the question were: "Do you believe more of the government's resources should be spent on global warming, at the cost of reducing other expenditures?" Table 18 below shows the DVNP visitor responses to this question. Forty-three percent of the sample indicated they would be in favor; 21 percent responded maybe they



would be in favor, and 26 percent said they would not be in favor, while 10 percent did not know whether they would or would not be in favor of additional resources devoted to global warming.

Table 18 DVNP Visitor Response to Whether They Would Favor More Government Resources Allocated to Global Warming		
	Number of respondents	Percentage
Yes	165	43
Maybe	83	21
No	101	26
Don't know	38	10
Total	387	100
Source: Urban Environmental Resources (UER) April Survey		

There was a statistically significant relationship between those who favored (or did not favor) additional government resources being allocated to global warming under all three Yucca Mountain scenarios posed in the survey. Below, we summarize the three scenarios and the responses provided to them by the respondents in the survey.

Under the first scenario, if a nuclear waste repository were to be built at Yucca Mountain, those who support extra resources to combat global warming are also less likely to visit DVNP. Of all those who said they would continue to visit DVNP, which is 45 percent of the total respondent sample, 37 percent of those who would support additional global warming resources versus 63 percent of those who would not indicated they would definitely or probably visit DVNP.

Under the second scenario, if no accident or safety problem occurred within a ten-year period, 39 percent of those who responded “yes” to supporting additional global warming resources would be likely to visit DVNP as compared with 51 percent who responded “maybe” and 66 percent of those answering “no” to additional global warming resources.

Under the third scenario of a transportation incident, all respondents, irrespective of position on global warming, indicated a decrease in their willingness to visit DVNP. Only 20 percent of the total sample indicated a continued willingness to visit, while “don’t know” responses under this scenario increased to 58 percent. Those responding “no” to the global warming question accounted for 22 percent of the total sample. But of those who support additional global warming resources, only 12.6 percent would still consider visiting; 17.5 percent would not and 76 percent stated they didn’t know what they would do. Of the global warming “maybe” respondents, 15.6 percent would still be likely to visit; 31 percent would not; and 37 percent stated they didn’t know. Of those respondents who would not support additional global warming resources, 39 percent would still be willing to visit DVNP; 34 percent would not; and 37 percent indicated they didn’t know what they would do under this scenario.

The information provided by the survey suggests a clear and strong correlation between environmental concerns in general and attitudes toward a nuclear waste repository at Yucca



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Mountain. We do know from our demographic cross tabulations that females, the highly educated, the higher income and the young are those whose visitation behavior would be most negatively affected by the proposed repository under all three scenarios.



APPENDIX C

**FINDINGS
JULY 8-9, 2010 DEATH VALLEY NATIONAL PARK SURVEY**

**Summary and Conclusions of the Death Valley National Park (DVNP)
Visitor Responses to the July 2010 Survey**

Below are the primary responses and conclusions drawn from the 291 visitor respondents who were interviewed at the Death Valley Visitors Center on July 8 and 9, 2010.

- Foreign visitors account for 55 percent of the sample, with 45 percent of the total sample coming from Western Europe. The primary purpose for conducting this second DVNP survey was that we understood there were more foreign visitors in the summer months.
- If there were to be a high level nuclear repository at Yucca Mountain, not just visitation to DVNP would be affected. Ninety-six percent of the surveyed visitors also visit other locations, with 35.1 percent of the sample also visiting Lone Pine, 23 percent Mammoth, 5.5 percent Manzanar, and 32.3 percent other locations.
- The majority of visitors in our sample (74%) make a day trip to DVNP, with four to six hours being the dominant length of stay.
- Approximately 22 percent spend one or more nights at DVNP, while 5 percent of the sample was not certain where they would stay. Of those who plan to spend the night within a three-hour driving radius, 41 percent expect to spend the night in Las Vegas, 21 percent in Northern Inyo County, and 11 percent at DVNP.
- Those respondents who spent or planned to spend money within a three-hour driving time of DVNP have twice the mean average per person lodging expenditure than those respondents who spent or planned to spend money in DVNP. Those spending money outside the Park had a mean per person, per day expenditure of \$88.75, and those inside the Park a mean expenditure of \$41.50 per person, per day. There was much less disparity in the mean per person, per day expenditures of those who spent money in the Park versus those who spent money elsewhere with respect to travel, food and other expenses.
- We ran a series of cross tabulations to compare expenditure data with a set of demographic characteristics in order to test the null hypothesis – that there is no statistical difference between respondent expenditure patterns and place of origin, group size, and demographic characteristics. There were little to no statistical differences for the travel, food and other expenditures, and only the income variable was found to be



- statistically significant for the amount the respondent paid for lodging, with higher income respondents expending more per person.
- If there were to be a high level nuclear repository located at Yucca Mountain, 57 percent of the sample would still be likely to visit (the combined “definitely” and “probably” categories), while 30.3 percent would not (the combined “probably not” and “definitely not” categories). Approximately 13 percent of the sample did not know what they would do with respect to visitation.
 - Under the scenario that the repository was open ten years without incident, 75 percent would still be likely to visit, while only 15 percent would not. Ten percent indicated they did not know what they would do.
 - Under the minor transportation accident scenario, only 30.8 percent would still be willing to visit DVNP, while 59 percent would not and 10 percent still did not know what they would do under this scenario. If the accident was taken up by the media (ala the recent BP spill), there could be a very significant reduction of visitation, not only in DVNP but elsewhere in Inyo County. This impact could be expected to last several years at a minimum.
 - We ran a set of cross tabulations between the responses to the three Yucca Mountain scenarios and the demographic characteristics of the respondents. There were no statistically significant relationships for the following characteristics: place of origin, age and income. Group size was found to be statistically significant, with one-person groups more likely to continue visiting, and two-person groups not as willing to visit DVNP. Groups of five or more were most likely not to know what they would do. With respect to gender, which was also statistically significant, women were found to be more risk adverse than men. Respondents with higher educational levels were more definitive at both extremes, both positive and negative, while the high school and/or some college respondents were more likely to state they didn’t know what they would do.
 - There is a very strong statistical relationship (at the .000 level) between the respondents’ answers to the three Yucca Mountain scenarios and their responses to the global warming question. Therefore, the global warming question is a good substitute for the three Yucca Mountain questions. This is the reason we only utilized the first global warming question in the Eastern Sierra Interagency Visitor Center Survey.

An Overview of the July, 2010 Death Valley National Park Survey Sample

Survey implementation was conducted July 8 and 9, 2010, from 9:00 a.m. to 4:30 p.m. at the Furnace Creek Visitors Center in Death Valley National Park. Surveys were conducted in the front, outside area of the center. This implementation resulted in 291 completed surveys. The



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confidence intervals (the estimated range of how likely the interval is to contain the population parameter, also known as margin of error), and the confidence levels (percent of how often the true percentage falls within the interval) were examined.

The demographics trended towards the first survey with the majority of people being Caucasian (86.6%). There was an even distribution of age range consisting of 18 – 29 (31.6%), 30 – 45 (29.9%), and 46 – 65 (33.3%) year olds; with a drop off of 65 and older (5.2%). This is an overall educated sample, with over 60 percent having obtained a college degree or higher. As anticipated, there was greater number of foreign visitors, especially Western European (45.4%). Day trips were predominate, with 74.2 percent of people indicating they were in DVNP for hours, not nights (21%); 4.8 percent either did not know or refused to answer. Consistent with this finding, the majority of people planned to stay outside DVNP (70.4%) as compared to those who planned to stay inside (25.8%), with 3.8 percent unsure where they would stay.

We had been told by Inyo County and DVNP personnel that the summer months attracted more tour groups, particularly groups that served Western Europeans and other visitors from outside the U.S. Only 2.4 percent of the sample was from such a group. The methodological constraint of a language barrier is the predicted cause of this occurrence. There were tour buses with foreign visitors, however, when the survey team approached these visitors, very few understood the survey team. Presumably, those visitors that speak English well enough to travel on their own are not on tour groups, and the tour groups are those visitors who need an English interpreter. Trying to adapt to the situation and obtain tour group participation, the survey team approached the tour directors and drivers of the busses and requested they announce the survey and the incentive for those who wish to participate. This did not increase response rate, due to the language barrier. The language difference was not a problem for foreign visitors not on tour groups, as they all spoke English.

Table 1 below indicates the place of origin for the respondent sample. Foreign visitors accounted for 55.4 percent of our DVNP visitor sample. The high rate of foreign visitation in the summer months was the reason this second survey was conducted. Western European visitors accounted for 45 percent of this 55 percent total. The next two largest groups – each at approximately 16 percent of the total – are visitors from the South and Southwest United States, as well as those from the Northeast and Midwest.

	Number	Percent
California and Northwest USA	28	9.6
Northeast and Midwest USA	46	15.8
South and Southwest USA	47	16.2
Western Europe	132	45.4
Eastern Europe	9	3.1
Other Foreign	20	6.9
Total*	282	100.0



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*Nine respondents did not provide their place of origin
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)

Table 2 presents the group size of the visitor respondents. The two-person party is the largest category, with 31.5 percent of the visitor sample falling into this category. The next three group categories, three, four and five-plus persons, account for between 21 and 22 percent of the sample. The smallest category, accounting for only 4 percent of the visitor sample, is respondents traveling alone.

Table 2		
Size of Travel Party		
Number of persons	Number of parties	Percent
One	12	4.2
Two	90	31.5
Three	63	22.0
Four	60	21.0
Five or more	61	21.3
Total*	286	100.0
*Five respondents did not answer this question		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

Respondents were asked about the type of group they were traveling with. Family groups accounted for 77 percent of the sample, followed by friends (11%), family and friends (5.2%), alone (4.5%) and in a tour group (2.4%). As previously mentioned, the reason for so few tour group respondents can be attributed to the fact that the preponderance of the tour group visitors were not fluent in English, while those foreigners traveling by themselves were fluent English speakers.

Question 5, which asked how Death Valley National Park fit into the visitors' travel plans, clearly demonstrates that if there were to be a nuclear repository located at Yucca Mountain, the entire County is likely to be affected by a decline in DVNP visitation. Ninety-six percent of the sample indicated they plan to visit a number of places in addition to DVNP. In fact, only five percent claimed that DVNP was their primary destination. Twenty-one percent indicated their primary destination was somewhere else and they only stopped along the way.

The respondents were asked whether they would be visiting Manzanar, Lone Pine, Mammoth or other locations on their current visit. Thirty-five percent of the sample indicated they would also be visiting Lone Pine, 23 percent Mammoth and 5.5 percent Manzanar. Thirty-two percent of the sample named other locations.

Of the 277 visitors who responded as to whether they were making a day trip only or spending one or more nights in DVNP, 78 percent indicated a day trip only and 22 percent one or more nights. The most frequently quoted number of daytime hours to be spent at DVNP is 4-6 hours. One hundred three, or 47 percent of those indicating a daytime trip only selected the 4-6 hour category; forty-seven (21.5%) of the daytime visitor respondents indicated a 1-2 hours visit, while



sixty-seven (26%) indicated a 7-10 hour stay. Only twelve respondents (5.5%) of the day tripper sample specified a visit of 11 hours or more.

Table 3 presents the type of lodging at which the respondents anticipated staying. Twenty-six percent anticipated staying within DVNP; 70 percent outside the Park; and approximately 4 percent were unsure at the time they were questioned.

Table 3 Lodging Inside or Outside DVNP		
	Number	Percent
Lodging Inside DVNP	78	25.8
Lodging Outside DVNP	205	70.4
Unsure	11	3.8
Total	291	100.0
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

Table 4 indicates the type of accommodations, whether inside the Park or within a three-hour drive of DVNP.

Table 4 Type of Accommodations Inside and Within 3-Hour Drive of DVNP				
	Inside DVNP		3-Hour Drive of DVNP	
	#	%	#	%
Motel/Lodge	53	18.2	93	32.0
RV Campground	3	1.0	13	4.5
Tent Campground	12	4.1	15	5.2
Other	7	2.4	95	32.6
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)				

Respondents were asked in which city they expected to spend the night. Forty-one percent indicated Las Vegas. However, 21 percent specified Northern Inyo County and 11 percent DVNP. Thus, if there were to be a minor accident, it would be expected to impact at least 73 percent of the overnight visitation. The remaining 28 percent of anticipated stays are at locations within Northern California, Southern California and other Southwest locations.

**Per Person, Per Day Expenditures for Lodging, Travel, Food and Other Purchases
Both Within DVNP and within a Three-Hour Drive of DVNP**

In all instances, those respondents spending money within a 3-hour drive of DVNP have higher per person, per day expenditures. The difference is greatest for lodging expenditures, as shown in Table 5 below. The inside-DVNP respondents' per person per day mean expenditure for lodging is \$41.50, while for those spending money within a 3-hour drive it is more than double, or \$88.75. Expenditures of those spending money within DVNP and of those spending money within a 3-hour drive of DVNP for travel, food and other items are much closer than they are for lodging expenditures, as shown in Table 5 below.



Table 5		
Mean Per-Person, Per-Day Expenditures for Lodging, Travel, Food and other Items of Travelers Spending Money Inside DVNP and Travelers Spending Money within a 3-Hour Drive of DVNP		
	Mean Value Inside DVNP	Mean Value 3-Hour Drive of DVNP
Lodging	\$41.50	\$88.75
Travel (gas, car rental, etc.)	\$29.00	\$34.25
Food	\$21.50	\$39.50
Other	\$37.75	\$44.25
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

In order to obtain more detailed information on those staying inside and outside DVNP, we ran a series of cross tabulations by the respondents' demographic characteristics to test the null hypothesis that there is no difference by characteristics. Place of origin, gender, ethnicity and income were all found to be statistically insignificant. However, two characteristics, the group size and the respondents' educational level, were related to the respondents' choice of staying inside or outside DVNP.

With respect to group size, those in groups of two or three were more likely to stay within the Park; one- and four-person groups were more unsure as to where they would be lodging that night, and groups of five or more were more likely to be staying outside DVNP. Group size was statistically significant at the .023 level.

While the majority of both educational categories were likely to spend the night outside DVNP, those with high school and/or some college were more likely to state they were unsure as to where they would be staying.

We also tested per-person, per-day expenditures by the same set of demographic characteristics. Lodging expenditures were only statistically related to income at the .024 significance level. As one would expect, the higher the income, the greater the amount of per-person, per-day lodging expenditures. None of the characteristics achieved statistical significance with respect to per-person, per-day travel expenditures, though group size (five or more) and ethnicity (other races) came closest in the higher per-person, per-day expenditures for travel. The statistical significance by group size was .054 and for ethnicity .057.

With respect to per-person, per-day food expenditures, only group size came close to statistical significance at .054. The smaller the group, the more likely the respondent indicated \$25 or less, and the larger the group, the more likely a \$25 to \$50 per-person, per-day expenditure was cited. Groups of five or more were most likely to specify an over-\$50 per-person, per-day expenditure. There is some likelihood that some of those respondents in groups of five or more misunderstood the question and were not breaking down the expenditures into per-person subtotals.



The final expenditure category, for “other” expenditures, was not found to be statistically significant for any of the following variables: place of origin, number in travel party, gender, ethnicity, age, education or income.

**Responses to the Possibility of a Nuclear Waste Repository
Located at Yucca Mountain and Its Impact on Likely Future Visits to
Death Valley National Park**

Question 13 asked, “If a nuclear waste repository were currently located at the Yucca Mountain Site, would you have still visited DVNP?” The 291 respondents were provided five potential responses: definitely, probably, probably not, definitely not, and don’t know. Approximately 27 percent of the sample responded “definitely,” 30 percent “probably,” 22 percent “probably not,” 7 percent “definitely not,” and 13 percent “don’t know.” See Table 6 below.

Table 6 Likely DVNP Visitation if there were to be a Nuclear Repository at Yucca Mountain		
	Number	Percent
Definitely	78	26.9
Probably	87	30.0
Probably Not	63	21.7
Definitely Not	25	8.6
Don't Know	37	12.8
Total*	290	100.0
*One respondent did not answer this question		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

Respondents were then asked, “What if the repository had been open for ten years and had operated safely without any problems. Would you still have visited DVNP?” Under this option, 75 percent of the sample indicated they either definitely or probably would still visit DVNP. Approximately 15 percent said probably or definitely not. An additional 10 percent responded they did not know what they would do. These data are shown in Table 7 below.

Table 7 Visitation to DVNP if No Nuclear Incident After 10 Years of Operation at Yucca		
	Number	Percent
Definitely	92	31.7
Probably	126	43.4
Probably Not	29	10.0
Definitely Not	14	4.8
Don't Know	29	10.0
Total*	290	100.0
*One respondent did not answer this question		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		



Finally, respondents were asked, “What if there had been a transportation incident in which a truck carrying high level nuclear waste to the repository resulted in a ‘minor’ release of radiation. Would you still have visited DVNP?”

Table 8 presents the responses to this question. Under this scenario, only 31 percent of the sample indicated they would definitely or probably have still visited DVNP. Fifty-nine percent stated they probably or definitely would not have visited DVNP under this scenario, and 10 percent state they did not know what they would do.

Table 8		
Visitation to DVNP Under the Scenario There is a Minor Release of Radiation		
	Number	Percent
Definitely	27	9.3
Probably	62	21.5
Probably Not	81	28.0
Definitely Not	90	31.1
Don't Know	29	10.0
Total*	289	100.0
*Two respondents did not answer this question		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

While the potential impact of a nuclear repository lessens under the scenario that no incident occurs over a ten-year period, all three scenarios show a potential loss of visitors. Should even a minor event occur, this impact could result in a significant drop of visitation. If this incident is played up by the media, a drop in DVNP visitation could be quite significant, at least during that period the incident is in the news. Impacts from media publicized “scares,” whether nuclear or the apple scare, is likely to last a minimum of several years.

In order to obtain a better understanding of how various demographic groupings are likely to be impacted by the possibility of a nuclear repository being located at Yucca, we ran a series of cross tabulations for the three above questions by the following demographic factors: zip code or country of origin; group size; gender; ethnicity; age of respondent; education and income.

The statistical test – the Pearson chi square -- was run for each of the crosstabs to ascertain whether the relationship between the respondents’ answers to the three questions and their demographic characteristics being tested were likely to be correlated. The more categories or cells in the table, the less likely statistical significance will be achieved; the fewer cells, the more likely. A .05 level of significance permits the analyst to reject the “null hypothesis” that there is no difference based on the variables being tested -- in this instance, responses to the nuclear repository questions and the respondent’s demographic characteristics.

With respect to Question 13, “If a nuclear waste repository were to be currently located on Yucca Mountain...”, only two of the above demographic characteristics were found to be



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statistically significant: group size and education. With respect to group size, one- and three-person groups were more likely to respond they would “definitely” have visited DVNP, four-person groups were more likely to respond “probably” would visit, while groups of five or more responded “don’t know” more frequently. Two-person groups were more negative as to their expectations of visiting DVNP. It is likely these larger sized groups were more frequently part of a tour than those of four persons or fewer.

With respect to education, the more highly educated – university graduate or post-graduate – more frequently responded they definitely would visit DVNP, as well as more likely to state they probably or definitely would not have visited DVNP. The less educated – high school grad and/or some college – more frequently responded they probably would have still visited DVNP or they did not know what decision they would make under this scenario. Tables 9 and 10 present these cross tabulations.

Table 9 Question 13: Likelihood of Visitation by Size of Group												
	Group Size										Total/% of Sample	
	One		Two		Three		Four		Five +			
	#	%	#	%	#	%	#	%	#	%	#	%
Definitely	5	41.7	25	27.8	22	34.9	11	18.3	15	25.0	78	27.4
Probably	3	25.0	23	25.6	15	23.8	29	48.3	15	25.0	85	29.8
Probably Not	2	16.7	26	28.9	13	20.6	10	16.7	11	18.3	62	21.8
Definitely Not	1	8.3	10	11.1	6	9.5	4	6.7	4	6.7	25	8.8
Don't Know	1	8.3	6	6.7	7	11.1	6	10.0	15	25.0	35	12.3
Total	12	100.0	90	100.0	63	100.0	60	100.0	60	100.0	285	100.0
Pearson Chi-Square Value 28.12 = df = 16 Significance at .031												
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)												

Table 10 Question 13: Likelihood of Visitation by Education						
	High School/ Some College		University Grad/ Post-Grad		Total/ % of Sample	
	#	%	#	%	#	%
Definitely	25	23.4	52	29.2	77	27.0
Probably	34	31.8	52	29.2	86	30.2
Probably Not	18	16.8	43	24.2	61	21.4
Definitely Not	8	7.5	16	9.0	24	8.4
Don't Know	22	20.6	15	8.4	37	13.0
Total*	107	100.0	178	100.0	285	100.0
Pearson Chi-Square Value 10.43 = df = 4 Significance at .034						
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)						

Under the scenario that there are no incidents after ten years of operation, the same two demographic characteristics, group size and educational attainment, were the only demographic characteristics that achieved statistical significance at the .05 level. However, gender barely



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missed achieving statistical significance at .051. With respect to gender, women respondents were far more likely to respond “don’t know” as to their possible visitation than were men respondents.

Group size reached a .022 statistical significance level. Those in one- and three-person groups were more likely to state they would definitely visit. Four-person groups were more likely to say they would probably visit DVNP. Two-person groups were more negative, either stating they would probably or definitely not visit DVNP. Once again, groups of five or more were most likely to answer “don’t know.”

Educational attainment achieved statistical significance at the .012 level. Those who either graduated from college or obtained post-graduate degrees were more likely to be positive – definitely would visit DVNP – or negative, in that they probably or definitely would not visit DVNP. Respondents in the high school graduate and/or some college group were more likely to indicate they probably would visit DVNP or did not know what they would do. The more highly educated were, therefore, more definitive in what they would or would not do.

Table 11 Question 14: Likelihood of Visitation by Size of Group If no Incident in Ten Years of Operation												
	Group Size										Total/% of Sample	
	One		Two		Three		Four		Five +			
	#	%	#	%	#	%	#	%	#	%	#	%
Definitely	5	41.7	29	32.6	24	38.1	14	23.3	20	32.8	92	32.3
Probably	5	41.7	35	39.3	20	31.7	37	61.7	25	41.0	122	42.8
Probably Not	1	8.3	13	14.6	6	9.5	5	8.3	4	6.6	29	10.2
Definitely Not	0	0	8	9.0	5	7.9	0	0	1	1.6	14	4.9
Don't Know	1	8.3	4	4.5	8	12.7	4	6.7	11	18.0	28	9.8
Total	12	100.0	89	100.0	63	100.0	60	100.0	61	100.0	285	100.0
Pearson Chi-Square Value 29.31 = df = 16 Significance at .022												
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)												

Table 12 Question 14: Likelihood of Visitation by Education If no Incident in Ten Years of Operation						
	High School/ Some College		University Grad/ Post-Grad		Total/ % of Sample	
	#	%	#	%	#	%
Definitely	30	27.8	61	34.5	91	31.9
Probably	51	47.2	73	41.2	124	43.5
Probably Not	6	5.6	23	13.0	29	10.2
Definitely Not	4	3.7	10	5.6	14	4.9
Don't Know	17	15.7	10	5.6	27	9.5
Total*	108	100.0	177	100.0	285	100.0
Pearson Chi-Square Value 12.86 = df = 4 Significance at .012						
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)						



Question 15, which asked the likelihood of visitation if a minor transportation accident occurred, showed statistically significant differences for three categories: group size, gender and ethnicity. Group size was statistically significant at the .001 level. One-person group visitors were more likely to state they would definitely visit DVNP. Three- and four-person groups stated they would probably visit. One-person and five-or-more-person groups were more likely to state they would probably not, and five-or-more-person groups once again were more likely to state they did not know what they would do under this scenario.

Gender achieved statistical significance at the .005 level. Male respondents were more likely than females to state they definitely would still visit or they probably would not visit. Females, on the other hand, were more likely to state they probably would visit or would definitely not visit DVNP, as well as provided a higher percentage of “don’t know” responses.

Ethnicity was statistically significant at the .049 level. Caucasians were more likely to respond definitely or probably would visit, or definitely would not visit DVNP. Other races were more likely to respond probably would not visit or “don’t know.”

**Table 13
Question 15: Likelihood of Visitation by Size of Group
If Minor Accident Occurred**

	Group Size										Total/% of Sample	
	One		Two		Three		Four		Five +			
	#	%	#	%	#	%	#	%	#	%	#	%
Definitely	4	33.3	8	8.9	8	12.7	4	6.8	3	5.0	27	9.5
Probably	1	8.3	20	22.2	16	25.4	14	23.7	11	18.3	62	21.8
Probably Not	5	41.7	17	18.9	14	22.2	20	33.9	23	38.3	79	27.8
Definitely Not	2	16.7	42	46.7	17	27.0	15	25.4	12	20.0	88	31.0
Don't Know	0	0	3	3.3	8	12.7	6	10.2	11	18.3	28	9.9
Total	12	100.0	90	100.0	63	100.0	59	100.0	60	100.0	284	100.0

Pearson Chi-Square Value 29.86 = df = 16 Significance at .001
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)

**Table 14
Question 15: Likelihood of Visitation by Gender
If Minor Accident Occurred**

	Male		Female		Total/ % of Sample	
	#	%	#	%	#	%
	Definitely	23	14.3	4	3.1	27
Probably	34	21.1	28	21.9	62	21.5
Probably Not	49	30.4	32	25.0	81	28.0
Definitely Not	41	25.5	49	38.3	90	31.1
Don't Know	14	8.7	15	11.7	29	10.0
Total*	161	100.0	128	100.0	289	100.0

Pearson Chi-Square Value 14.69 = df = 4 Significance at .005
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)



Table 15						
Question 15: Likelihood of Visitation by Ethnicity If Minor Accident Occurred						
	Caucasian		Other		Total/ % of Sample	
	#	%	#	%	#	%
Definitely	25	10.0	2	5.1	27	9.3
Probably	58	23.2	4	10.3	62	21.5
Probably Not	67	26.8	14	35.9	81	28.0
Definitely Not	79	31.6	11	28.2	90	31.1
Don't Know	21	8.4	8	20.5	29	10.0
Total*	250	100.0	39	100.0	289	100.0
Pearson Chi-Square Value 9.55 = df = 4 Significance at .049						
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)						

What can we conclude from these crosstabs? First, we can conclude that zip code or country of origin, age and income do not permit us to reject the “null hypotheses” that there is no difference based on the above demographic characteristics with respect to patterns of visitation under the three Yucca Mountain scenarios.

Further, the data suggests that with respect to group size, one-person visitor groups are most likely to continue to visit DVNP under all three of the Yucca scenarios, while two-person groups are far more likely not to visit Death Valley. Larger groups of five or more are most likely not to know what they would do under these three scenarios.

With respect to gender, this survey does not differ from many others showing women to be more risk adverse than men. Thus, to the extent the woman is the decision maker as to whether to travel to DVNP, a Yucca repository could cause a decrease in visitation under all three scenarios.

Finally, with respect to educational achievement, the more highly educated respondents appear to be more definite either positively or negatively than the less educated visitors with respect to their visitation expectations. And Caucasians, as a group, appear more definitive in their positions, whether positive or negative, than the category of “other races.”

The Relationship Between the Responses Supporting Additional Government Resources to Combat Global Warming with Responses to the Three Yucca Mountain Scenarios

Table 16 below shows the survey responses to the expending of governmental resources to combat global warming. Specifically, the question asked, “Do you believe more of the government’s resources should be spent on global warming, at the cost of reducing other expenditures?” Respondents were offered four choices: Yes, Maybe, No, and Don’t Know. Over half of the sample (52%) responded “yes”; 19 percent “maybe”; 15 percent “no” and 14 percent “don’t know.”



Table 16		
Should Government Allocate More Resources to Global Warming?		
	Number	Percent
Yes	151	52.4
Maybe	155	19.1
No	42	14.6
Don't Know	40	13.9
Total*	288	100.0
*Three respondent did not answer this question		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

We first ran a series of cross tabs to ascertain if the responses to the global warming question related to the respondents' demographic characteristics. Once again, a .05 level of statistical significance permits the analyst to reject the "null hypothesis" that there is no difference based on the variables being tested. None of the tested demographic characteristics – zip code or country, gender, ethnicity, age, education and income – were found to be statistically significant, with point of origin (zip code or country) and income coming closest at .10 and .12 significance levels. For example, California and Northwest USA, and Western Europe respondents did appear to be the most concerned about global warming, along with the highest income category respondent (over \$120,000).

The primary reason for asking this global warming resources question was to reconfirm there was a statistically significant relationship between those who answered "yes" and those who reveal the greatest concern under the three Yucca Mountain scenarios. All three scenarios were found to be statistically significant at the .000 level with respect to their relationships to the responses to the global warming question.

Those respondents who indicated that the government should allocate more resources to the global warming problem were also far more likely to state they would not be likely to visit DVNP if a nuclear repository were to be located at Yucca Mountain. Those who responded "maybe" were also more likely to select "probably would" or "probably would not" visit DVNP if the Yucca Mountain repository were to be established. Those who responded "no" to the global warming question were most likely to indicate they would "definitely" or "probably" would still visit DVNP. And those who responded "don't know" to the global warming question were also most likely to respond "don't know" to the three Yucca Mountain repository scenarios. While the percentages differed under the three scenarios, with the strongest negative reaction posited for the minor accident or third scenario, the relationships between the responses to the two questions did not. Thus, we utilized only the first Yucca Mountain scenario, as well as the global warming question, in the Eastern Sierra Interagency Visitor Center survey, since they tap the same responses as utilizing all three specific Yucca Mountain scenarios.



APPENDIX D

DEATH VALLEY NATIONAL PARK VISITOR SURVEY

Date _____ Interviewer _____

My name is _____ and I am conducting a Death Valley visitors' survey on behalf of Inyo County. I would greatly appreciate _____ minutes of your time. We also have a small gift for your participation. May I confirm you are above the age of 18? If not, I am unfortunately not permitted to interview anyone under 18. Before we begin, I would like to know if you are an Inyo county resident?
_____ yes _____ no.

If yes, thank the respondent and discontinue the interview. If no, begin with question 1.

1. Where do you live?
U.S. zip code _____
Foreign country _____
2. On this visit, how many people are in your group, including yourself?
_____ number of people
3. What kind of group are you with?
_____ Alone
_____ Family
_____ Friends
_____ Family and friends
_____ Tour group

If on a tour group, ask:

4. From where did this tour originate? _____
- 4a. What is the name of your tour group _____

All respondents:

5. How did Death Valley National Park fit into your travel plans?
_____ DVNP was the primary destination
_____ We planned on visiting a number of places, including DVNP
_____ Our primary destination is somewhere other than DVNP, and we stopped



“along the way”
 _____ OTHER: _____

6. On this trip, do you expect to visit, or have you already visited, any of the following locations?
- 6a. Manzanar _____ yes _____ no
 6b. Lone Pine _____ yes _____ no
 6c. Mammoth Lake _____ yes _____ no
 6d. Other _____

All respondents:

7. On this visit, how much time will you spend, or have you spent, in DVNP?
- If less than 24 hours, _____ number of hours
 24 hours or more, _____ number of days including partial days

For those staying more than 24 hours:

8. How many nights did you or do you expect to stay in DVNP on this visit?
- _____ number of nights

For all respondents:

9. How many nights did you or do you expect to stay in an area outside of the Park, within a 3-hour drive of the Park, on this visit?
- _____ number of nights (indicate 0 if no nights)

For all those who did or will spend 1 or more nights, ask:

10. At which of the following did you or do you expect to stay?

	Inside DVNP	Within 3-hour drive of DVNP
10a. Motel/Lodge		
10b. RV Campground		
10c. Tent Campground		
10d. Other (specify)		

11. In which city do you expect to spend the night? _____



Ask all respondents NOT on a group tour:

12. On this visit to DVNP, roughly how much money did you and your group spend, or expect to spend per person per day, for lodging, food and other items within the park and a 3-hour drive of the park?

Key	Money Spent	Within DVNP (Use Key in left column)	Outside DVNP, within a 3-hour drive (Use Key in left column)
1. Less than \$25	12a. Lodging (motel, camping)	\$	\$
2. \$25 - \$49	12b. Travel (gas, car rental, etc.)	\$	\$
3. \$50 - \$74		\$	\$
4. \$75 - \$99	12c. Food (restaurant, groceries)	\$	\$
5. \$100 +	12d. Other (film, souvenirs)	\$	\$

THE U.S DEPARTMENT OF ENERGY HAS PROPOSED BUILDING A REPOSITORY TO PLACE AND STORE NUCLEAR WASTE OR SPENT FUEL FROM COMMERCIAL NUCLEAR POWER PLANTS AT YUCCA MOUNTAIN, NEVADA WHICH IS LOCATED APPROXIMATELY 30 MILES FROM DVNP AND 100 MILES NORTHEAST OF LAS VEGAS.

I'd like to ask you a few questions about the effect that such a repository might have on your travel plans IF THE REPOSITORY BECOMES A REALITY.

13. If a nuclear waste repository were currently located at the Yucca Mountain site, would you have still visited DVNP?

Definitely
 Probably
 Probably not
 Definitely not
 Don't know

14. What if the repository had been open for ten years and had operated safely without any problems. Would you still have visited DVNP?

Definitely
 Probably



- Probably not
- Definitely not
- Don't know

15. What if there had been a transportation incident in which a truck carrying high level nuclear waste to the repository resulted in a "minor" release of radiation? Would you still have visited DVNP?

- Definitely
- Probably
- Probably not
- Definitely not
- Don't know

16. Do you believe more of the government's resources should be spent on global warming, at the cost of reducing other expenditures?

- Yes
- Maybe
- No
- Don't know

For all respondents:

17. Number of visits to DVNP, including this one? _____

18. Gender: M F

19. Ethnicity:

- White/non-Hispanic Hispanic Asian Native
American Black Other

20. Age (mark one):

- under 18
- 18-29
- 30-45
- 46-65
- over 65

21. Education (mark one):

- less than high school



- high school graduate
- some college
- 4-year college/university graduate
- post-graduate

Ask foreign visitors:

21a. What is your highest level of education attainment? _____

For all respondents:

22. Which of the following categories includes your household's before-tax 2009 income (In U.S. Dollars)?
- Under \$39,999
 - \$40,000 - \$79,999
 - \$80,000 - \$119,999
 - \$120,000 - \$159,999
 - \$160,000 and above



APPENDIX E

**FINDINGS
JULY 22-24, 2010 EASTERN SIERRA INTERAGENCY
VISITOR CENTER SURVEY**

**SUMMARY AND COMPARISON OF THE EASTERN SIERRA INTERAGENCY
VISITOR CENTER SURVEY WITH THE SPRING AND SUMMER
DEATH VALLEY NATIONAL PARK SURVEYS**

Prior to conducting the July 22-24 survey at the Eastern Sierra Interagency Visitor Center (ESIVC), surveys had been conducted on April 10-11 and July 8-9 at Death Valley National Park (DVNP). All three surveys gathered demographic information, but the questions asked at the two Death Valley surveys concentrated on ascertaining behavioral changes likely to be induced by the operation of the proposed Yucca Mountain nuclear waste repository. The ESIVC survey summarized herein was designed to allow inferences to be tested concerning the socio-economic effect of the repository. However, the primary purpose of the ESIVC survey was to gain a broader perspective on the makeup of visitors to Inyo County and the purpose of their trips to the County. Therefore, the ESIVC survey asked a broader range of general tourism questions than did the two DVNP questionnaires, and somewhat fewer questions on attitudes toward the Yucca Mountain Nuclear Repository. This decision was based on the fact that the Visitor Center, located in Lone Pine, is a stopping off point for those visitors typically entering Inyo from the County's western border.

Over half of the ESIVC respondent visitors are from Southern California (51%) and traveling with family members (50%). Over half of those surveyed planned to visit downtown Lone Pine (53%), and almost half Mt. Whitney (49%). Both locations are proximate to the Center.

The primary reasons for stopping at the Visitors' Center are what one would expect: to obtain destination information (54%), to use the restrooms (53%), and to obtain permits (28%).

What is interesting to note is that half of the ESIVC sample (50%) obtained trip information about their current trip from the Internet, and many of those were persons in the 30-45 year age grouping.

The majority (78%) of the respondent visitors stated they would not change anything about their present trip, and those who indicated they would have liked a change most typically wanted better weather and/or better preplanning.

The place of origin for one-fourth of the sample is outside the United States, while approximately half (51%) of the travelers originated from Southern California. The top four trip destinations are downtown Lone Pine (53%), Mt. Whitney (49%), Bishop (42%) and DVNP (37%).



The majority of the ESIVC respondents anticipated spending one or more nights at their designated trip locations. The percent of respondents who indicated they would not be spending one or more nights at their designated locations ranged from a low of 9 percent from the “Other California” category, to a high of 22 percent at DVNP. In this regard, the responses to this question significantly differed from the DVNP summer survey responses, in which 74 percent of the respondents indicated they would be making a day trip and would not be spending the night in Death Valley.

The ESIVC respondents were asked only two questions about the possibility of a nuclear repository being established at Yucca Mountain. They were:

1. Have you heard or read anything about the possibility of a nuclear waste repository to be located at Yucca Mountain near Las Vegas?
2. If a nuclear waste repository were currently located at the Yucca Mountain site, would you have altered your present trip’s plans?

Approximately 37 percent of the ESIVC sample indicated they had heard about the possibility of a nuclear repository being established at Yucca Mountain. The responses as to whether the ESIVC visitors would have altered their current trip plans if there was a nuclear repository at Yucca fell in between the two DVNP survey samples. Sixty-one percent of the ESIVC sample indicated they would probably not or definitely not alter their present trip plans. Sixty-seven percent of the April DVNP sample also indicated they would not have altered their travel plans, while 57 percent of the July DVNP sample said they would not have changed their travel plans based on this knowledge.

As to supporting the concept of greater governmental support to combat global warming, once again the percent of ESIVC respondents who said yes (51%) was closer to the summer DVNP sample, in which 52 percent indicated they would approve of additional governmental resources being expended for this purpose, than it was to the April DVNP sample, in which only 43 percent of the DVNP respondents indicated they would support additional governmental expenditures.

A Comparison of the April and July DVNP Demographic Characteristics with the Summer ESIVC Visitor Respondents

- The proportion of male to female respondents indicates that the July DVNP survey is identical to the proportion of male (55%) to female (45%) ESIVC respondents.
- The percent of Caucasian respondents was almost identical between the ESIVC sample (86%) and the July DVNP sample (87%).
- The ESIVC sample age distribution tended to fall in between the April and July DVNP



sample distribution. Almost one-fourth of the ESIVC sample (24%) were between the ages of 18 and 29, while 14 percent of the DVNP April sample and 32 percent of the July DVNP sample respondents fell into this age grouping. The other end of the age spectrum (46-65) contributed the largest age category in all three surveys – 40 percent of the ESIVC sample fell into this age category, while 47 percent of the April and 33 percent of the July DVNP sample were between the ages of 46 and 65.

- All three samples consisted of highly educated visitors. Sixty-seven percent of the ESIVC sample indicated they had either graduated from a four-year college or had a post-graduate education. Seventy percent of the April and 62 percent of the July DVNP samples also were either college graduates or had received post-graduate education.

INTRODUCTION

On July 22-24, 2010, a survey of respondents visiting the Eastern Sierra Interagency Visitors Center (ESIVC) was conducted from 9:00 a.m. – 5:00 p.m. The ESIVC is located in Lone Pine and the interviews were conducted in the back portion of the center, as well as in the outside entryway. This implementation resulted in 390 completed surveys. The confidence intervals (the estimated range of how likely the interval is to contain the population parameter, also known as margin of error), and the confidence levels (percent of how often the true percentage falls within the interval) were examined. The 390 completed surveys resulted in a successful confidence interval of 5 percent, with a standard 95 percent confidence level. Questions that were not answered, or missing from the system, were questions that participants either refused to answer or specifically asked the survey team not to record.

The majority of visitors were from Southern California (51.3%) and traveling with family (50.3%). In addition, the majority were stopping at the center for destination information (54.1%) and to use the restrooms (52.6%). The largest “other” reason for stopping category was “Permits” at 27.9 percent. Half of those surveyed planned to visit downtown Lone Pine (52.8%) and Mt. Whitney (49.2%). This intuitively makes sense because both of these destinations are located near the center. Further, about half of the respondents obtained information from a website (50.3%) and/or family/friends (48.7%), with 65.1% percent of persons indicating hiking as the purpose of their trip. Most people (78.2%) indicated they would change nothing about their trip.

Table 1, below, ranks the respondents’ primary reasons for stopping at the ESIVC. Destination information and restroom use were each selected by more than half of the sample.



Table 1		
Primary Reasons for Stopping at the ESIVC		
	Number	Percent
Destination Information	221	54.1
Restroom Use	205	52.6
Overnight Accommodation Information	69	17.7
Driving Instructions	58	14.9
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

The respondents' places of origin are shown in Table 2. Over half of this respondent sample resides in Southern California.

Table 2		
Respondents' Place of Origin		
	Number	Percent
Foreign	96	24.6
Northern California	27	6.9
Southern California	200	51.3
Western United States	29	7.4
Other	38	9.7
Total	390	100.0
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

Approximately 6 percent of the respondents were traveling by themselves, and 26 percent consisted of parties of five or more persons. The mean or average travel group size is 3.3, and the median, in which half the sample falls above and half below, is 3.0.

Half of the sample traveled with family members (50.3%), 29 percent with friends, 12 percent with family and friends. Only 6 percent traveled by themselves and 3 percent as part of a tour.

Table 3 ranks the respondents' destination(s) by the number and percent who expect to visit these locations. Because the ESIVC is located in Lone Pine, it is not surprising that almost 53 percent anticipate visiting this city. Mt. Whitney is the number two destination, with 49 percent indicating they would be visiting Mt. Whitney, while Bishop was ranked third. Death Valley National Park (DVNP) was ranked fourth, with an estimated 37 percent visitation rate.



Table 3 Respondents' Ranked Destination Locations		
	Number	Percent
Downtown Lone Pine	206	53
Mt. Whitney	192	49
Bishop	163	42
Death Valley National Park	146	37
Mammoth Lakes	143	37
Las Vegas	139	36
Other Northern Inyo County	137	35
Northern California	135	35
Southern California	129	33
Mono Lake	126	32
Other Nevada	69	18
Manzanar	61	16
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

Table 4 specifies the number of nights respondents indicated they plan to spend at the six grouped locations. If a respondent indicated they will be visiting three destinations during their present visit, then their response to this question will have been recorded three times.

Mt. Whitney appears to be the number one destination within Inyo County. One hundred thirty, or a third of the sample, anticipated visiting this location, and of these 130, 71 percent anticipated spending one or more nights. The second dominant location is “Other Inyo County Locations” (excluding DVNP and Lone Pine). Seventy-two percent of those indicating other Inyo County locations anticipate spending one or more nights. Fifteen percent of the sample anticipates visiting DVNP and 14 percent Lone Pine. Approximately 73 and 63 percent expect to spend one or more nights at DVNP and Lone Pine, respectively.

Table 4 Number of Overnights by Location												
	None		One Night		Two Nights		Three Nights		Unsure		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
DVNP	13	22	28	47	7	12	8	14	3	5	59	100
Mt. Whitney	23	18	22	17	29	22	41	31.5	15	11.5	130	100
Other California	15	9	29	17	24	14	76	45	25	15	169	100
Inyo County	21	20	29	28	21	20	25	24	8	8	104	100
Lone Pine	12	21	25	45	7	13	3	5	9	16	56	100
Western U.S.	10	16	12	19	16	26	20	32	4	7	62	100
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)												

We asked the respondents how they obtained information for planning their present trip. Table 5 presents the answers to this question. Half of the sample utilized the Internet. This was also the largest category – an important factor when considering how to promote Inyo County’s



visitor attractions.

	Number	Percent
Website	196	50
Travel Guide	93	24
Travel Agent/Tour Group	21	5
Friends/Family	190	49
Past Trips	143	37
Other	3	1
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

Respondents were then asked as to the primary purpose of their current trip. These are summarized in Table 6. Hiking was the dominant purpose, with 65 percent indicating they planned to hike. Sightseeing was the number two reason, with almost half of the sample (48%) indicating this activity.

	Number	Percent
Hiking	254	65
Camping	124	32
Fishing	53	14
Sightseeing	188	48
Visit Family/Friends	65	17
Part of Larger Group	11	3
Other	17	4
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

Table 7 summarizes the respondents' per person, per day expenditure patterns for lodging, travel, food and other purchases.

	Less than \$25		\$25 to \$49.99		\$50 or more		Total*	
	#	%	#	%	#	%	#	%
Lodging	153	42	80	22	128	35	361	100
Travel	114	33	140	40	95	27	349	100
Food	152	42	133	36	80	22	365	100
Other	230	74	55	18	26	8	311	100
*Totals do not include all survey respondents because of refusals or not knowing the answers to the question.								
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)								



Respondents were also asked, “What, if anything, would you change to make your trip a more pleasant experience?” Only eighty-five, or 22 percent of the sample, provided an answer to this question, and those who did respond mentioned factors beyond the County’s control. Of those who responded, 23 persons, or 27 percent cited better trip preparation; improved weather was mentioned by 24, or 28 percent, and more travel time by 21, or 25 percent. All of the above responses could almost be applied to all the trips each of us makes. Only eleven, or 13 percent of the respondents, cited better restrooms, and six, or fewer than 7 percent, better signage.

In order to be able to compare the responses of this sample to the two previous surveys that we conducted at DVNP, respondents were asked whether they had heard of the Yucca Mountain Nuclear Repository. One hundred forty-five, or 37 percent, said they had heard, 214, or 55 percent had not heard, and 31, or 8 percent, could not recall whether they had heard of the Yucca Mountain Repository.

Respondents were then asked whether they would have altered their present trip plans if a nuclear waste repository were currently located at Yucca Mountain. Only 9 percent said they definitely would have, and 17 percent would probably have altered their present trip plans under this scenario. However, 32 percent indicated they would not and 29 percent definitely would not have altered their plans for their current trip. In other words, 61 percent would have still traveled to Inyo despite the possibility of a nuclear waste repository at Yucca Mountain. Approximately 13 percent stated they did not know what they would do under this scenario.

With respect to the question of whether the government should expend more resources to decrease global warming, half of the sample (50%) said “yes”, 21 percent “maybe”, 19 percent “no”, and 10 percent “don’t know.”

ESIVC Sample Demographics

Fifty-five percent of the sample was male and 45 percent female. Eighty-six percent were Caucasian and 14 percent of other racial/ethnic groups. Table 8 below shows the sample breakdown by age, which was further grouped for the cross tabulations, since only 31 persons, or 8 percent of the sample, were over the age of 65. We utilized 46+ in the cross tabulations. Approximately 39 percent of the sample is between the ages of 46 and 65; 24 percent are 18-29 years, and 29 percent are age 30-45.

	Number	Percent
18-29	92	24
30-45	111	29
46-65	153	39
65 and older	31	8
Total	387	100
*Three respondents would not state their age.		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		



Table 9 presents the educational attainment of the respondents who reside in the United States, as well as the ninety-six who reside in other countries. Only 3 percent have less than a high school education, while 9 percent are high school graduates. Over half the sample are either college graduates (39%) or have had a post-graduate education (28%).

Table 9		
Respondents' Educational Attainment*		
	Number	Percent
Less than high school	12	3
High school graduate	34	9
Some college	80	21
4-year college/university graduate	149	39
Post-graduate	108	28
Total	383	100
*Seven respondents would not provide this information.		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

The respondents' 2009 household income is shown in Table 10. Thirty-four respondents refused to provide this information. Of those who did select the appropriate 2009 household income category, 22 percent fell into the under-\$50,000 and 23 percent in the \$50,000-\$74,999 categories. Thirty-seven percent indicated incomes over \$100,000.

Table 10		
Respondents' 2009 Household Income*		
	Number	Percent
Under \$50,000	79	22
\$50,000 - \$74,999	80	23
\$75,000 - \$99,999	65	18
\$100,000 and above	132	37
Total	356	100
*Thirty-four respondents would not answer this question.		
Source: Gruen Gruen + Associates; Urban Environmental Research (UER)		

CROSS TABULATIONS

In order to obtain a greater understanding as to why respondents answered specific questions as they did, we ran a series of cross tabulations that combine two independent variables or characteristics. Typically, key demographic characteristics are combined with the respondents' preferences or behavioral characteristics. We utilized age, education and household income characteristics as our demographic independent variables. Cross tabulation analysis does not provide causation information, but merely correlation relationships. In other words, we can find a statistical relationship between age and height with children being of less height than older adolescents and adults, but we still can't claim that the age factor is the cause. Further, the three demographic characteristics are also correlated. For example, older residents tend to have a



higher percent of higher income households than do younger respondents.¹

The Relationship Between the Respondent's Age and Place of Residence and Visitation Characteristics

Respondents' Age Grouping and Visitation Location

We combined the two oldest age groupings: 46 – 65 and 65+ into one category, 46+. The fewer the variables, the more likely the chi squares would be found to be statistically significant should a relationship exist.

The chi square statistical analysis suggests that younger (18-29) respondents are more likely to be visiting Mt. Whitney. Thirty- to forty-five-year-olds are most likely to be visiting Las Vegas and Southern California. Persons over age 46 are more likely to be visiting Manzanar and Southern Inyo County than are the two younger age groups.

Age of Respondent and Source of Trip Information

Thirty- to forty-five-year-olds are more likely than the younger and older age groups to obtain information from the Internet. Eighteen- to twenty-nine-year-olds are more likely than the other age groups to depend upon family and friends for their information, and the over-46 group are more likely to depend upon their previous trips to the area.

Age of Respondent and Primary Activities

Of the nine specified trip activities, only two were found to be statistically significant by the age of the respondent. Eighteen- to twenty-nine-year-olds were more likely to indicate hiking and camping as their primary activities, as compared to the other age groups.

Expenditures by Age Groupings

There were four expenditure categories in the survey: lodging, travel, food and other (i.e. souvenirs). Only two were found to be statistically significant with respect to age grouping: travel and lodging. Ages 46 and older spent higher amounts for these two expense categories.

¹ We utilized the Pearson chi square to test whether the null hypothesis – that there is no difference between the categories being tested – can be statistically refuted at the .05 level. When the data of research consists of frequencies in the discrete categories, the chi square (X^2) test may be used to determine the significance of differences between two independent groups. The chi square tests whether or not the null hypotheses can be refuted – that there is no statistical difference between the independent groups. Statistical significance indicates there is a strong correlation between the two variables, but does not relate to causation, or what causes this relationship. Nonetheless, it does permit the making of reasonable hypotheses.



Age of Respondent and Knowledge about the Possible Nuclear Repository at Yucca Mountain

The younger (18-29) and 30-45-year-old respondents were most likely to state they would have still made their current trip if there were to be a Yucca Mountain Repository. The younger age grouping also had a higher probability of indicating they didn't know what they would do. The over-46 respondents were more likely to state they definitely would not have altered their plans.

Age of Respondent and Attitude Toward More Governmental Resources Being Expended for Global Warming

Younger respondents were more likely to support, and older respondents were least likely to support additional governmental resources being applied to combat global warming.

The Relationship Between the Respondents' Highest Level of Educational Attainment and their Visitation Patterns

Respondents' Education Level by Visitor Destinations

Of the fifteen designated trip destinations (question 6), only two were found to be statistically related to the respondents' educational level. Bishop attracted a higher proportion of the some college/less than high school grouping, and Southeast Inyo County a higher proportion of the post-graduate respondents.

Respondents' Educational Level by Number of Nights Anticipated to be Spent in the Area

Some college/less than high school respondents were most likely to indicate no nights would be spent. Respondents with four years of college were more likely to spend one night, and post-graduate respondents two or more nights.

Respondent's Educational Level by their Primary Trip Purpose

Of the nine designated trip purposes, only two were found to be statistically significant. Sightseeing was most associated with the lowest level of education (some college/less than high school). Hiking was more likely associated with the highest, post-graduate level respondents.

Respondents' 2009 Household Income by Their Visitation Patterns

Household Income by Place of Origin

The following 2009 household incomes and places of origin were found to be statistically significant:

- Foreign born and Northern California have a higher proportion of under-\$50,000



- households.
- Western U.S. and Other U.S. have a higher proportion falling into the \$50,000 - \$74,999 income bracket.
 - Southern California is most associated with those respondents in the \$75,000 - \$99,999 income category.
 - Southern California is most associated with those specifying \$100,000 or more household incomes.

As would be anticipated, income is highly correlated with the anticipated number of nights spent at the alternate locations. The higher the income, the more nights. But there was no statistically significant relationship between income and how the respondent received information about their present trip.

Only two primary activities were statistically significant by income groupings: camping (most associated with the under-\$50,000 respondent) and sightseeing (with both the under-\$50,000 and \$50,000-\$74,999 income categories).

Knowledge about the Yucca Mountain Repository was not found to be statistically significant, but responses to whether they would have gone on their present trip had such a repository existed were. The answer “definitely would have altered plans” was most associated with the \$75,000 - \$99,999 income grouping. “Probably” was most associated with those respondents falling into the \$50,000-\$74,999 income category. “Probably not” was most associated with the under-\$50,000 group, and “definitely not” with those respondents with incomes of \$100,000 or more. This latter finding suggests less of a potential negative impact on the higher income tourist should a nuclear repository be established at Yucca Mountain.

The Relationship Between Household Income and Attitudes Toward More Resources being Devoted to Global Warming

The under-\$50,000 were most likely to respond with either “yes” – more resources should be allocated to global warming, or “don’t know” whether they should be or not. Those respondents answering “maybe” more resources should be expended were most likely to fall into the \$50,000 - \$74,999 income category. Those who responded “no” were more likely to indicate incomes of \$100,000 or more.

As previously noted, there are strong correlations between the age, education and household incomes of the survey respondents. For example, younger respondents are likely to be in one-person households with incomes under \$50,000, and are less likely to have completed college and/or graduate school because of their age. Those respondents falling into the highest household income category are also likely to be older and more educated.



APPENDIX F

EASTERN SIERRA INTERAGENCY VISITOR CENTER SURVEY

Date _____ Interviewer _____

My name is _____ and I am conducting an Eastern Sierra Interagency Visitors Center survey on behalf of Inyo County. I would greatly appreciate ____ minutes of your time. We also have a small gift for your participation. Before we begin, may I confirm you are above the age of 18? If, not, I am unfortunately not permitted to interview anyone under 18. May I begin by asking:

1. Where do you live?
U.S. zip code _____
Foreign country _____
2. On this visit, how many people are in your group, including yourself?
____ number of people
3. What kind of group are you with?
____ Alone
____ Family
____ Friends
____ Family and friends
____ Tour group

If on a tour group, ask:

4. From where did this tour originate?

- 4a. What is the name of your tour group?

All respondents:

5. Did you stop by the Visitor Center today in order to: *(Check all that apply)*



**A County at Risk: The Socio-Economic Impacts of the
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	Yes	No
5a. Get driving instructions?		
5b. Obtain information about one or more visitor destinations?		
5c. Use the restroom?		
5d. Obtain a wilderness permit?		
5e. Visit the bookstore?		
5f. Obtain information on overnight accommodations?		
5g. Other (please specify)		

6. Which of the following have you visited or do you plan to visit on this trip?
(Check all that apply)

	Yes	No
6a. Death Valley National Park		
6b. Downtown Lone Pine		
6c. Mammoth Lakes		
6d. Manzanar		
6e. Bishop		
6f. Mt. Whitney		
6g. Mono Lake		
6h. Other Northern Inyo County locations (Onion Valley/Independence, Big Pine Creek, Bristlecone Pine Forest, Bishop Creek)		
6i. Other Southeast Inyo County locations (China Date Ranch, Tecopa/Shoshone)		
6j. Southern California		
6k. Northern California		
6l. Las Vegas		
6m. Elsewhere in Nevada		
6n. Bodie (California State Park)		
6o. Yosemite National Park		
6p. Other (please specify)		

7. From the above list, how many nights do you anticipate spending in each of these destinations? (insert destinations from Question 6)



Destination	None	One	Two	Three	Four or more
7a.					
7b.					
7c.					
7d.					

8. Is this your first visit to Inyo County?

Yes No Lives in Inyo County

For those who respond no and don't live in Inyo County:

How many times have you visited Inyo County, including this visit? _____

9. From the above list, which of these locations are your primary trip destinations?
List all that are applicable.

9a. _____

9b. _____

9c. _____

9d. _____

If one or more primary destinations are located in Inyo County, ask:

10. How did you obtain your trip information for this trip?

10a. Website _____

10b. Travel guide _____

10c. Travel agent/tour group _____

10d. From friends, family etc. _____

10e. From past trips _____

10f. Other (please specify) _____



11. What is the primary purpose of your trip?

11a. Backpacking _____

11b. Camping _____

11c. Fishing _____

11d. Mountain bike riding _____

11e. Off-highway vehicle riding _____

11f. Rock hounding/geological exploration _____

11g. Sightseeing _____

11h. Visit friends/family _____

11i. Part of a larger tour _____

11j. Other (please specify) _____

12. On this trip, what is your average per person daily expenditure for the following:

	Less than \$25	\$25 – \$49.99	\$50 – \$74.99	\$75 – \$99.99	\$100 +
9a. Lodging					
9b. Travel (gas/car rental)					
9c. Food (restaurant/groceries)					
9d. Other (souvenirs, film, etc.)					

13. What, if anything, would you change to make your trip a more pleasant experience?

14. Have you heard or read anything about the possibility of a nuclear waste repository to be located at Yucca Mountain near Las Vegas?



Yes No Can't recall

THE U.S DEPARTMENT OF ENERGY HAS PROPOSED BUILDING A REPOSITORY TO PLACE AND STORE NUCLEAR WASTE OR SPENT FUEL FROM COMMERCIAL NUCLEAR POWER PLANTS AT YUCCA MOUNTAIN, NEVADA WHICH IS LOCATED APPROXIMATELY 30 MILES FROM DVNP AND 100 MILES NORTHEAST OF LAS VEGAS. THE CURRENT STATUS OF THE YUCCA REPOSITORY IS UNCLEAR UNTIL THE NUCLEAR REGULATORY COMMISSION MAKES A FINAL DECISION ON A WITHDRAWAL PETITION BY THE DEPARTMENT OF ENERGY.

15. If a nuclear waste repository were currently located at the Yucca Mountain site, would you have altered your present trip's plans?

- Definitely
- Probably
- Probably not
- Definitely not
- Don't know

16. Do you believe more of the government's resources should be spent on decreasing global warming, at the cost of reducing other expenditures?

- Yes
- Maybe
- No
- Don't know

For all respondents:

17. Gender: M F

18. Ethnicity:

- White/non-Hispanic Hispanic Asian Native American Black Other

19. Age (mark one):

- 18-29
- 30-45
- 46-65
- over 65



20. Education (mark one):
- less than high school
 - high school graduate
 - some college
 - 4-year college/university graduate
 - post-graduate

Ask foreign visitors:

20a. What is your highest level of education attainment? _____

For all respondents:

21. Which of the following categories includes your household's before-tax 2009 income (In U.S. Dollars)?
- Under \$25,000
 - \$25,000 - \$49,999
 - \$50,000 - \$74,999
 - \$75,000 - \$99,999
 - \$100,000 and above

