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NNWSI PROJECT

High-Level Nuclear Waste Transport and Storage Assessment of Potential Impacts on Tourism in the Las Vegas Area

INTERIM PROGRESS REPORT

September 30, 1983

SCIENCE APPLICATIONS, INC.

HIGH-LEVEL NUCLEAR WASTE TRANSPORT AND STORAGE ASSESSMENT OF POTENTIAL IMPACTS ON TOURISM IN THE LAS VEGAS AREA

DRAFT

INTERIM PROGRESS REPORT

Prepared for:

United States Department of Energy

Nevada Waste Management Project Office

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1.0 INTRODUCTION

The Yucca Mountain area, Nye County, Nevada, approximately 100 miles northwest of Las Vegas, Nevada, is presently under consideration by the U.S. Department of Energy for nomination as one of three candidate sites to be further evaluated as a possible location for the nations first high-level radioactive waste repository. At public hearings on this matter pursuant to the Nuclear Waste Policy Act (NWPA), public officials expressed concern that, among other things, the transport and storage of high-level radioactive waste would harm the local tourism industry. The purpose of this report is to present results of work in progress on a study whose objectives are to make a preliminary assessment of the potential for such damage, and to suggest areas where further investigation would be useful.

1.1 PROJECT DESCRIPTION

1.1.1 The Waste Repository Plan

Under the proposal now being evaluated by the Department of Energy's (DOE's) Nevada Operations Office, high-level radioactive waste would be stored in a repository excavated in volcanic tuff underlying an area adjacent to the Nevada Test Site (NTS), a 1,350 square-mile area which has been used since 1981 for nuclear weapons testing and related defense activities. According to the DOE, the current assumption is that approximately 90 percent of the waste material to be emplaced in the repository would be transported to the site by rail (Melancon, 1983). Westbound trains carrying from one to severl shipping casks would not enter Las Vegas; rather, they would travel to the Yucca Mountian site by way of a newly-constructed spur at Dike's Siding, about 5 miles northeast of the city. It is not known whether or how the trains will be specially marked. Flatbed trucks transporting wastes would be clearly marked and would each carry one shipping cask surrounded by a wire mesh cage. Although truck transportation routes have not been designated, the procedure followed in a recent shipment of spent fuel from Florida to the NTS provides one possible model. Trucks carrying casks were met by an escort on Interstate Highway 15 outside Las Vegas. The convoy then proceeded to the NTS via U.S. Highway 95.

1.1.2 Potential for Public Exposure

The following events could pose a risk to the general public, including tourists:

- o Non-nuclear related traffic accidents
- o Release of radiation from transported casks
- o Ground-level release of radiation following a transportation accident

Accidents of the first type are estimated to result in 2 to 5 fatalities and 20 to 47 injuries for rail transportation over the life of the project. Truck transportation would result in about 25 facilities and 240 injuries. (These figures are based upon the assumption that tranportation is wholly by rail or truck).

For routine rail transportation, the maximum dose to a"member of the general public whose habits tend to maximize the resulting radiation exposure that the individual may receive for a given release" was estimated by the DOE to be 1.6×10^{-4} rem per year, compared to a nominal annual dose of 0.1 rem from naturally occurring radiation. For truck transport, the maximum dose to the same individual would be 2.6×10^{-4} rem per year.

The most severe postulated accidental release would occur as the result of a train crash and fire, followed by a ground-level airborne release. The resulting 70-year dose commitment to the nearest individual would be 3 and 7.4 rem for spent fuel and high-level waste transportation, respectively. The estimated frequencies of this type of accidental exposure are estimated to be 8×10^{-7} and 2.7×10^{-7} per year, respectively.

1.2 PUBLIC PERCEPTION OF NEVADA TOURISM IMPACTS

Rather than presuming that a tourism effect eixsts, the assessment reviews alternative theories by which location of the project at Yucca Mountain could affect tourism levels and then investigates available research and data on historical cases as evidence that could support each theory. Thus, for example, cases which appear in Section 4 were selected as examples

of perceived threats to safety rather than for their similarity to the proposed waste repository.

Given the preliminary stage of Yucca Mountain engineering design studies, and to simplify the assessment, this study does not attempt to evaluate the characteristics of the Yucca Mountain waste repository project. Rather, potential public perception of project characteristics are considered. The relationship between these perceptions, and the actual characteristics of the preject and DOE policy will be considered in a later report.

1.3 THE LAS VEGAS TOURISM INDUSTRY

1.3.1 Description

The Nevada tourism industry is concentrated in the Las Vegas area within approximately 100 miles of the proposed site. The principal tourist activity in the area is gaming and associated resort hotel recreation. Lake Mead and Hoover Dam are both nearby. Visitor statistics for these activities are shown in Tables 1.3-1 and 1.3-2, along with convention attendance, which is a major source of income and employment in Las Vegas. Over two-thirds of Nevada gaming revenues are generated by Clark County, where gaming generated $1.75 billion in taxable revenues in 1982. These revenues were up by more than 300 percent from 1972, when the county generated only $476 million. Industry observers indicate that "image" is an important aspect of the hotel/casino industry.

1.3.2 Importance to the Economy

Tourism plays a key role in the state and local economies. Over 60 percent of Nevada state taxable revenues come from gaming. Direct levies paid by the Nevada gaming industry are shown in Table 1.3-3. The hotels, gaming and recreation sector employed 30 percent of the Clark County establishment-based industrial work force or 69,000 workers in May 1982. Thus, even small changes in tourism growth rates may have larger absolute effects - in terms of employment, income and the fiscal well-being of the area.

Table 1.3-1

LAS VEGAS TOURISM TRENDS

Year	Total Visitor Volume (000)	Convention Attendance (000)	Clark County Taxable Gaming Revenues ($ Million)
1972	7,955	291	476
1973	8,475	357	588
1974	8,665	312	685
1975	9,151	350	770
1976	9,769	367	846
1977	10,137	417	1,015
1978	11,178	607	1,236
1979	11,696	638	1,424
1980	11,942	656	1,617
1981	11,821	720	1,676

Source: Las Vegas Convention and Visitors Authority (15 March 1983)

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Table 1.3-2

VISITOR VOLUME AND REVENUES IN THE LAS VEGAS, NEVADA AREA, 1981-1982

	1981	1982
Visitor Volume (000)		
Hoover Dam	662	654
Lake Mead	5,402	5,565
Conventions	720	810
Visitor Revenues ($ Million)		
Gaming	3,122	3,434
Other tourism	1,676	1,751
Total	4,798	5,185

Table 1.3-3

DIRECT LEVIES PAID BY THE NEVADA GAMING INDUSTRY TO ALL GOVERNMENT ENTITIES, 1972-1976

(All levies in millions of dollars)

	Fiscal Year Ending 30 June				
	1972	1973	1974	1975	1976
Total Levies Paid	77.5	79.3	92.8	100.8	111.0
Federal Levies	11.8	4.9[a]	5.0	4.3	4.7
Percent Total	15.2	6.2	5.4	4.3	4.2
State Levies	54.9[b]	62.3	74.4	82.5	91.2
Percent Total	70.8	78.6	80.2	81.8	82.2
County Levies	8.0	9.1	10.1	10.7	11.5
Percent Total	10.3	11.5	10.9	10.6	10.4
Other Levies[c]	2.8	3.0	3.3	3.2	3.2
Percent Total	3.6	3.8	3.6	3.2	2.9

Source: Nevada National Bank (undated) from Nevada Gaming Control Board

[a]Effective July 1, 1972 Federal Annual Slot Machine tax reduced from $250/machine to $50/machine due to 80 percent Federal tax credit allowed to the State of Nevada.

[b]Includes new State Annual Slot Machine tax of $200/machine (paid in advance of July 1, 1972) for machines operated during the fiscal year ended June 30, 1973. Based on 80 percent Federal tax credit noted above.

[c]Cities and other local governments.

1.3.3 Recent Trends

Of particular concern to casual observers has been the Las Vegas economy's unexpectedly strong response to the recent recession, with five casinos going bankrupt and others known to be in trouble according to press accounts (U.S. News & World Report, 30 May 1983). Negative press accounts associated with this downturn have caused additional concerns in the industry that misinformation is being spread that the famous Las Vegas atmosphere itself is depressed. With the high importance of image to the hotel/casino business, the industry must be concerned about its media presence. However, many reasons - not limited to the recent economic downturn and unfavorable press coverage - have been ascribed to recent conditions in the industry, where 1982 total visitor volume declined 1.6 percent from its 1981 level. For example, the establishment of a gaming center in Atlantic City, New Jersey may have affected Las Vegas tourism.

1.4 OUTLINE OF THE STUDY

Section 2 of this interim report contains the results thus far of our review of the literarure on public attitudes towards natural and man-made hazards, and of historical effects of various types of facilities and events upon tourism. Section 3 explores alternative analytical frameworks for a study of this type and describes the ones chosen. Five historical cases are presented in Section 4. Finally, Section 5 outlines our proposed approach for completing the study.

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2.0 REVIEW OF PREVIOUS RESEARCH

2.1 PUBLIC PERCEPTION OF HAZARDOUS SITUATIONS

This section review past research on relationships among actual safety hazards, public perception of safety hazards and actual behavior. This literature relies extensively on survey research and other interview techniques for data. Our review is presented in four parts, relating to (1) perception of natural hazards, (2) risk-benefit considerations, (3) public attitudes versus distance, and (4) socioeconomic factors underlying survey responses.

2.1.1 Perception of Natural Hazards

White and Haas (1975) reviewed the literature on the socio-economic impacts of natural disasters, and concluded that the public tends to underestimate the magnitude of a variety of natural hazardous events (floods, volcanos, earthquakes, hurricanes, tornados, etc.) prior to their occurrence. During and soon after, however, the event's cognitive impact on affected individuals is great. As time passes without another significant event, a false sense of security dominates the public's attitude. Baker et al (1977) conclude from an extensive review of the literature that all natural short-term, infrequent hazards have certain common behaviorial aspects, such as relocation of residence and purchase of insurance.

2.1.2 Risk-Benefit Considerations

Starr (1969) attempted to quantify risk/benefit ratios for various man-made, non-nuclear hazards, and to relate these ratios to the public's attitude toward the hazard. He concludes that the public is willing to accept risks 1,000 times greater if they are "voluntary" then if they are imposed on them. He also concludes that the acceptability of a risk is approximately proportional to the cube of the (perceived) benefits.

2.1.3 Public Attitudes Versus Distance

A survey by Resources for the Future for the Council on Environmental Quality (CEQ, 1980) found that public support for or opposition to the construction of various facilities including factories, coal-fired power plants, and office buildings, varied with the distance between place of residence and the proposed site. Results were virtually identical for nuclear power plants and hazardous waste sites, which tended to produce opposition at relatively short distances. In contrast, Brunn et al (1980) found that significantly more people (91.2 percent) opposed siting nuclear waste repositories in their county than opposed nuclear power plants (61.8 percent), possibly as a result of lower perceived benefits from the former. The CEQ also reported findings suggesting that opposition to nuclear power plants and disposal sites for hazardous waste chemicals decreases only slightly with distance. Seventy-five percent of those surveyed opposed siting either facility within 10 to 20 miles of their homes. More than half would still be opposed if the distance were 100 miles. In another study of this question, Brunn et al (1980) also failed to detect a decrease of public opposition with distance (up to the maximum studied, 10 miles). This contrasts sharply with findings for opposition to non-nuclear facilities, which has traditionally been found to decline logarithmically with distance (e.g., White, 1974).

2.1.4 Socio-Economic Factors

Brunn et al (1980) also reported that for nuclear waste facilities there was no significant diffference in the attitudes of those surveyed based on age, sex, marital status, education, occupation, and type and length of residence. There was "strong opposition across the boards." Their results conflict with those of other researchers. For example, Smith and Hanham (1961) and Johnson (unpub. MS) find that for non-nuclear facilities, opposition varied among different socio-economic groups.

2.2 STUDIES OF HISTORICAL DATA

As part of this literature reveiw, a number of studies were identified in which researchers examined the relationship between events perceived to be

hazardous to public safety and actual tourism behavior as revealed in historical time series data. Although the most extensive work has been done in response to questoins about the effects of proposed floating nuclear power plants, the historical effects of other types of nuclear facilities on tourism and population levels have also been addressed. These works include an analysis of the relationship between Nevada Test Site operations and Las Vegas tourism as well as an evaluation of economic impacts of the Three Mile Island incident, based on a tourism impact analysis.

2.2.1 Nuclear Power Plants

2.2.1.1 Floating Nuclear Power Plant Proposal

The impacts of nuclear power plants on tourism and recreation were studied by Baker et al (1977), Bykoski et al (1978) and West and Baker (1983). These three papers stem from the same study, and represent different approaches to assessing the potential impacts of floating nuclear power plants (FNPs) on beach recreation and tourism along the coast adjacent to the plant.

One approach (Baker et al 1977; West and Baker, 1983) was to ask patrons at two beaches in Florida and one in Cape Cod if they would continue to return to that beach if an FNP were sited immediately offshore. They found that 22.8 to 26.5 percent of those interviewed said that they would not return. There was a decrease in impact with distance such that only about 5 percent said they would not return to the beach if the FNP were sited 50 miles away. Baker and West then reduced the survey finding to 5 to 10 percent in consideration of seven qualitative "considerations (West and Baker, 1973)":

(1) the direct wordign of the question probably increases the likelihood of pro-avoidance responses (see Orne, 1962).

(2) The initial intentions to avoid are based on emotional responses that are likely to dissipate over time in the absence of further information. Later behavior is likely to show less change than is implied by the intention measured (Leventhal, 1970).

(3) Individuals routinely take a wide variety of risks because they underestimate the likelihood and consequences of risk with which they have not had negative experiences. In addition, individuals often believe the benefits of a given behavior exceed its associated risks.

(4) The instability of the intention to avoid figures is highlighted by the 40.3 to 50 percent reduction figure when respondents learned of NRC safety certification.

(5) The intention to avoid questions did not force respondents to consider the costs that are involved in selecting an alternative beach. The information integration tasks forced the subjects to give additional thought to their responses and to make the necessary tradeoffs. The results of these tasks showed that proximity to a floating nuclear plant was far less important than other beach attributes such as proximity to one's home, cleanliness, quality of facilities, and crowding. There appears to be a strong bias to return to a beach when the initial visit is favorable. Although several instances of aesthetic disruption (e.g., dredging) were noted during the present study, they had little impact on respondents' future plans to visit their favorite beach.

(6) The direct avoidance questions and the information integration tasks all indicated that intentions to avoid decrease sharply as the distance to the nuclear plant increases.

(7) The study of the four analogous situations revealed no major impacts of existing coastal nuclear plants. Neither the park attendance data nor the interviews with special interests indicated a reduction in tourism due to the plants, and fewer than 5 percent of the beach visitors were aware of anyone having been deterred from the beach by a nearby plant.

As they admit, others may use the same considerations to reduce the figures by other amounts. In fact, no justification for any reduction is given. All surveys were performed prior to the Three Mile Island accident.

2.2.1.2 Beach Tourism Near Land-Based Nuclear Power Plants

Baker et al also reported actual attendance (shown in Figure 2.2-1) at four beaches near (land-based) nuclear generating facilities. At a beach near the Zion nuclear power plant in Illinois, a precipitour drop in attendance occurred immediately after the start-up of the reactor. This was followed by three years of depressed figures before a rise to near the average pre-Zion levels. Although other areas generally had growth over this period, this beach showed none. It should be pointed out, however, that there were also large fluctuations in attendance before Zion started up. Weather variations, the opening of new recreation areas, and an encephalitis scare in 1975 further complicate the situation. Interviews of 56 patrons found none who claimed to avoid the beach due to the nuclear power plant, but 9 percent said that they knew people who did avoid the area for that reason.

At San Onofre, California, attendance increased continuously after the power plant became operational, except for a brief decline following the opening of another park nearby. None of the 15 subjects interviewed knew of anyone who avoided the beach due to the nuclear facility.

At Rocky Neck State Park, Connecticut (five miles from the Millstone nuclear power plant) tourism declined following the opening of Millstone, then went up again briefly, but has remained lower than pre-Millstone figures ever since. Of the 56 subjects interviewed, none knew anyone who avoided the beach due to Millstone and 36 percent were unaware that Millstone was only 5 miles away.

No parks at St. Lucie, Florida kept attendance figures, but of 104 people surveyed, 5 percent knew people who avoided the beaches due to the power plant, and 7 percent indicated that they themselves felt increased reluctance to use beaches close to the plant. However, 13 percent felt the beaches were now more attractive due to better fishing and surfing conditions.

Another facet of the study (Bykoski et al, 1977) involved interviewing government officials and business representatives from 10 counties with nuclear generating plants and water-oriented recreational facilities; Brunswick, North Carolina; Berrien, Michigan, Middlesex, Connecticut, Dauphin, Pennsylvania; and Lake, Illinois. Five to thirteen officials were interviewed for each site. Only one of the interviewees felt that the presence of the nuclear facility had any adverse effect on tourism.

Using Baker, et al, (1977) adjusted figure of five to ten percent decline in beach attendance, and calculating the corresponding decline in revenues, Bykoski et al (1978) concluded that the resulting drop in total revenues would be "less than one percent," based on the small percentage of total revenues represented by tourism in the areas surveyed.

2.2.1.3 Other Nuclear Facilities/Tourism Studies

Two studies (Nutant et al, 1981; Peelle, 1977) evaluated the effects of nuclear generating facilities, as well as the nuclear weapons testing program in Nevada, on tourism in nearby communities.

Peelle (1977) studied the effects on tourism of two nuclear generating stations. The Pilgrim Nuclear Power Station is located near Plymouth, Massachusetts, on Cape Code Bay, 35 miles south of Boston. Construction of this plant ws controversial and received a great deal of publicity. After slow growth in the 1950's and 1960's, Plymouth underwent explosive growth beginning in 1968 when construction of Pilgrim 1 began. Growth was attributed by Peelle to the influx of power plant workers and to a much broadened tax base due to the power plant. Using population growth as an indicator of growth in resort economies, Peelle concluded that the constuction and operation of Pilgrim had a positive effect on tourism in the Pilgrim area.

Another site looked at by Peelle was the Millstone Nuclear Power Station located near Waterford, Connecticut. Like Plymouth, Waterford has enjoyed sustained economic growth (overall growth, not specifically tourism). Peelle

found no evidence to suggest that Millstone's operation had any effect on the tourist industry of the region.

In a smaller analysis of historical data, Nutant et al (1977) studied tourism effects associated with the Oyster Creek Nuclear Generating Station in New Jersey. Like Pilgrim, Oyster Creek was controversial and received considerable publicity in the regional press. Using population growth as an indicator of tourism levels, Nutant el al, found no evidence to suggest that Oyster Creek has had a negative impact on the resort economy of Ocean County.

Simple qualitative assessments of the communities surrounding three other nuclear plants (Turkey Point, Florida; Maine Yankee, Maine; and San Onofre, California) also revealed no indication of adverse consequences due to the nuclear power plants (Nutant et al, 1981). Finally, Nutant et al, (1981) investigated the effects of the nulear weapons testing program at Yucca Flats on tourism in Las Vegas. Analyzing gaming revenues, employment levels, and the number of hotel and motel rooms through the last 30 years, they were unable to find any negative effects of the Nevada Test Site on Las Vegas tourism.

2.2.1.4 Socioeconomic Impacts of the Three Mile Island Incident

The Commonwealth of Pennsylvania's final report on the socio-economic impacts of Three Mile Island (TMI) (undated) addressed the subject of impacts on tourism. They concluded that the 1979 accident caused an immediate loss of $5 million in a six county area by the end of April 1979. Losses continued through the summer and into the following fall, but other factors (gasoline shortages, polio scares) may have contributed significantly to these latter losses. By 1980 tourism levels had approached pre-accident levels.

In another part of their study, potential tourists from Baltimore, Cleveland, Long Island, New Jersey, Philadelphia, and other communities were asked whether they intended to travel to Pennsylvania the coming summer (1979). Two percent said they would avoid the state entirely due to TMI concerns. in addition, 7 percent who would be traveling in Pennsylvania said they intended to avoid the Harrisburg-Hershey area due to TMI considerations.

The Commonwealth of Pennsylvania's report concluded that while there were major short-term impacts (e.g., 50 percent decline in tourism business in Lancaster County for April 1979 and 25 to 50 percent declines for the summer season as a whole in many areas) the long-term effects of TMI on tourism were minor. However, due to concern over continuning adverse publicity, the Commonwealth decided to launch a major media campaign in the East to promote tourism in Pennslvania.

2.2.1.5 Santa Barbara Oil Spill

A 1976 environmental impact statement for Santa Barbara Channel oil developmetn discusses a survey of public attitudes toward the impacts of offshore platforms on tourism in Santa Barbara and Ventura counties. Of the people interviewed one year after the 1969 oil spill, 53 percent said that they used the beach less in the 12 months following the spill than they had in the 12 month prior. Survey results also indicated that the mean number of beach visits per year declined from 27.9 to 20.8, translating to a decline of 744,000 beach visits for the year following the spill. Analysis of survey results led them to the conclusion that development may have a long-term effect on the "spiritual" value of an "undefiled" or untampered environment, and that "this value is held dear by many people."

3.0 STUDY METHODOLOGY

3.1 MAJOR ALTERNATIVE APPROACHES

In assessing the potential impacts of a new project such as the proposed Yucca Mountain high level radioactive waste repository, the three basic approaches found in the subject literature are (1) analysis of historical data as evidence of the revealed responses of tourism to similar events, (2) analysis of survey data developed specifically for the subject project, and (3) use of survey data developed for projects analogous to the subject project. The literature review presented in Section 2 provides evidence of all of these approaches.

3.1.1 Historical Case Studies

Historical data are useful in testing theories about the underlying causes of changes in tourism levels, such as perceived public safety hazards. The primary advantage of an historical data analysis approach is that the data reflect actual social and economic behavior in light of the totality of information available at the time to both potential and actual tourists who are often faced with many decision alternatives. However, because of the many factors which influence actual tourism behavior, it is sometimes necessary to employ statistical techniques to separate the effect of a particular event - such as construction of a nuclear reactor or a heightened level of awareness of unsafe conditions - from other factors which influence tourism decisions, such as income levels, transportation costs and the availability of similar alternative forms of recreation.

Based on the literature review presented in Section 2, the most common pitfall of historical data analysis as applied to tourism research appears to be the inability of the researcher to distinguish the effect of the event of interest from that of so-called "confounding factors." However, none of the studies reviewed in Section 2 exhibits any evidence of attempts to separate the effects of perceived safety hazards from the effects of other economic factors on tourism. Finally, results obtained from analysis of historical situations have a limited range of application. While they may enable the

researcher to identify systematic relationships between certain types of situations and tourism behavior, each situation is unique. Conclusions based on historical relationships must be applied with care to the analysis of future situations.

3.1.2 Surveys

Public opinion surveys are a relatively quick and inexpensive means of gauging potential public responses to hypothetical future events. An advantage over historical studies is that the response to the project itself, rather than to a similar historical situation, may be assessed. On the other hand, even well-designed surveys are typically subject to several pitfalls, including the following:

- Inaccurate responses. Respondents may give interviewers the answers they think are expected or desired, rather than what they really believe. In addition, there is not certainty that the interviewee's actions will be the same as his or her answers to the survey.

- Insufficient information. In order to keep the interview reasonably short (and sometimes to disguise the true nature of the inquiry), it may not always be possible to give the interviewee enough information to make the same decision he or she would in a real situation.

- Biased samples. Great care must be taken to assure that the survey sample is representative of the greater population of interest, in this case prospective tourists. For example, some of the findings of Baker et al (1977) cited in Section 2.2.1.2 may be questionable, since the interviewees had already made the decision to go to a beach near a nuclear power plant; those people who had deliberately avoided the beach were not interviewed. For the same reason, any increases in tourism would not be detected from on-site interviews using this method.

3.2 STUDY APPROACH

3.2.1 Characterization of Proposed Action in Terms Relevant to Tourism Impacts

This section reviews in an analytical context the means by which a Yucca Mountain high-level radioactive waste repository could affect tourism in the surrounding area. The review is based on preliminary discussions with observers of the Las Vegas tourism industry that were held for the purpose of identifying a range of potential impacts on Las Vegas tourism.

3.2.1.1 Alternative Theories About a Negative Tourism Effect

Interviews with observers of the tourism industry in Las Vegas indicate that concerns about project impacts on tourism center around the effects of the project on tourism demand. Such effects could occur by several means:

- Reduced safety. Visitors and residents may perceive that the project makes Las Vegas an unsafe place to stay. If potential visitors were concerned about their personal safety in Las Vegas, they might be less likely to choose Las Vegas as a place to go to "get away from it all." This view is based on the assumptions that (a) the Yucca Mountain repository would be perceived as a safety threat to tourists and (b) tourism behavior is sensitive to changes in perceived safety levels.

- Reduced aesthetic appeal. This view assumes that a high-level radioactive waste repository would be widely viewed as a detriment to the aesthetics of the Las Vegas atmosphere or image. It is based on the assumption that aesthetic features of the waste repository (about 100 miles away) will directly affect the aesthetics (image) of Las Vegas as a tourism attraction.

- Increased Nevada Test Site Visibility. A third and related view is that any adverse affects of the repository project would be compounded by heightened visibility of not just the repository itself but of any or all potentially unsafe or aesthetically unappealing activities

being conducted at the Nevada Test Site. This view depends on the assumption that an increase in the level of visibility of existing activities at the NTS would have a negative affect on Las Vegas tourism. If we accept that assumption, the effects on tourism would be two-fold: first, the behavior of potential tourists who were already aware of the existing activities at the NTS would be affected by the incremental Yucca Mountain repository activities; second, the behavior of potential tourists who were not previously aware of on-going activities at the NTS would be affected by both the incremental YM repository activities and the new or renewed perception of all other NTS activities. This view is based on the assumption that increasing the visibility of ongoing NTS activities would decrease tourism. These views may all be summed up as the concern that repository construction and operation would hurt Las Vegas' "image" (an intangible feature of the area) in such a way that it would make the Las Vegas area less attractive to tourists.

3.2.1.2 Testable Implications

Although no project like the Yucca Mountain waste repository exists and there is no economic and social environment quite like that surrounding the Yucca Mountain site (which includes Las Vegas), certain elements of the viewpoints summarized above produce testable implications that may be of use in gaining an understanding of the degree of potential tourism impacts of a Yucca Mountain waste repository on Las Vegas tourism:

- Increases in the level of visibility of ongoing NTS activities are accompanied by decreases in tourism levels.

- Tourism behavior is sensitive to perceived safety levels.

- Operation of the Yucca Mountain repository, including nuclear waste material transportation, will be perceived as a safety threat to tourists.

- Aesthetic features of the waste repository will directly affect the aesthetics (image) of Las Vegas as a tourism attraction.

- The YM repository will have a high level of visibility as unsafe and as aesthetically unpleasing.

The assertions that NTS visibility adversely affects tourism and that tourism behavior is sensitive to perceived safety levels will be tested through the case study analyses presented in Section 4 of this report. The other three approaches depend on actual characteristics of the repository itself, which are not addressed in this report.

3.2.1.3 Theories About Positive Effects on Tourism

Finally, there is the potential for positive effects on tourism. This study, like others, responds to questions that have been asked about the existence or magnitude or negative effects on tourism. However, interviews designed to identify the scope of the issue have led to the identification of an alternative viewpoint: that the Yucca Mountain repository could have at least a partial positive effect on tourism. According to this view, a high level of visibility attached to the project could lead to increases in tourism levels. This would occur if the repository itself became a tourist attraction (e.g., as people became curious about the repository and other activities at NTS) or if there were some other positive effect of heightened visibility brought to Las Vegas by virtue of the project (e.g., such as the effect of advertising).

3.2.3 Case Study Selection and Analysis

Two types of situations were considered in selecting historical case studies for analysis. The first were short-term events which posed a safety threat to the general public and which were widely publicized. The other type of situation consisted of the existence and operation of a facility (or the continuation of a natural phenomenon) which is perceived by a significant portion of the general public as being hazardous. Table 3.2-1 presents a partial list of the original set of situations considered for further study.

Table 3.2-1

LAS VEGAS TOURISM STUDY - POSSIBLE ANALOGOUS CASES

Place	Situation	Media Attention	Tourist Activities
Niagara Falls, NY	Love Canal - contamination of water, soil	Known locally for long time Media attention in 1978	Sightseeing
Harrisburg, PA	Three-Mile Island cooling system failure	Heavy nationwide publicity March - Summer 1979	Sightseeing, conventions
Kitsap County, WA	Trident nuclear submarine base	Local	Recreation, conventions
Mammoth Lakes, CA	Volcano alert (continuing)	Articles in Los Angeles newspapers	Skiing in Mammoth Lakes
Atlanta, GA	Murders of black children	Heavy nationwide publicity	Conventions
Times Beach, MO	Dioxin contamination	National attention in early 1983	None
Philadelphia, PA	Legionnaires' Disease outbreak	Nationwide publicity in August 1976	Conventions
Beatty, NV	Nuclear waste site	Slight	Recreation & Sight-seeing - Death Valley
West Valley, NY	Nuclear waste site	Slight	State park, skiing
Las Vegas, NV	Nuclear test site	Occasional	Gambling, entertainment
Sacramento, CA	Rancho Seco Nuclear Plant	Slight	Sacramento, Delta recreation

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LAS VEGAS TOURISM STUDY - POSSIBLE ANALOGOUS CASES
(Continued)

Place	Situation	Media Attention	Tourist Activities
Hanford, WA	Nuclear waste disposal	Scant	Recreation
S. Padre Island, TX	Hammerhead shark infestation	Local attention, June 1977	Recreation
Yellowstone Nat. Park, WY	Grizzly bear attacks	Present	Recreation
Glacier Nat. Park, MT	Grizzly bear attacks	Brief nationwide attention	Recreation
Las Vegas, NV	MGM Grand fire	Brief nationwide attention	Gambling, entertainment
Duluth, MN	Taconite dumping (threatening drinking water)	Scant public attention	?

DRAFT - PRELIMINARY AND AS SUCH MAY CONTAIN CORRECTED. FOR IN-HOUSE

Nuclear reactor locations and hazardous waste sites on the U.S. Environmental Protection Agency's superfund cleanup list were also considered. Although some cases were eliminated as offering too few characteristics of interest to present meaningful tests of the "implications" identified in Section 3.2.1.2, the dominant reason for elimination was the absence of adequate tourism time series data surrounding the event of interest, and/or by our inability to obtain such data during the short time available.

Five cases were selected for analysis. The first was the March 1979 accident at the Three Mile Island nuclear power plant in Harrisburg, Pennsylvania. It was chosen because it occurred in an area which has significant tourist activity (including conventions), received widespread and intensive publicity, and involved nuclear energy. In addition, as was learned later, a study of the socioeconomic impacts of the incident had already been conducted.

The second case was the relocation of families following exposure to toxic chemicals in the Love Canal area of Niagara Falls, New York. It was selected because Niagara Falls is a heavily-visited tourist area and because the toxic waste site has been perceived as a long-term threat to health and safety. Also, the situation received considerable publicity over several years. Thus, this case may be used to test whether increased visibility of an existing facility affects tourist activity.

Our third case consists of a potential natural hazard in a popular tourist area: earthquakes and a volcano notice at Mammoth Lakes, California. Like the other cases, this was selected in order for us to test sensitivity of historical tourism behavior to perceived hazard levels.

The fourth case was the outbreak of Legionnaires' Disease in Philadelphia, Pennsylvania in August 1976. It was chosen because Philadelphia is a major tourism center and convention site, and because it allows insight on whether a short-lived but highly publicized incident would affect tourism.

Finally, in order to examine impacts in the area of interest, we selected the MGM Grand and Hilton Hotel fires, which occurred in Las Vegas in November

1980 and February 1981, respectively. These incidents provide us with the opportunity to test the effects on tourism in Las Vegas of situations perceived to be hazardous.

4.0 CASE STUDY ANALYSIS

The following discussion constitutes a progress report on our analysis of the five case studies identified in Section 3. At this point, we have held discussions with local experts on tourism in each of the potentially affected areas, reviewed published analyses, and requested from local public and private source data which would be useful in elucidating possible tourism effects. Since most of the requested data has only recently arrived, and some important data sets are incomplete, we believe it appropriate to defer our analysis until the final report. Instead, we present in this section descriptions of the events associated with the case studies, along with summaries of news media accounts which may have influenced public perception thereof.

4.1 THREE MILE ISLAND

4.1.1 Description of the Event

The Three Mile Island (TMI) Nuclear Power Plant, located on the Susquehanna River at Harrisburg, Pennsylvania, was the site of the worst operating incident in the 20-plus year history of non-military nuclear power generation. On 28 March 1979, a pump supplying water to TMI unit 2's steam generator failed. A subsequent series of equipment malfunctions and human errors coused the core of the reactor to overheat, resulting in the release of radioactive gases into the surrounding environment. As the situation deteriorated over the next few days, an advisory evacuation notice was issued to pregnant women and pre-school children residing within a five mile radius of the plant. By 6 April 1979 officials at the plant indicated that the crisis had passed as the situation stabilized.

Among the more important tourist attractions in the immediate vicinity of TMI are Harrisburg, the state capital and host to many conventions; and Hershey, Pennsylvania, the site of Hersheypark - a theme-park located approximately 10 miles east of TMI.

4.1.2 Public Perception

Review of news media data bases indicates that the Three Mile Island incident was accompanied by a significant level of national news exposure. A media search of the NEXIS database alone yielded some 340 newspaper articles over a three-month period, in addition to numerous wire service releases. Most major newspapers in the United States carried articles discussing concerns over public safety at nuclear plants.

Some newspaper accounts attributed changes in the local business climate to the incident. According to the press, business from outside Pennsylvania were not only reluctant to purchase milk, meat, and other food products from that Pennsylvania region, but also tractor parts and shoes (Seaberry, 1979). Local chamber of commerce officials expressed concern over losing a major share fo the state's $4.7 billion tourism business. Motel and restaurant proprietors said that their business had dropped markedly. A spokesman for the State Department of Commerce stated that millions of dollars of convention bookings were also cancelled.

Two months after the incident, the Washington Post reported that many businesses had "lost a mint" (Seaberry, 1979). However, this same press account quoted local officials as saying that "the state's second-largest industry, tourism, has rebounded," and noted that posters, T-shirts, buttons and other souvenirs from Three Mile Island were in high demand. In addition, Marriott hotels began construction in May 1979 of a new 300 room hotel just eight miles north of the Three Mile Island reactors. "The public's memories are short. They'll forget all about it (the accident)," a Marriott spokesman said. In contrast, the same publication told reade5rs on 8 June that "if you're worried about eating fish caught near the site of the Three Mile Island nucleara accident, breathe a sigh of relief" (Almy, 1979). This indicates a continuing perception of a safety problem.

News media accounts of the local enironment seven months after the accident noted that "Middletown has become a tourist mecca" (Begley and Lord, 1979). However, the same report notes that "the plant is still closed, and

uneasy townsfolk wonder about the effect of the near-catastrophe on their health."

In summary, review of press accounts over the seven months following the accident indicate that the perception of a safety hazard (1) persisted in the local area surrounding TMI, and (2) was given high visibility in the national news media over the entire period.

4.2 MOMMOTH LAKES EARTHQUAKES

4.2.1 Description of the Event

On 26 May 1982, the U.S. Geological Survey (USGS) issued a "notice of potential volcanic hazard" for the area surrounding Mammoth Lakes, located in east-central California (Kerr, 1982). This notice, the lowest of three warning levels as defined by the USGS, warns that "the outbreak of volcanic activity is a possibility but by no means a certainty." Since 1978, the Long Valley-MONO Lake area, which include the towns fo Mammoth Lakes, June Lakes, Lee Vining and Bridgeport, has been shaken by an unusual sequence of earthquakes accompanied by spasmodic tremors. Volcanologists generally consider spasmodic tremors to be the result of rock fracturing associated with the flow of magma or magmatic gases which can precede the onset of volcanic eruptions (Kerr, 1982). The area has been a site of eruptions and other volcanic activity for about 700,000 years. Small earthquakes and tremors (and supposedly magma) emanating from depths around tow to three kilometers from the surface precipitated the issuance of the alert. Tourism in the area (Mono Count) centers areound the Mammoth Lakes and June Lakes ski resorts.

4.2.2 Public Perception

Examination of the print-media databases, NEXIS and Newsbank, indicates that conccern about public safety were affected by the recent volcanic activity in the Mammoth Lades region. Such public concern appears to have originated primarily in Northern Califormia. However, from among the nearly 100 media articles yielded by the database search were news clippings from the

Washington Post, New York Times, and Los Angeles Herald-Examiner, as well as the Associated Press, United Press International, and Reuters wire services. This indicates that the perception of public safety hazards may not have been limited to the local area.

Media attention to the situation began when the U.S. Geological Survey issued a notice of potential volcano hazard on 26 May 1982. Subsequent media warned that "an eruption is immenent." For example, a 27 August 1982 United Press International story began with the statement, "Avolcano eruption in the Mammoth Lakes area of the High Sierra could wipe out homes and utilities and have a devastating effect on the Los Angeles water supply, officials warn."

According to a San Jose paper, local townspeople in Mammoth Lakes were not as frightened and angered by the danger of eruption as they were by the negative publicity that "has kept tourists away from Mammoth Lakes" (San Jose Mercury, 5, July 1982). Thousands of calls were made to the resort home owners and by relatives and other people concerned about the safety of family members and friends. Interviews with local officials refer to an "hysteria" created by the USGS's announcement, with one official asserting that " the media has basically destroyed us" (San Jose Mercury, 25 July 1982). Similar reports appeared in Sacramento and Los Angeles newspapers.

4.3 LOVE CANAL HAZARDOUS WASTE EMERGENCY

4.3.1 Description of the Event

On 2 August 1978, the New York State health commissioner declared a health emergency, stating that young children and pregnant women living within a 16-acre residential tract in the La Salle area of Niagara Falls be evacuated. Between 1930 and 1953, Hooker Chemical and Plastics Corporation used the abandoned Love Canal as a chemical waste dump. The site was covered over in 1954 and eventually sold to residential land developers in the late 1950s. After several years of heavy rains, chemicals began seeping into basements and rising to the surface in 1976. Residents became suspicious when a growing number of illnesses, birth defects and cancers began to show up among the families living over and along the filled-in canal. On 21 May 1980,

President Carter issued a state of emergency at Lave Canal and announced the temporary relocation of 2500 residents (roughly 400 homes) responding to several controversial environmental health studies and public pressure.

After th completion of remedial cleanup work at the site and the release of a highly criticized report by the EPA on the extent of current chemical contamination at Love Canal (Smith, 1982a; Smith, 1982b), it is still not conclusively known if residents can safely return to their homes.

Niagra Falls, in which Love Canal is a suburb, is known worldwide for its famous waterfalls and vacation resorts. The tourist dollar is an important component in the town's economy.

4.3.2 Public Perception

Examination of news media data bases indicates that the discovery of a health hazard at Love Canal was accompanied by a significant level of news-media exposure. A review of the databases yielded some 600 articles, including 95 articles from one newspaper alone over a four-month period. The presence of exposure in the New York Times, Washington Post, and Christian Science Monitor indicated that the event was of national significance.

Media attention to the situation began immediately after the declaration of a health emergency by a New York State health commissioner on 2 August 1978. Safety concerns were evident. Media interviews with cancer researchers urged the relocation of many Love Canal families, and urged the state to pick up the costs (MacClennan, 1978a). These same accounts warned of toxic gases, muagenic chemicals, and of the high rate (16 percent) of birth defects occuring in the area. The newspaper accounts dealt primarily with the major safety concerns of Love Canal homeowners, health and birth defects (MacDonald, 1978).

Three months after the health emergency declaration, the media coverage began to shift away from the hazard and toward establishing "guilt." A 21 October 1978 article in the Buffalo Evening News discussed a task force created to pinpoint responsibility for the hazard (Shribman and MacClennan,

1978). Potential "suspects" mentioned in the article included Hooker Chemical Company, dump site operators, and municipal officials. Other accounts during the smae period questioned whether it was the State of the U.S. Environmental Protection Agency which had greater responsibility to insure proper cleanup and relocation funding (MacClennan, 1978b).

4.4 LEGIONNAIRES' DISEASE OUTBREAK IN PHILADELPHIA

4.4.1 Description of the Event

The term "Legionnaires' Disease" is currently used to refer to illness resulting from infection with the bacterium that caused the July 1976 outbreak among attendees of the American Legion convention at the Bellevue-Stratford Hotel in Philadelphia, PA. Of those who were known to have been inside the hoted at some point during the convention, 182 became ill, and 29 died. Of those who were known to be inthe hotel vicinity, 39 became ill, and 5 died (CDC, 1976).

Research on this previously unidentified infectious organism has shown that a similar outbreak occurred at the hotel in 1974, when 20 persons attending an Oddfellows convention developed pneumonia and 2 died; these cases are now believed to have been caused by the Legionnaires' Disease bacterium. The source fo the orgnaism was traced to the hotel's air-conditioning cooling tower water.

The city of Philadelphia hosts many large conventions each year and also hosts many tourists who visit the city's historical attractions. The Bellevue-Stratford ws closed in November 1976 after a long decline in hotel business, but was subsequently reopened under new managerment in 1980.

4.4.2 Public Perception

Unlike the Three Mile Island and Love Canal cases, a search for new media accounts of the "Legionnaires' Disease" incident (using Newsbank and NEXIS as sources) yielded few articles on the subject, especially concerning tourism

levels in the area. This is probably because NEXIS and newsbank sources offer little or no coverage for 1976.

Recent press reports, however, indicate that the incident was perceived at the time to have adversely affected tourism, noting that in 1976 "A mysterious outbreak of deadly Legionnaires' Disease blighted convention business (U.S. News & World Report, 15 June 1981).

Four years after the incident stories from Philadelphia indicate that the public seems to have forgotten. As reported by Lenhart (1980):

> Perhaps the most dramatic example is one of the city's grand old hotels, the Bellevue-Stratford, which was already in a state of decline in 1976 when an outbreak of the so-called Legionnaires' disease focused attention on it. It closed in November 1976, was then purchased by the Fairmont Hotels group, which reopened it las September after a $22 million restoration project. Now called the Fairmont, the luxury hotel is resplendent with marble columns, decorated plaster ceilings, and stained glass skylights restored to their 1904 glory. It has had no trouble garnering a large share of the city's newly burgeoning convention and tourist trade.

4.5 LAS VEGAS HOTEL FIRES

4.5.1 Description of the Event

Las Vegas was the site of disastrous hotel fires: at the MGM Grand Hotel on 21 November 1980, and at the Las Vegas Hilton on 10 February 1981. While the Hilton fire toll (8 dead, 242 injured) was much lower than that of the MGM fire, and while there were differences in the circumstances surrounding the causes of the fire (the Hilton fire was blamed on arson; the MGM blaze was caused by an electrical short), there were striking similarities in the two tragedies. In both cases, only a handful of those who died suffered burns. Most of the deaths were by asphixiation resulting from smoke and toxic fumes. Fire alarm and safety systems operated inadequately or not at all.

4.5.2 Public Perception

The MGM Grand and Las Vegas Hilton Hotel fires generated a great deal of news and media attention. A search of the NEXIS and Newsbank new databases found over 700 articles from newspapers, magazine, and wire service bulletins. Publications including the Los Angeles Times, San Diego Union, San Francisco Chronicle, New York Times, and Washington Post carried articles discussing the fires and safety concerns of the two hotels.

Public perception of the two fires - as influenced by the news media - centered on the lack of proper safety and alarm equipment in the two hotels, and on the presence of synthetics and plastics which released toxic fumes.

Following the fires, many other hotel-casinos became concerned about these issues (Secter et al., 1981). Concern about hotel safety extended to the entire hotel industry. In response, many other Las Vegas hotel/casinos began to upgrade their own safety systems.

5.0 APPROACH FOR COMPLETING THE STUDY

5.1 LITERATURE REVIEW

Our Research to date has uncovered many additional reports and articles which will be of help in defining tourism issues. Table 5.1-1 is a partial list fo references which we proposed to consult during the remainder of the study. We will also continue to discuss particular historical case studies with the corresponding researchers.

5.2 HISTORICAL DATA ANALYSIS

At this writing we have received the following types of data from the case study localities:

- o Three Mile Island: Hersheypark attendance figures (1972 to the present), Harrisburg convention attendance, assorted information from Governor's socioeconomic study
- o Love Canal: Bridge crossing data
- o Mammoth Lakes: Transient occupancy data for Mono County
- o Philadelphia: None received yet
- o Las Vegas: Considerable economic and demographic data

For each case, we will choose the most appropriate indicator of tourist activity and perform time series analyses to determine whether there was a significant change in activity after the event of interest (e.g. the TMI accident). Local experts will be consulted to ascertain whether factors other than the event of interest had a significant influence. National and regional economic trends, as well as important short-term events such as airline strikes and gasoine shortagesmay be taken into account in the analysis.

Since more information is available for Las Vegas tourism than for tourism in the other case study areas, this analysis will be more extensive. The focus shall be upon the hotel fires and the operation of the Nevada Test Site. The dependent variable will likely be gaming revenues, since theyt may be considered an indicator of tourist activity. For the cases of the hotel fire, stock prices of undamaged hotels in the Las Vegas area may also be a useful indicator. Multiple regression analysis will be performed for both annual and quarterly data. Independent variables representing occurrence of the events of interest.

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