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IMPACT OF OFFSHORE NUCLEAR GENERATING STATIONS ON RECREATIONAL BEHAVIOR AT ADJACENT COASTAL SITES

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Impact of Offshore Nuclear
Generating Stations on Recreational
Behavior at Adjacent Coastal Sites

Abstract

A multi-faceted investigation was undertaken to project the impact of offshore nuclear power plants on beach visitation at adjacent beaches. 1. Related literature was reviewed concerning human adjustment to natural hazards, risk-taking behavior, and public attitudes toward nuclear power. 2. Approximately 2400 people were interviewed at beaches in three states with respect to: a) intended avoidance of beaches near a hypothetical floating nuclear plant (FNP), b) relative importance of proximity to a FNP, when compared to other beach attributes, c) onshore-offshore preference for coastal nuclear plant location, d) behavioral impact of NRC licensing of FNP's, e) relative tourism impact of coastal nuclear plant compared to coastal coal-fired plant, f) public concerns about nuclear safety, g) public attitudes toward alternative energy sources, h) public confidence in sources of information about nuclear power, i) visual impact of a FNP, and j) knowledge about nuclear power. 3. Four beach areas near currently operating coastal nuclear power plants were studied to assess impacts on tourism resulting from plant construction. Data suggest that proximity of a FNP is less important than other beach attributes in determining beach attractiveness, probably no more than (and perhaps less than) 5% to 10% of current beach patrons would avoid a beach after FNP siting three miles directly offshore, and impact of a FNP would decrease exponentially as distance away increased.

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Preface

The authors received the able assistance of individuals too numerous to mention, but special thanks are in order for some. J. Kenneth Mitchell at Rutgers University organized the interview team in New Jersey; Stephen Gunn of Connecticut College organized and oversaw interviewing at Cape Cod and near the Millstone plant; Jordan Louviere of the University of Wyoming provided considerable input regarding design and analysis of the information-integration tasks; Mary Lawrence patiently typed (and retyped) various drafts of the report and carried the brunt of other secretarial duties. Finally, thanks are due to all the student assistants involved with interviewing, coding, and other necessary tasks.

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IMPACT OF OFFSHORE NUCLEAR
GENERATING STATIONS ON RECREATIONAL
BEHAVIOR AT ADJACENT COASTAL SITES

Chapter 1

Problem Statement and Conceptual Framework

Certain elements of the nuclear power industry favor siting of nuclear generating plants offshore in the coastal waters of the United States. The units would be manufactured at a central facility and towed by tugboat to the desired location off the shoreline. There the unit(s) would float, moored within a man-made breakwater for protection against storm action and collisions. Electricity would be transmitted to land by cables beneath the ocean floor.

This study explores questions regarding the behavioral consequences of floating nuclear plants (FNP's). Specifically, if a nuclear power plant were located off the coast of a beach community whose economy depends on tourism, what impact would the plant have on tourism and beach visitation? This report assesses the potential magnitude of beach avoidance associated with floating nuclear plants and investigates variables which may affect the beach visitation decision.

An individual's trip to a beach is the result of a complex decision-making process. A simplified representation of the process is depicted in Figure 1.1. Two general factors are likely to be involved in the beach-goer's decision: his perception of the quality of the particular beach and his general attitude toward beaches relative to other forms of recreation. His attitudes and beliefs about nuclear power may influence his perception of beach quality if a nuclear plant is sited offshore.

Principal factors affecting perceived quality of a particular beach having a floating nuclear plant offshore are 1) proximity to home, 2) crowding, 3) cleanliness, 4) quality of facilities, 5) proximity of offshore nuclear plant, and 6) proximity of other potentially noxious or unaesthetic facilities. The first four of the variables have been identified in other studies (Stutz and Butts,1975; Mott-Smith, 1975) and in a survey conducted in conjunction with the research reported here (Baker and West, 1976) as being

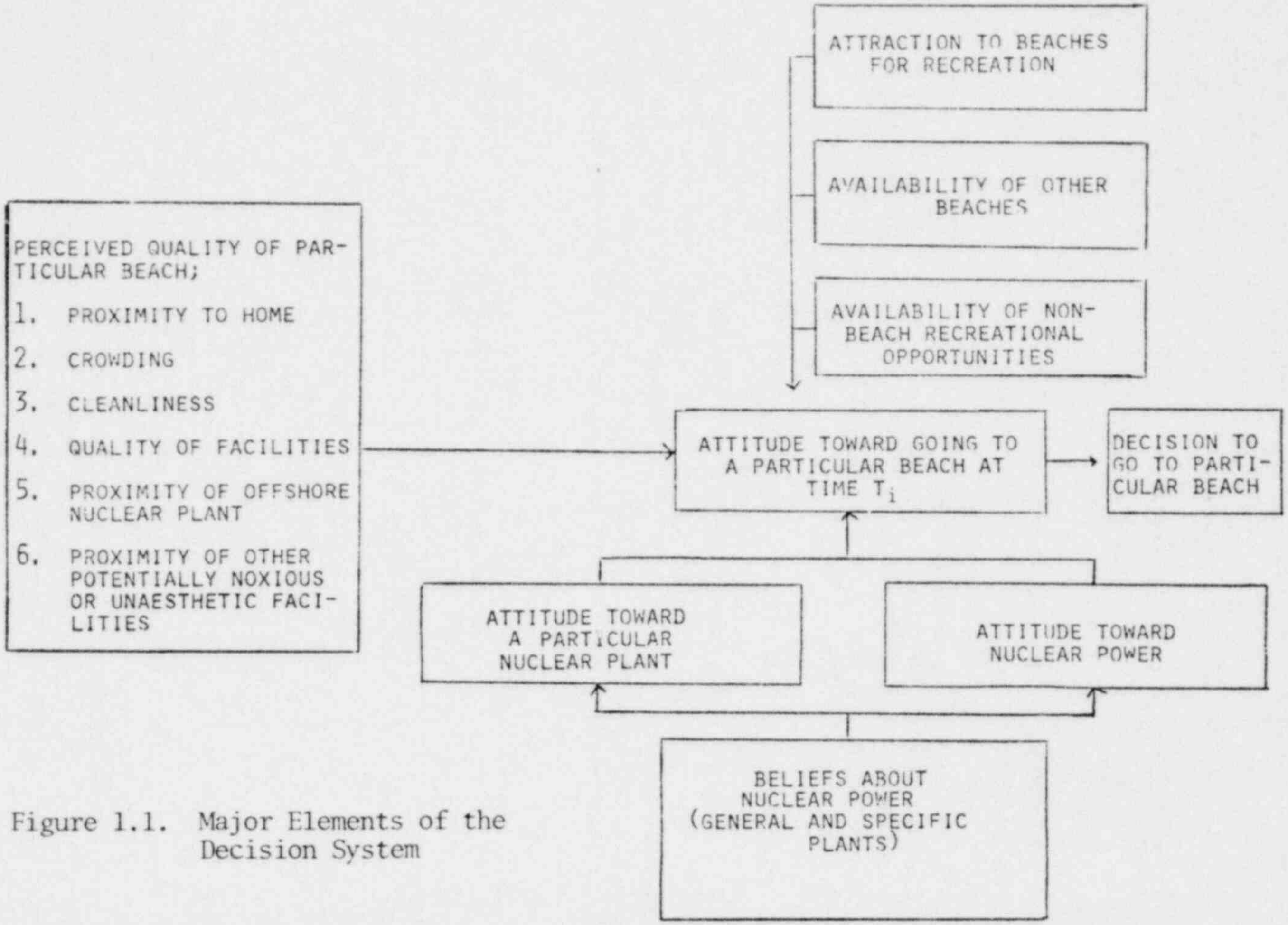

Figure 1.1. Major Elements of the Decision System

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the principal characteristics normally considered in choosing among beaches. The fifth and sixth variables are of relevance to the special case being considered here.

Also significant in the beach-visitation decision is the relative importance of beach-going to the person's general recreation behavior. That is, a person to whom a beach vacation or visit is extremely important may react differently to a beach having a nuclear power plant offshore than a person to whom beach trips are only one of many enjoyable recreational experiences.

Finally there is a set of factors relating to the person's attitudes toward nuclear power. At least two subsets are relevant: 1) attitudinal components derived from beliefs about nuclear safety, and 2) attitudinal components derived from non-safety concerns such as environmental impact. Both subsets may apply to nuclear power in general and to a specific nuclear generating facility.

The attitudes either toward nuclear power generally or toward a particular plant are primarily a function of beliefs about nuclear power or plant. The information influencing the beliefs may be of several types--on-site safety, waste disposal, economics, etc.--and may address specific events or issues individually (for example, an accident at a particular plant) or may be more general discourses (for example, a lengthy discussion about various aspects of nuclear safety). The information can be conveyed via a variety of media: television, newspapers, magazines, public addresses, movies, books (fiction or non-fiction), personal conversation, etc. The information may be pro-nuclear, anti-nuclear, or neutral. The decision-maker may receive information about nuclear power or a plant often or seldom. The source of the information may have high credibility or low credibility with the decision-maker.

As new information reaches the decision-maker, as characteristics of a beach change, and as the availability or characteristics of other recreational opportunities change, the person's decision to visit a given beach may change. The research reported here was designed to address the likelihood of such decision changes, given various scenarios.

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Chapter 2

Related Literature

There are three principal areas of previous research which relate most directly to the problem at hand: 1) natural hazards adjustment and perception, 2) risk-taking and subjective evaluation of risk, and 3) attitudes toward nuclear power.

Adjustment to and Perception of Natural Hazards

While behavioral research into nuclear risks has been relatively recent, human response to natural hazards has been studied for more than three decades. Prior to 1942 the only adjustment to floods which had received widespread attention was construction of protective structures. In that year White outlined a broad spectrum of alternative adjustments, most of which tended to minimize the damage potential of flood hazard. Within White's volume were three pages of assertions concerning awareness of the flood hazard as understood by flood-plain residents.

The essence of White's conclusion was that flood-plain dwellers tended to underestimate the magnitude of the hazard which faced them. During and soon after a given flood, the event's cognitive impact on affected individuals was significant, but as time passed without another major flood, complacency and false security permeated attitudes toward the hazard. Some floods were recalled more easily than others, but there was a propensity to believe that the worst events would not be repeated or exceeded. White attributed the decay of awareness to infrequency of flood events, coupled with the "frailties of human memory (p. 51)."

Not until 1956 (when White returned to the University of Chicago faculty) did behavioral research in natural hazards resume. A team of researchers began a study of urban flood-plain occupance, and one of the investigators' prime tasks was to determine what factors were responsible for spatial and temporal variations in the adoption of adjustments to flood hazard (White et al, 1958). Flood-plain managers were interviewed regarding estimation of flood hazard, confidence in structural protection works and general technological advances in flood control, and awareness of the theoretical range of adjustments. The findings lent credence to White's earlier assertions.

The next few published studies refined the research paradigm substantially and provided much of what is presently understood about human adjustment to natural hazards and therefore will be discussed in some detail. Roder (1961) and Burton (1961) each investigated the expectancy of future flooding as conceived by flood-plain dwellers and attempted to correlate the expectations (optimistic, neutral or pessimistic) with experience of past floods, age, income, and knowledge of protective flood structures in the respective areas. Expectation was found to vary only with experience. Roder and Burton also found widespread ignorance about flood-plain information sources.

Burton (1962) later made a significant contribution in his study of agricultural flood-plain occupance. He found that agricultural managers were more aware of the magnitude of flood hazard than urban managers. He extended the generalization to within-group comparisons, concluding that heightened awareness of the hazard varies with "closeness" to or dependence on the resource affected by the hazard. Burton also substantiated another of White's assertions of twenty years before, noting that accuracy of hazard evaluation was greater at sites which had been more frequently flooded.

Also in 1962, Kates investigated the decision-making process which presumably occurs when flood-plain residents evaluate the hazard and alternative adjustments. He found Simon's bounded rationality model (1957) to apply to flood-plain managers, most of their decisions to be conscious, and satisficing rather than optimizing to be the principal choice criterion. Kates extended and formalized White and Burton's findings regarding frequency and awareness of flooding into what he called a "certainty" hypothesis. His position was that as the certainty of hazard recurrence increases (as determined by technicians), 1)the greater is the collective experience with flood hazard, 2) the flood-plain dwellers are more likely to view natural events as repetitive (as opposed to unpredictable), 3) the more affirmative are the dwellers' expectations of future flooding, and 4) the greater is the adoption rate of adjustments. Kates found adoption of alternative adjustments to be associated with expectation of flood recurrence and interpretation of the state of nature (determinate/indeterminate).

Where flooding had been relatively frequent (high certainty situation), experience acted as a good teacher. To abate flood losses man tended to repeat behaviors which had been effective in the past. Thus, a long history of floods enabled the adjustment process to evolve, eliminating practices which had been unhelpful. Conversely, infrequent experiences tended to result in misconceptions regarding the efficacy and reliability of various practices.

Kates found that individuals attempt to reduce the uncertainty of hazard by viewing events as more regular than random and people tend to view annual probabilities as being dependent, an occurrence in one year reducing the likelihood of recurrence the following year.

Kate's monograph also popularized use of the term "perception" in natural hazard research. Thereafter it became standard practice to refer to "perception of the hazard" or "perception of alternative adjustments" in place of earlier references to "evaluation" or "awareness."

In 1964 White formulated a decision matrix involving alternative adjustments and the principal factors which affect the choice process. His position was that the theoretical range of choices available to decision makers is actually reduced to a "practical" range by socio-cultural and cognitive conditions. A simplified scheme for delineating factors affecting choice of adjustment would be to consider the manager's perception of 1) the theoretical range of choice, 2) flood hazard, 3) technology, 4) economic efficiency per adjustment, 5) spatial linkages between action in the flood plain and resource use in other areas, and 6) social constraints.

The first study involving hazards other than flood was Saarinen's study of drought (1966), followed by investigations of urban snow, coastal storms, hail storms, tornadoes, hurricanes, earthquakes, coastal erosion, strong winds, landslides, frost, avalanches, and volcanoes (see White, 1974 for a representative sample of recent studies.)

The findings in the studies have generally supported the conclusions regarding flood hazard. Most of the few "conflicting" findings such as Burton, Kates, and Snead's (1969) observation of greater awareness of coastal storm hazard than was found in flood-plain research do not actually contradict earlier findings. For example, the coastal storm awareness should have been anticipated by integrating Kates's certainty-awareness hypothesis with Burton's awareness-dependence findings. Thus, it appears that most behavioral aspects of adjustment to hazards apply across hazards.

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Summary. Most studies have revealed a willingness to occupy hazard-prone areas because 1) dwellers tend to believe the benefits of occupance exceed the risks, 2) dwellers tend to underestimate the likelihood of a hazardous event, 3) dwellers tend to underestimate the likelihood of being adversely affected by a hazardous event if it does occur, and 4) dwellers underestimate the extent of damage they are likely to suffer if they are affected by a hazardous event.

Risk Evaluation and Risk-Taking

The risk-taking literature deals primarily with artificial laboratory situations and suggests little of use in projecting impacts in the problem of concern here. Several recent experiments, however, while not addressing actual real-world risk-taking propensity, are enlightening with respect to how individuals reach their assessments of risks, likelihoods, and consequences of uncertain events. Much of the notable research has been conducted at the Oregon Research Institute by a team now with Decision Research, Inc. Most of the work discussed below is summarized in Slovic (1964) and Slovic, Fischhoff, and Lichtenstein (1976a).

Risk-taking. Several early studies attempted to correlate risk-taking propensity with personality attributes and other variables. The experiments employed a variety of risk-taking measures in laboratory situations (for example, gambling bet preferences and guessing on tests on which incorrect responses are subtracted from one's score). The generalizations were inconsistent depending on the measure employed and generally inconclusive. Slovic has suggested that the inconsistencies stem from the studies' failure to take into account the multidimensionality of risk and motivational and other influences (1964). Several studies have shown that risk-taking propensity is reduced when actual (real-world) consequences are involved, as opposed to purely hypothetical consequences as employed in most risk-taking studies (Feather, 1959; Shulman, 1961; Rawson, 1961; Slovic, 1969).

Risk Evaluation. Simon's theory of bounded rationality proposed that individuals simplify real world decision-making situations due to their inability to fully comprehend and process all the relevant information necessary to optimal choice (1957). With respect to the simplified model, individuals approximate rationality, but that rationality seldom resembles real-world optimality. Recent studies have supported Simon's contention, as illustrated below.

Expected Value. Edwards (1954) and others suggested that rational decisions would be made so as to maximize the expected value of payoff or benefits over several risky situations. Most experiments to test the proposition (usually involving gambling bet preferences) have failed to substantiate it, however. Two studies (Lichtenstein, Slovic, and Zink, 1969; Slovic and Tversky, 1974) carefully instructed subjects in the notion of expected value and still found that it was either rejected or employed improperly. Shanteau (1974, 1975) has noted, however, that individuals do multiply probability and payoff in some manner to arrive at an overall evaluation of the worth of a risk choice. That is, risk evaluation is not a simple additive combination of probability and payoff, but a multiplicative combination. A particularly interesting finding contrary to the expected value model is that a given likelihood may be valued differently depending on whether it pertains to a positive or to a negative consequence. Similarly, a given magnitude of consequence may be given a different importance weighting depending on whether it is a desirable consequence (Slovic and Lichtenstein, 1968). This suggests that beach-goers may not integrate likelihood and consequence of a nuclear accident in a mathematically optimal manner when evaluating the overall risk.

Law of Small Numbers. Various studies have observed that individuals do not understand the principles of generalizing from a subset (sample) of events to the set (population) of all similar events. This has led to what Tversky and Kahneman (1971) have called the "law of small numbers": individuals place undue confidence in conclusions suggested by small numbers of cases. Failure of people to understand that reliability decreases and variance increases as sample size decreases has been found among both the lay public (Kahneman and Tversky, 1972) and among scientists (Tversky and Kahneman, 1971). Thus, even one severe mishap at a nuclear power plant may lead the public to believe future mishaps are likely.

Others Errors in Subjective Probability. Kahneman and Tversky (1973) have also found other cognitive behaviors which deviate from normative statistical procedures. The first is that individuals place more emphasis on new, specific information about an event than they place on probabilistic information they had about the event before receiving the specific information. For example, if one is given the probability of a certain type of nuclear accident and then that accident actually occurs, the person will subsequently view its recurrence as being more likely than the given probability.

Slovic (1972) and Tversky and Kahneman (1974) have documented a phenomenon they have called "anchoring". That is, after an anchor (or starting point) is given by a person as a first approximation to an estimate, he revises it inadequately when given additional information. Thus, one's initial estimate will bias his eventual estimate. The principle is also supported by individuals' reluctance to regress their estimates toward a group average when they learn that their information has low validity (Kahneman and Tversky, 1973). This process tends to moderate changes in beliefs brought about by the "law of small numbers" and the recency effect discussed above.

Tversky and Kahneman (1973) have also found what they term an "availability" bias. The notion is that one's judgment about an event's probability depends on the person's ability to recall or imagine instances relating to the event's occurrence. Actual frequency is a desirable contributor to "availability", but there are also contaminating factors such as recency of the event's occurrence and the emotional involvement the event holds for the person. Slovic, Fischhoff, and Lichtenstein (1976a) recently illustrated the principle by having subjects judge the more likely of 106 pairs of 41 causes of death. Individuals were generally successful in choosing the actual more likely cause only when it was at least twice as likely in reality. Causes of death whose probabilities were seriously overestimated were accidents, cancer, botulism, and tornadoes, all of which get considerable media attention, thus creating high availability. Asthma and diabetes--two ailments receiving little public notice--were underestimated. Nuclear accidents were not included in the list, but they will probably have increasing "availability" in the future, as media discussion increases.

Slovic, Fischhoff, and Lichtenstein (1976b) have also documented a phenomenon labelled the "certainty illusion." The notion, essentially, is that people have terrific confidence that some things are definitely true--absolutely certain--when in fact the "facts" are untrue. Thus, individuals may have certain beliefs about nuclear safety which will be difficult to change.

Hindsight. Fishhoff (1974) has investigated the process by which individuals tend to believe "they knew it would happen" after being told of the occurrence of a previously unanticipated event. That is, people tend to believe that which has occurred was obviously inevitable and they knew it would occur, even though they did not in fact anticipate the event. Fischhoff has pointed out that this false self-confidence can prevent our learning from surprises--that is, failing to recognize the fact that we were surprised by an event.

Knowledge about Knowledge. Individuals do not predict accurately how well they have answered questions (Lichtenstein and Fischhoff, 1976). In general there is a tendency to be overconfident of responses to difficult questions and underconfident about responses to easy questions. Thus, some individuals may have certain correct beliefs about nuclear power which are very susceptible to change, and other incorrect beliefs which are not likely to change.

Risks and Benefits. Starr (1969), using a technique he calls "revealed preference" asserts that society is willing to accept risks roughly proportional to the cube of the benefits and that it (society) is willing to accept risks roughly 1000 times greater if the risks are voluntary than if they are involuntary. Recent laboratory studies tend to support Starr's generalizations (at least ordinally) but also suggest that other factors besides voluntariness may affect the risk-benefit relationship (Fischhoff, et al., 1976).

Attitudes toward Nuclear Power

Recently investigations have been undertaken to assess individuals' reactions to the risks posed by nuclear power. Studies of attitudes and beliefs about nuclear power have been comprehensively summarized by Kasperson, et al. (1976), and the following discussion draws heavily on their work. Results of other studies have also been integrated into this review, however.

Table 2.1, an expanded version of one prepared by the Kasperson group, summarizes the results of various public opinion and electoral polls regarding nuclear power. Most surveys and votes have shown the public to be in favor of nuclear power (usually over 60%) by a two or three-to-one margin. The most notable exception in the U.S. was a survey in Indian Point, N.Y. (site of a nuclear plant) where supporters and opposers were equally divided. In a number of foreign polls supporters have been in the minority, although this was not the case in Canada or London.

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Table 2.1. Summary of Public Opinion Surveys and Electoral Referenda Regarding Restrictions on Nuclear Power

Survey	Site	Scope	N	Attitude Toward Nuclear Power: Support	Oppose	No Opinion
Harris (1975)	U.S.	National	1,537	63%	19%	18%
Harris (1975)	U.S.	3 Nuclear Plant Sites	301	63%	23%	14%
Greer-Wooten and Mitson (1976)	Canada	National	2,100	68%	21%	11%
Kasperson, et al (1976)	Boston, U.S.A	1 city	100	69%	24%	7%
	London, England	1 city	100	62%	25%	13%
	Toronto, Canada	1 city	100	83%	9%	8%
	Boston, U.S.A.	1 city	243	58%	42%	
	Indian Point, NY	1 city region	100	47%	49%	4%
	Waterford, CT	1 city region	100	65%	28%	7%
	Seabrook, NH	1 city region	100	63%	32%	5%
Central Surveys (1972)	New Hampshire	2 county region	350	52%	10%	38%
Dalèug (1975)	Sweden (1974)	National	600	?	59%	?
	Sweden (1975)	National	600	31%	63%	
"Une Semaine Nucleaire" (1975)	France	National	?	51%	?	?
Smith and Spanhoff (1976)	Netherlands	National	?	20%	33%	45%
Sundstrom, et al (1977)	Hartsville, Tenn	County region	288	68%	31%	
Vester (1976)	Birkenhead, N.Z.	1 city	?	38%	62%	
Wu, et al (1976)	Birkenhead, N.Z.	1 city	60 community leaders	43%	57%	

Table 2.1. (continued)

Referendum State	N	Disposition Toward Restricting Nuclear Power: Against	For
California (June 1976)	5,913,267	67%	33%
Arizona (Nov., 1976)	694,295	70%	30%
Colorado (Nov., 1976)	1,006,188	71%	29%
Montana (Nov., 1976)	296,482	59%	41%
Oregon (Nov., 1976)	989,610	58%	42%
Ohio (Nov., 1976)	3,579,634	68%	32%
Washington (Nov., 1976)	1,252,502	67%	33%

Referendum County	N	"Do you want a floating nuclear power plant located in the Atlantic Ocean off the coast of Atlantic City?" Yes	No
Atlantic County, NJ (Nov., 1976)	40,335	37%	63%

Reasons for Support or Opposition. Most studies have shown safety to be the overiding issue of concern to both supporters and opposers of nuclear power. The Harris Poll (Louis Harris, 1975) found only 20% of the public believing that nuclear plants were unsafe, but there apparently is considerable geographical variation. Kasperson, et al. (1976) found 44% of interviewees in Boston to view nuclear energy as unsafe, and in three cities having reactors (Indian Point, N.Y.: Waterford, Ct.; Seabrook, N.H.) the figure was 30%. Sundstrom, et al. (1977) found supporters in Hartsville, Tenn. (site of a proposed nuclear power plant) to view safety and hazards as being less likely than opposers. A poll in a New Zealand city (where opposers outnumbered supporters) indicated that supporters and opposers tended to differ on many issues other than safety, such as beliefs about beneficial effects of the plant, environmental degradation, and cost of electrical production (Vester, 1976).

Correlates with Attitudes toward Nuclear Power. One of the most interesting aspects of the attitude surveys is the attempt to discover variables which predict attitude. Knowledge about nuclear energy--potentially important because of its ability to be manipulated--was found to be inversely related to support for nuclear power by Kasperson, et al. (1976). The same study found educational attainment to be inversely related, but the Harris Poll and Mazar (1975) data indicated just the opposite. One clear correlate is sex: men are much more likely to support nuclear power than women are (Louis Harris, 1975; Kasperson, et al., 1976; Sundstrom, et al., 1977). The Harris data also showed environmentalists more likely to oppose nuclear power and that opposition is greater in the West.

Stability of Support. Harris Polls taken four times from September, 1973 to April, 1975 revealed nationwide support to be relatively stable: 64%, 75%, 66%, and 67% respectively (Louis Harris, 1975). Kasperson, et al. (1976) asked individuals if their beliefs about nuclear safety had changed, and 20% replied affirmatively, most of those indicating the change was to believe that nuclear power was less safe. A particularly interesting trace of changes in nuclear attitudes was conducted during a one-month period prior to the California Referendum on Proposition 15. The situation is unique because of the intense debate and public advertising blitzes conducted by proponents and opponents of nuclear power. Opposition to the referendum (that is, support for nuclear power) grew from 41% to 54% to 56% over the month-long time span (San Francisco Chronicle, 1976). Increase in support apparently came from previously "undecided's".

Summary

Previous empirical and theoretical work is of little use in making forecasts regarding the problem at hand. Studies which do exist suggest some general tendencies but offer no help in making quantitative estimates of behaviors. The hazard literature suggests that individuals will underestimate and tolerate risk from certain rare events. The risk-taking literature says nothing about the absolute level of risk people are willing to take, but it does suggest that initial beliefs about risks, actual experiences with risk sources, benefits stemming from the risk source, and ease of imagining the risk consequences are important to the evaluation of risk. The nuclear attitude surveys indicate that about a third of the public opposes nuclear power, the primary reservation is safety, and opposition may or may not increase with increased knowledge about nuclear power. These general attitudes toward nuclear power may have little relationship to an individual's willingness to visit a beach with a nuclear power plant off-shore, however.

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Chapter 3

Methodology

The approach employed here to investigate the tourism impact of floating nuclear plants consisted of three parts: 1) review of existing literature, already presented 2) personal interviews with beach-goers, and 3) assessment of the beach visitation impacts of selected existing nuclear power plants at beach locations. The various facets of the study should be viewed as complementary, each component providing additional insights into interpretation of the others. In the final chapter, results from the three major sections will be integrated to yield an overall assessment of the potential tourism impact of floating nuclear plants. Because the most important facet of the study revolves around the second of the stages listed above, the methods used in that phase will be discussed in greatest detail below.

Sites and Sampling

After consultation with Nuclear Regulatory Commission staff, four sites were chosen for interviews with beach visitors: the Panama City Beach-Ft. Walton Beach area of northwest Florida; the Clearwater-St. Petersburg Beach area of south Florida; the south shore of Cape Cod, Massachusetts; and the Atlantic County-Ocean County beach areas of New Jersey (see Figure 3.1). The sites were chosen primarily due to their representativeness of a range of beach recreation opportunities: each depends upon a different regional clientele and affords the user different experiences; the type of regional patronage at the northwest Florida site is similar to that of many beaches from Texas to North Carolina; tourism patterns at the south Florida site mirror those at other Florida beaches except Miami and the panhandle; the New Jersey and Cape Cod sites represent beach-recreation opportunities for the Middle Atlantic and Northeastern states. The sites were chosen not because of any hypotheses regarding differential reactions of tourists to offshore power plants, but to include a broad enough range of sites to enhance possible efforts to generalize to other places. The New Jersey site provides the added attraction that an offshore nuclear installation (the Atlantic Generating Station) has been proposed for that area. This afforded the opportunity to pose questions of a less hypothetical nature to beach-goers. Decisions regarding representativeness of various beach areas were reached after consultation with Florida Division of Tourism officials and conversations with numerous individuals having personal familiarity with different beach areas.

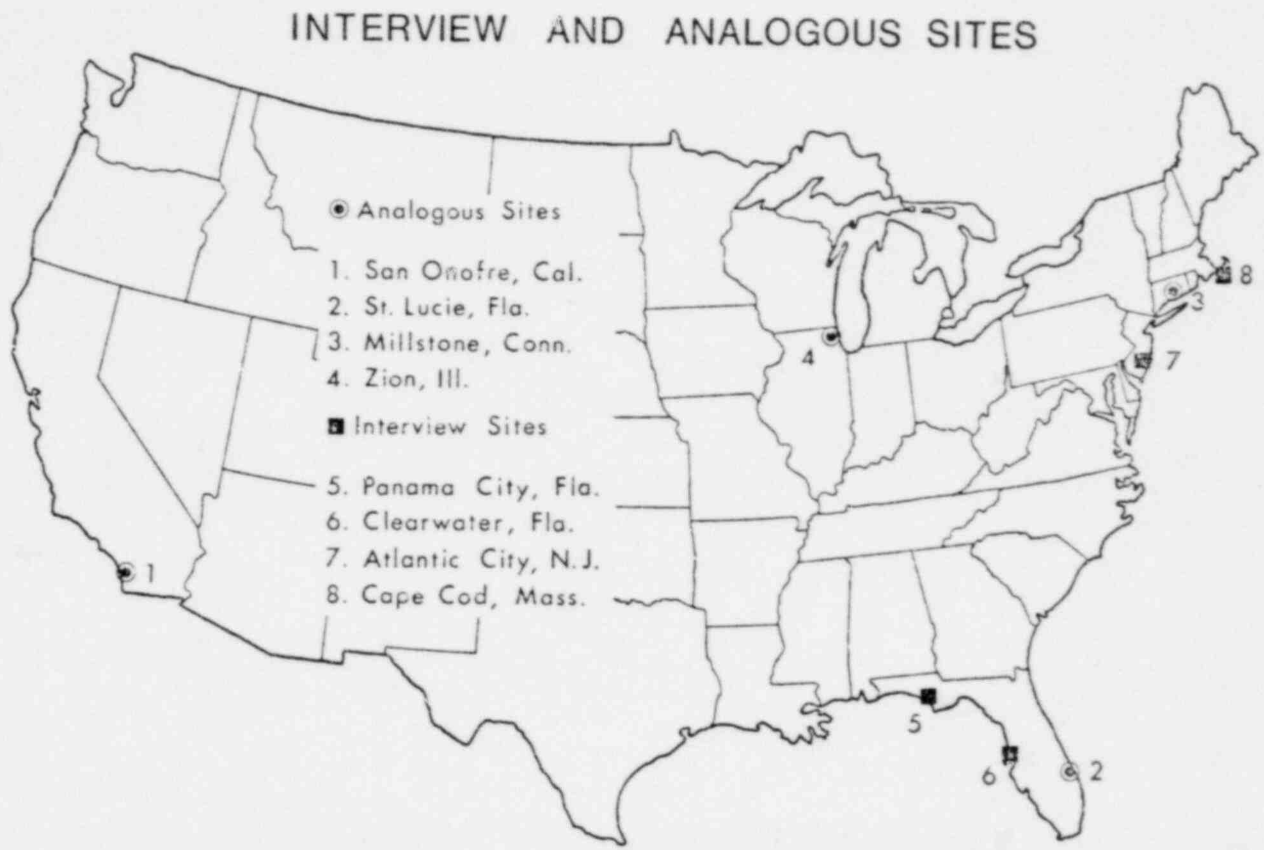

Figure 3.1. Field Study Locations

The northwest Florida beach areas advertise their white sandy beaches and clean blue-green waters. The beach is somewhat narrow in places and eroding. Development along the beach is diverse, ranging from high-rise condominiums and large hotels, to densely located, more modest motels, to amusement parks, to areas of sparse beach-front development where the dunes are relatively unaltered by man. The two major clusters of interviewing were Panama City Beach and Fort Walton Beach, the two areas being approximately 50 miles apart. Most interviews were conducted in the Panama City Beach region, over an area extending approximately 15 to 20 miles.

The south Florida site is in Pinellas County, with most interviewing being done at Clearwater Beach and St. Petersburg Beach. The beach is wide and the water clear, most of the beach areas more crowded than the northwest Florida areas. Condominiums and motels are prominent, although lower density residential development is interspersed. Dunes are not in evidence. The interviewing was conducted at points along approximately 20 miles of beach, although within each of the four or five clusters, less than a mile of beach was covered.

In New Jersey interviews were conducted in seven areas: Ocean City, Margate City, Atlantic City, Brigantine Beach, Beach Haven, Surf City, and Barnegat Light, from south to north, over a two-county region covering approximately 40 miles. The points were chosen to provide an evenly spaced distribution of places at various distances in both directions from the proposed Atlantic Generating Station (AGS) site. A criterion of proximity to the proposed AGS location was employed to assure reliable estimates at points closest to the proposed reactor site. The Oyster Creek nuclear generating plant is located approximately five miles from the city of Barnegat Light, north of the city on Barnegat Bay. The plant was not visible from interview points on the Atlantic beach. The seven beaches vary considerably with respect to type and extent of development, ranging from the intense commercial activity of Atlantic City, to the dense crowding of Beach Haven, to the relatively sparse development of Brigantine and Barnegat Light.

Five municipalities were used as first-order interview clusters along the south shore of Cape Cod--virtually every developed beach area to which the public has access on the mainland. All beaches were public beaches, owned by the local municipality, with no permanent commercial development located on the beach. Municipally operated parking, sanitary, and mobile eating facilities existed at most areas. Residential development bordered some of the municipal beaches. Commercial development is present in some areas but is set well back from the beach. The south shore of Cape Cod extends approximately 25 to 30 miles.

At each site approximately 600 individuals were interviewed on-the-spot at the beach. Data was collected at least three different times from late July through August, 1976. At the Clearwater-St. Petersburg site, one-third of the interviews were conducted in March, 1977 to include the early spring tourists.

Multi-stage cluster sampling was used to choose respondents: Several beach locations (towns, municipalities, etc.) were chosen along each of the four coastlines, serving as the first-stage clusters, then certain beach areas were chosen within each first-stage cluster, and then individuals were selected at each spot. The individuals in each cluster were chosen by a spatially systematic procedure (every tenth person, for example) with random starts. Sample size at each beach location was approximately proportional to the number of people at the location. In New Jersey an effort was made to augment sample sizes at locations nearest the proposed reactor site to assure reliable estimates of impacts at those locations, regardless of population size. In all cases the population of interest was current beach-goers; no effort was made to sample individuals who do not visit beaches at this time, although they could be considered potential patrons. Non-response rate (proportion of individuals sampled who refused to participate in the survey) was estimated to be roughly five percent overall--a very low figure.

Items Used in Interviews

Certain questions were asked of all respondents, but other questions were asked only of subsets of the total sample. Inclusion of all questions for each interviewee would have made the procedure excessively long. Figure 3.2 outlines the various sets of questions employed. The questionnaire combinations were color-coded for convenience of reference. All individuals were administered the "pink" form, and one of the other six forms depicted in Figure 3.2. Each form is described in detail below, and the actual forms are included as Appendix A.

Pink Form-Background data was collected from all respondents (for the specific questions asked, see Appendix A, Section I, referred to as the "Pink Form"). Those questions addressed four categories of information: 1) socio-economic and demographic data, 2) past and planned visitation of the beach where the interview

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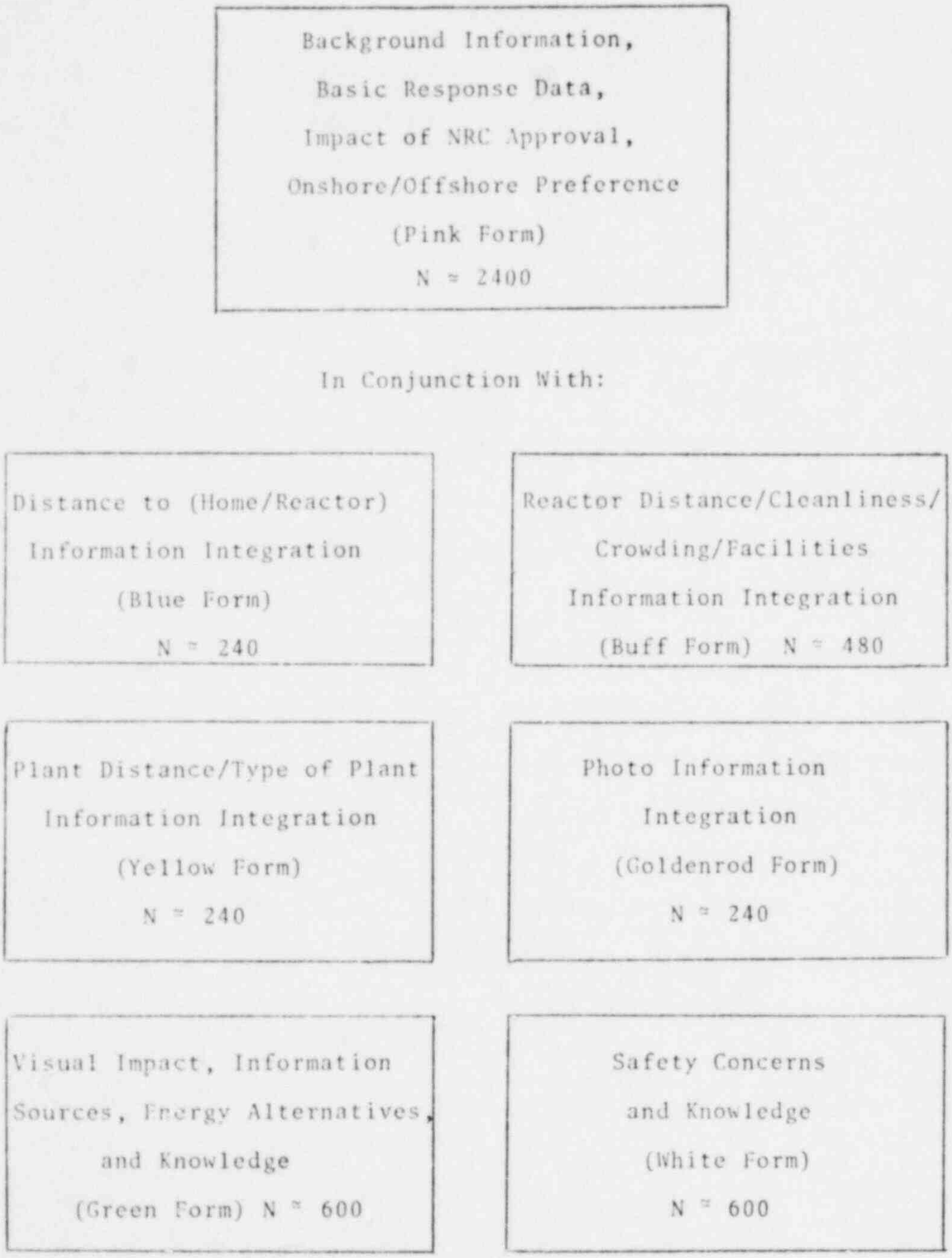

Figure 3.2. Questionnaire Sets Used in Study

was being conducted, 3) relative importance of beach-going to the respondent's recreation experience set, and 4) residential location. The background data was intended to provide a description of various characteristics of the samples--characteristics which could be tested later to assess their relationship to a person's tendency to avoid a beach having a floating nuclear plant offshore. For example, if individuals having high incomes are more likely to avoid a beach than low income people, that should be taken into account when projecting total economic impact on tourism.

All respondents in Florida and Massachusetts were asked whether siting of a nuclear power plant directly offshore (three miles) from the location of the interview at the beach would keep them from visiting that beach in the future. (See Appendix A, Section VIIA). Those who replied affirmatively were asked if they would return if the reactor were sited five miles down the coast; those continuing to reply affirmatively were progressively asked if they would return if the plant were ten, twenty-five, and fifty miles down-shore.

All respondents in New Jersey were given a parallel question. (See Appendix A, Section VIII). An offshore nuclear facility has been proposed for New Jersey, near Little Egg Inlet. Those interviewed at the seven beaches in New Jersey were told that fact, shown a map of the region indicating the proposed location, and told the distance to the proposed reactor site from their own location (distance varied from five to twenty-two miles). Respondents were asked whether actual siting at the proposed location would keep them from returning to the beach where the interview was being conducted.

This very direct question was designed to provide a starting point for projecting beach avoidance. It was not expected to provide an accurate estimate of actual behavior but would be interpreted in light of results from other components of the study.

At all interview sites, individuals indicating that offshore siting (directly offshore in Florida and Massachusetts, and the proposed site in New Jersey) would keep them from returning to their beach were asked a follow-up question (see Appendix A, Sections VIIB and VIIIB). They were asked whether certification of the offshore reactor's safety by the U.S. Nuclear Regulatory Commission would change their decision. The purpose of the question was to test the stability of responses to the previous question generally and to assess the potential impact of this specific piece of information. It was suspected that a large number of respondents, having given little or no prior thought to their reaction to a floating nuclear plant, may not be aware that there is a Federal safety certification procedure. Thus, if all respondents had that knowledge, would it affect their decision whether to avoid a beach?

All respondents were also asked whether they would prefer offshore or onshore siting if a coastal nuclear power plant were to be located in the area of the interview (See Appendix A, Sections VIIC and VIIIC).

Information-Integration Tasks-One difficulty with the hypothetical questions dealing with response to an offshore nuclear installation is that respondents are not forced to make trade-offs with other variables which affect their choice of beach. Half the subjects received one of four "information-integration tasks" to force those other considerations to be made, as they might be in reality (See Appendix A, Section VI). This technique describes situations or entities to the respondent by telling him about selected attributes of a situation or entity. For example, a particular beach can be described in terms of how crowded it is, how clean it is, how good the facilities (amusements, restaurants) are, and how far away from one's home it is. These variables are the ones which were identified in previous research as being the most important in determining the desirability of a beach for most people. People can be given several different beach descriptions based solely on these variables and asked to rate each beach as to its desirability. For example, one beach may have good facilities, be clean and uncrowded, but far away, while another has good facilities, is littered and crowded, but nearby. In deciding how attractive each is, the subject must make trade-offs among the attributes. Several such judgments can enable researchers to find out just how important each variable is (the main purpose for employing the technique in this study), what effect the variables have on the importance of one another, and even what equation, or formula, the person's judgments appear to follow (whether he realizes it or not). In short, the procedure tells how the subject is putting together, or integrating, the information given to him, thus, the term information-integration.

Buff Form - Approximately 1' subjects at each site were given several beach descriptions based on three of the variables used in the example--cleanliness, crowding, and facilities--but added was a fourth variable: proximity of an offshore nuclear power plant. ("Buff Form" in Appendix). Thus, the judgments reveal what impact having such a plant at varying distances would have on the desirability of beaches, how important that would be when compared to the importance of other variables, and how proximity of the plant would interact with the other variables to affect desirability.

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Blue Form - In a separate task administered to approximately 60 people, only two variables were used: proximity of an offshore nuclear plant and distance of the beach from one's home. ("Blue Form").

Yellow Form - Still another group of approximately 60 received a different task. This one specified the existence of either a nuclear-powered plant or a coal-burning plant at various distances from the beach. ("Yellow Form'). Thus, the judgments indicate the relative impacts of coal and nuclear power plants on beach attractiveness.

Goldenrod Form - A final information-integration experiment differed in that it supplemented verbal descriptions with a map and photographs and did not restrict the variables which a person could use in evaluating beach desirability. ("Goldenrod Form"). A map of the actual vicinity in which the interview was being conducted was shown to the respondent, and on the map five spots along the coast were marked. A panoramic set of photographs taken at each spot was also presented (the photographs showing several views of the respective beach), and the subject was asked to rate each spot with respect to its attractiveness. Then a mark was placed on the map indicating an offshore nuclear power plant. The five beaches were rated again, and respondents were asked to indicate which factors about the beaches were most important to them in their evaluations of beach attractiveness. At a later date students at Florida State University were asked to rate the beaches with respect to cleanliness, crowding, extent of development, quality of facilities, and overall desirability in order to provide subjective levels of the independent variables (beach characteristics). The Goldenrod Form was designed to assess the relative importance of the same sort of variables investigated with the Buff Form. Photographs were used, however, to give respondents more latitude in employing various attributes of the beaches in reaching their overall evaluations of the beaches. That is, specific attributes were not delineated for the respondents. The two major deficiencies in the Goldenrod task were 1) quantitative judgments about the beach attributes were supplied by a sample different from the one supplying overall beach ratings, and 2) there was the possibility that beach attributes would be intercorrelated, thereby complicating and possibly invalidating the planned statistical analysis.

White Form - Another subset of the sample--150 people at each of the four interview sites--received a set of questions dealing with concerns they might have about offshore nuclear power plants (see Appendix A, Section II, referred to as the "White Form").

Iritially, respondents were asked an open-ended question about any concerns felt. After that, a list of ten events which some individuals might have concern about was read to the interviewees. Six of the events were nuclear safety issues (leaks, sabotage, transportation accident, storm damage to reactor, core melt, and atomic explosion), and four were other beach-related safety issues (hurricanes, tornadoes, oil spills, and shark attacks). The nuclear events were selected after consultation with NRC staff and after a pilot survey. Respondents were asked to rate the likelihood, magnitude of consequences, and their overall concern for each of the events. Likelihood was rated on a twenty-one point scale, with zero implying that the event would definitely not happen during a thirty-year time span and twenty implying that the event definitely would happen. Consequences referred to number of people expected to be killed, injured or suffer long-term damage to their health if the event occurred. A twenty-point (categorical) semilogarithmic scale was provided to facilitate responses (0; 1; 5; 10; 25; 50; 75; 100; 250; . . .100,000). A twenty-one point scale was also employed for the overall concern rating, with zero implying no concern at all and twenty implying extreme concern.

The open-ended question at the beginning of the White Form was intended to allow respondents to specify their conerns about floating nuclear plants, whatever the concerns may be. It has the advantage of being non-directive, but it has the disadvantage of omitting responses which do not occur to the respondent readily but which may be very important to him after more careful thought. The ratings questions about specific perceived nuclear risks were intended to 1) quantitatively assess the relative concerns with various events, 2) assess whether the concerns stemmed from perceived likelihood of the events or from the perceived consequences, and 3) compare concerns about the nuclear events with concerns about non-nuclear risks present at the interview sites.

An additional set of questions dealing with knowledge about nuclear power was administered to all interviewees receiving either the White Form or the Green Form which is discussed below (see Appendix A, Section IX). Six multiple choice questions dealing with the following topics were asked: 1) nuclear fuel, 2) associated terms, 3) portion of nation's electricity generated atomically, 4) radioactive half-life, 5) worst possible accident at nuclear plant, and 6) harmful by-products of fission. Two questions also inquired whether the respondent was aware of nuclear generating facilities in his state of residence or in the state where the interview was conducted. The first six questions were derived from those used by the Risk Assessment of Rare Events (RARE) project at Clark University.

The knowledge test was included to assess the relationship between knowledge about nuclear power with beach avoidance. If such a relationship exists then awareness of it may be useful in anticipating future changes in beach avoidance, given various scenarios regarding changes in public knowledge about nuclear power.

Green Form - Another subset of the sample--150 at each site--received a different set of questions (see Appendix A, Sections III, IV, and V, referred to as the "Green Form"). The first part of that questionnaire dealt with the overall desirability of energy options (solar, coal, oil, nuclear, and hydro). A twenty-one point rating scale was used. The second part dealt with confidence which the respondent had in various potential providers of information about nuclear power (NRC, utility companies, environmentalists, news media, government scientists, university scientists, politicians). The rating was on a twenty-one point scale. These two questions are modified versions of questions developed by Project RARE. Both sets of questions were included so that tests could assess the relationship between the attitudes measured and beach avoidance.

Part three of the Green Form attempted to assess the visual impact of an offshore nuclear facility. Offshore Power Systems, a firm which plans to manufacture offshore plants, has prepared a color brochure showing an artist's conception of two units three miles offshore from an isolated beach on a slightly overcast day. An enlarged (8 in.X 10 in.) copy of the central panel of the brochure was used in the study (the side panels of the brochure showed a broader expanse of beach without offshore structures). Respondents were first shown a photograph of the beach with no structure offshore and asked whether they would visit the beach. They were then asked whether they would visit the beach if a nuclear power plant were offshore. Finally they were shown a photograph of the beach with the artist's conception of the offshore plants and asked whether they would visit the beach.

The potential visual impact of an offshore nuclear plant is important for at least two reasons. First, it may reduce the aesthetic attraction of the beach, regardless of perceived safety. Second, it may create awareness of the plant, where such awareness may not exist if the plant were closeby but not in view from the beach. While the visual impact of a floating nuclear plant may be important, however, it is extremely difficult to assess. Analogues such as offshore oil platforms are not perfectly suitable because the concerns stemming from one's awareness of the structure are probably very different from those stemming from one's awareness of a floating nuclear plant. The photographs employed in this study most likely fail to create the same visual impression as one would experience while looking at the actual beach. It is the researchers' opinion that the offshore nuclear plant appears more imposing in the photograph used with the beach interviews than the plant appears in the Offshore Power Systems panoramic illustration. Also, the photograph shows a view of the plant as it might appear three miles directly offshore only. No attempt was made to assess visual impact at distances farther away.

The same questions pertaining to knowledge described in the White Form were also administered to respondents receiving the Green Form.

Analogous Sites

In addition to interv'ews at beaches described above, an effort was made to assess impacts on tourism at sites analogous to the hypothetical offshore nuclear situation. The purpose of including an investigation of analogous sites was to attempt an assessment of actual beach use near coastal nuclear power plants, viewing actual behavior as opposed to hypothetical, intended behaviors. Good analogues are difficult to find, and none are exceptional. Nuclear risk may be viewed quite differently than other risks of comparable magnitude, so non-nuclear beach risk situations such as coastal-sited caustic chemical plants were rejected as analogues. Instead coastal- (ocean or lake) sited nuclear power plants near recreational beaches were sought.

NRC Environmental Statements on coastal reactors were consulted, and discussions were conducted with NRC staff and others to choose analogous situations. A number of candidates were identified, with preferred criteria being 1) a relatively lengthy (five years) period of operation, 2) out-of-town commercial tourism activity at a nearby beach, 3) data on tourism both before and after reactor siting, 4) tourist awareness of the plant, and 5) visibility of the plant from the beach. No place met all of the criteria, but the following were investigated more closely: 1) San Onofre, California 2) St. Lucie, Florida, 3) Millstone, Connecticut, and 4) Zion, Illinois.

Three types of data were sought at each site: 1) interviews with beach visitors, 2) interviews with officials or special interests, and 3) objective data on tourism before and after plant construction. A brief, structured interview schedule was employed to interview tourists (see Appendix B). Questions dealt with awareness of the plant, effect on the individual's decision to visit the beach, the individual's beliefs about the plant's effects on others' decision to visit the beach, and background data about the respondent.

"Officials and special interests" consisted of elected and appointed officials, planners, managers of tourist-oriented facilities (public or commercial), and financial interests (realtors, lenders, etc.). The interviews were unstructured, some were personal, and some were by telephone.

The objective data was historical before-after tourism figures, preferably commercial and preferably accompanied by other data such that variations in tourism attributable to other factors could be isolated. Most data was in fact 1) non-existent for adequate periods before and after, 2) non-commercial, and 3) confounded with other variables.

Summary

There were two major categories of original data collected as parts of this investigation: 1) Interviews were conducted with approximately 2400 people at four beach areas in three states. Questions dealt with reactions to hypothetical offshore nuclear plants, beliefs about nuclear safety, knowledge about nuclear power, attitudes toward alternative energy sources, confidence in various potential sources of information, and general background data about the respondent. 2) Assessments were made at four additional beach areas near currently operating coastal nuclear power plants to ascertain impacts on beach patronage resulting from plant construction.

In this chapter the data-collection procedures were discussed in detail, and in many cases the rationale behind the procedures and potential deficiencies were specified. In the two following chapters results are presented, but the reader will be reminded of how and why the data were collected and, in some cases, their shortcomings.

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Chapter 4

Principal Beach Interview Results

Sample Characteristics

This initial section describes the socioeconomic and demographic characteristics of the respondents at the four interview sites. Three types of data were collected: (a) standard demographic data (e.g., age, sex), (b) family income and distance traveled from home to the interview site, and (c) data concerning the respondent's activities and length of stay at the beach. A later section examines the extent to which these variables are related to intentions to avoid beaches with offshore nuclear generating stations.

Tables 4.1a-4.1d summarize the demographic and socioeconomic data from the four interview sites. As can be seen, the four sites were generally comparable in terms of the socioeconomic and demographic data from the respondents. Across all sites, slightly more males were interviewed than females. Approximately half the respondents were between 20 and 40 years of age, the northwest Florida sample being younger overall than the other groups. Only at the south Florida site (8.9%) was more than six percent of the sample over 60 years of age.

Differences between the sites did emerge in the distance traveled from the respondent's home to the beach. At both the New Jersey and Cape Cod beaches, most of the visitors lived less than 150 miles from the beach. In fact, over one-fourth of the New Jersey respondents lived less than 50 miles away. In contrast, at the north Florida site, almost 45% had traveled between 150 and 300 miles, and another 32% had traveled even further. The south Florida site had a bimodal distribution: almost 40% were locals from within 50 miles, while nearly 47% were from more than 600 miles away. Over 80% of the respondents traveled to the beach by automobile at each site.

There were also differences in the planned length of stay at the four sites. While 89.7% of the north Florida respondents intended to stay one week or less, 65.1% of the New Jersey respondents, 59.5% of the Cape Cod respondents, and 71.8% of the south Florida respondents intended to stay one week or less.

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Table 4.1a. Socio-Economic and Demographic Description of Sample (N Fla, N = 596)

Sex	Male	49.7%
	Female	50.3
Age	<20	13.1
	20-29	36.4
	30-39	22.0
	40-49	18.0
	50-59	7.9
	≥60	2.2
Distance Traveled	≤50 Miles	8.1
	51-150 Miles	14.8
	151-300 Miles	44.8
	301-600 Miles	21.1
	>600 Miles	10.9
Mode of Travel	Car	94.5
	Plane	4.1
	Other	1.4
Length of Stay	≤1 Week	89.7
	>1 Week	10.3
Visited Interview Site Before	No	21.4
	Yes	78.6
Plan to Visit Interview Site Again	No	3.7
	Yes	96.3
Visit Other Beaches	No	43.7
	Yes	56.3
Activities Mentioned	Swim	55.5
	Fish	5.2
	Sun	57.4
	Boat	5.0
	Socialize	11.4
	Other Active	17.1
	Other Inactive	28.1

Table 4.1a. (cont.)

Favorite Place for Weekend Visit	Beach	58.1%
	Other	41.9
Favorite Place for Vacation	Beach	61.9
	Other	38.1
Income	No Response	5.5
	<$7,500	9.4
	7,500-14,999	24.4
	15,000-24,999	34.0
	25,000-49,999	19.1
	≥50,000	7.4
Education	High School	26.4
	Trade School	6.8
	Some College	23.9
	2 yr Degree	11.8
	4 yr Degree	17.4
	>4 yr Degree	13.4
Cost of Lodging Per Day Per Person	≤$10	57.9
	11-20	33.2
	>20	9.1
Cost of Food Per Day Per Person	≤$10	73.1
	>$10	26.9
State of Residence	Alabama	30.3
	Georgia	22.2
	Florida	16.3
	Other	31.2

Table 4.1b. Socio-Economic and Demographic Description of Sample (NJ, N = 595)

Sex	Male	52.9%
	Female	47.2
Age	<20	10.9
	20-29	25.8
	30-39	23.5
	40-49	19.8
	50-59	15.4
	≥60	4.5
Distance Traveled	≤50 Miles	27.5
	51-150	58.4
	151-300	8.9
	301-600	4.1
	>600	1.1
Mode of Travel	Car	86.9
	Plane	.3
	Bus	2.4
	Other	10.4
Length of Stay	≤ 1 Week	65.1
	> 1 Week	34.9
Visited Interview Site Before	No	9.7
	Yes	91.3
Plan to Visit Interview Site Again	No	3.1
	Yes	96.9
Visit Other Beaches	No	44.2
	Yes	59.7
Activities Mentioned	Swim	62.1
	Fish	3.9

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Table 4.1b. (cont.)

	Sun	53.4%
	Dive	1.1
	Boat	2.2
	Socialize	3.4
	Other Active	21.9
	Other Inactive	42.8
Favorite Place for Weekend Visit	Beach	61.5
	Other	38.5
Favorite Place for Vacation	Beach	61.0
	Other	39.0
Income	No Response	9.7
	<$7,500	8.3
	7,500-14,999	20.0
	15,000-24,999	37.5
	25,000-49,999	19.0
	≥50,000	5.3
Education	High School	25.3
	Trade School	7.3
	Some College	19.4
	2-yr Degree	5.4
	4-yr Degree	21.5
	>4 yr Degree	16.7
	No Response	4.4
Cost of Lodging Per Day Per Person	<$10	69.4
	>$10	30.6
Cost of Food Per Day Per Person	<$10	75.5
	>$10	24.5
State of Residence	Pennsylvania	42.8
	New Jersey	41.8
	New York	6.9
	Other	8.5

Table 4.1c. Socio-Economic and Demographic Description of Sample (CC, N=569)

Sex	Male	54.9%
	Female	45.1
Age	<20	7.4
	20-29	28.6
	30-39	23.7
	40-49	24.2
	50-59	9.9
	≥60	6.0
Distance Traveled	≤50 Miles	15.8
	51-150	44.5
	151-300	27.0
	301-600	8.5
	>600	4.1
Mode of Travel	Car	90.6
	Plane	1.1
	Bus	1.1
	Other	7.3
Length of Stay	≤1 Week	59.5
	>1 Week	40.5
Visited Interview Site Before	No	24.7
	Yes	75.3
Plan to Visit Interview Site Again	No	6.6
	Yes	93.4
Visit Other Beaches	No	13.9
	Yes	86.1
Activities Mentioned	Swim	68.0
	Fish	2.5
	Sun	50.6

Table 4.1c. (cont.)

	Dive	3.4%
	Boat	2.3
	Socialize	3.9
	Other Active	17.3
	Other Inactive	45.0
Favorite Place for Weekend Visit	Beach	60.1
	Other	39.9
Favorite Place for Vacation	Beach	59.9
	Other	40.1
Income	No Response	4.4
	<$7,500	5.1
	7,500-14,999	21.6
	15,000-24,999	35.6
	25,000-49,999	28.0
	≥50,000	5.0
Education	High School	14.2
	Trade School	4.1
	Some College	18.1
	2-yr Degree	10.6
	4-yr Degree	22.7
	>4-yr Degree	26.9
	No Response	3.5
Cost of Lodging Per Day Per Person	<$10	69.4
	> 10	30.6
Cost of Food Per Day Per Person	<$10	67.3
	> 10	32.7
State of Residence	Massachusetts	57.8
	Connecticut	11.1
	New York	9.5
	Other	21.6

Table 4.1d. Socio-Economic and Demographic Description of Sample (S Fla., N=550)

Sex	Male	52.2%
	Female	47.8
Age	<20	11.8
	20-29	35.3
	30-39	16.8
	40-49	15.7
	50-59	11.5
	≥60	8.9
Distance Traveled	<50 Miles	39.5
	51-150	4.0
	151-300	2.7
	301-600	6.9
	≥600	46.8
Mode of Travel	Car	81.0
	Plane	14.3
	Other	4.7
Length of Stay	<1 Week	71.8
	≥1 Week	28.2
Visited Interview Site Before	No	30.7
	Yes	69.3
Plan to Visit Interview Site Again	No	3.5
	Yes	96.5
Visit Other Beaches	No	29.9
	Yes	70.1
Activities Mentioned	Swim	61.8
	Fish	3.9
	Sun	63.1
	Boat	3.6
	Socialize	7.3
	Other Active	27.5
	Other Inactive	37.7
Favorite Place for Weekend Visit	Beach	44.8
	Other	55.2

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Table 4.1d. (cont.)

Favorite Place for Vacation	Beach	51.6%
	Other	48.4
Income	No Response	8.2
	<$7,500	10.0
	7,500-14,999	29.6
	15,000-24,999	32.1
	25,000-49,999	15.3
	≥50,000	4.7
Education	High School	39.6
	Trade School	6.5
	Some College	18.2
	2-yr Degree	13.1
	4-yr Degree	12.5
	>4-yr Degree	10.0
Cost of Lodging Per Day Per Person	<$10	81.7
	> 10	18.3
Cost of Food Per Day Per Person	<$10	87.2
	> 10	12.8
Place of Residence	Florida	44.6
	Canada	8.1
	Ohio	7.2
	New York	4.2
	Other	35.9

Results of the pilot study mentioned earlier (Baker & West, 1976) had suggested that beach choice tends to be a habitual behavior. That is, when asked "Why do you come to this particular beach?", at least a third of the respondents made statements such as "I have always come here." In addition, a large percentage of the respondents reported previous visits to the interview location. The results of the present study clearly confirmed this result: Over 90% of the respondents at all sites expected to return in the future. These data suggest that beachgoers tend to return to the same location year after year so long as their experience is satisfactory. Further, data from the Panama City site (north Florida) suggest that individuals may also have a substantial tolerance for at least occasional "tainted" experiences at their favorite beach site. During the interview period, a beach restoration project was carried out at the north Florida location. This project dirtied the water and beach noticeably and was visible from several areas; many respondents spontaneously mentioned it as a nuisance. Despite this disruption, 96% of the interviewees still planned to return to the same beach area in the future.

The data also indicated that the respondents at least occasionally visited other beaches. Slightly over 50% of the respondents at the New Jersey and north Florida sites indicated that they visit other beaches, while 85% of the Cape Cod respondents and 70% of the south Florida respondents also go to other beaches. Across all locations, 50%-60% of the respondents indicated that the beach was their favorite place for a weekend recreational trip or vacation.

Swimming and sunbathing were the most frequently mentioned beach activities at all sites. Over half the respondents do go into the water to swim; relatively few people fish. Some of the respondents indicated that they also engaged in other active social functions (17% to 28%) and/or other inactive social functions (28% to 45%) while at the beach.

The measures of socioeconomic status did indicate some differences among the four sites primarily in terms of education. The family incomes were generally comparable with most respondents' families earnings over $15,000 annually. Cape Cod had a slightly larger percentage of visitors in the $25,000-$50,000 category. Larger differences emerged with respect to education: 49.6% of the Cape Cod respondents, 38.2% of the New Jersey respondents, 30.8% of the north Florida respondents, and 22.5% of the south Florida respondents had completed at lease a four-year college degree. Finally, spending on food and lodging was generally comparable at the four sites.

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Response to Offshore Siting (Tables 4.2a, b, c, d)

All respondents at the north Florida, south Floirda, and Cape Cod sites were presented with the hypothetical scenario of a nuclear power plant being located offshore. The specific questions that were employed are presented in Appendix A, Section VII. The responses of the three interview groups were very similar. At its closest possible point to the shore, an offshore facility prompted 22.8% to 26.5% of the respondents to indicate that they would not return to the beach. For all three sites, the form of the distance decay curve is well approximated by a negative exponential function. The number of persons who indicated that they would be affected by the presence of the facility decreased sharply as the distance to the facility increased. The Cape Cod visitors were slightly more affected at the closest point than beachgoers at the two Florida sites, but they and the south Florida visitors were slightly less affected when the plant was further away.

The direct wording of this question has the advantage of permitting a direct estimate of the percentage of subjects who believe that they would no longer visit the site if a floating nuclear plant were located at some distance away. However, the direct wording of the question has two disadvantages: (a) It does not require that the respondent consider the costs involved (e.g., finding new accomodations, travel time, unfamiliarity) in traveling to another location. This disadvantage would lead to an overestimation of the percentage of respondents who would avoid the site if forced to make an actual choice. (b) The direct wording of the questions could tend to lead to demand characteristics (Orne, 1962) such that some respondents would attempt to give a socially desirable response rather than the response that they believed they would actually make in the situation. This disadvantage may lead to an overestimation of the percentage of the respondents who would avoid the beach site if the reactor were located at the nearest point. Because of the structure of the question, it is difficult to estimate the direction of bias, if any, when the floating nuclear facility was to be located at more distant points. Note that the information-integration tasks to be described below minimize these two problems although they do not permit a direct estimate of the percentage of subjects who believe they would avoid the beach if a nuclear facility were sited offshore.

A related problem is that nearly all respondents had not given prior consideration to floating nuclear power plants. Because of time constraints on the interview, the respondents could not

Table 4.2a. Percent of Sample Who Indicated Unwillingness to Return to Beach if Reactor Were Sited Offshore (N Fla, N=596)

Distance to Reactor (3 miles offshore in all cases)	Percent Affected
Directly Offshore	22.8%
Five Miles Downshore	17.3
Ten Miles Downshore	15.0
Twenty-five Miles Downshore	10.7
Fifty Miles Downshore	7.6

Table 4.2b. Percent of Sample Who Indicated Unwillingness to Return to Beach if Reactor Were Sited Offshore (CC, N=569)

Distance to Reactor	Percent Affected
Directly Offshore	26.5
Five Miles Downshore	14.9
Ten Miles Downshore	10.0
Twenty-five Miles Downshore	7.2
Fifty Miles Downshore	3.7

Table 4.2c. Percent of Sample Who Indicated Unwillingness to Return to Beach if Reactor Were Sited Offshore (S Fla., N=550)

Distance to Reactor (3 miles offshore in all cases)	Percent Affected
Directly Offshore	23.1
Five Miles Downshore	10.2
Ten Miles Downshore	7.1
Twenty-five Miles Downshore	6.9
Fifty Miles Downshore	4.4

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Table 4.2d. Percent of Sample Who Indicated Unwillingness to Return to Beach if Reactor Were Sited Offshore (NJ, N=551)

Location and Distance to Reactor	Percent Affected
Ocean City (22 mi.) (N=70)	5.7%
Margate City (17 mi.) (N=80)	5.3
Atlantic City (13 mi.) (N=115)	12.2
Brigantine (8.5 mi.) (N=81)	7.4
Beach Haven (5 mi.) (N=91)	18.7
Surf City (13 mi.) (N=92)	5.4
Barnegat Light (20 mi.) (N=22)	18.2

be given a period of time to consider possible effects of floating nuclear plants and effects of relocating to another beach area. Recent evidence (e.g., Petty, Wells, & Brock, 1976) suggests that a person's final attitude upon encountering new information is directly related to the amount of time the respondent spends thinking about the positive and about the negative aspects of the issue. It is likely that many people would initially focus on safety and aesthetic concerns when presented with information about floating nuclear reactors near their own beach. Consequently, their attitudes should be somewhat more negative than they would be later when they had a chance to think about the costs involved in visiting an alternative beach site. There is also evidence that suggests that to the extent that the respondent has thought about the issues involved, the higher the relationship between his attitudes and his actual behavior (cf. Cartwright, 1949; Snyder and Swann, 1976). Finally, learning about the possibility that a nuclear facility may be located near one's favorite beach may lead to an emotional response by the respondent. Emotional reactions to communications often lead to initial intentions to change behavior; however, in the absence of further information, these intentions grow weaker, and the number of people who actually change their behavior is small relative to the number who initially intended to change their behavior (see Leventhal, 1970). These considerations lead to the conclusion that the direct avoidance figures overestimate the number of people who will no longer go to beach sites adjacent to an offshore nuclear facility.

The New Jersey respondents received the direct avoidance question with a different formulation. Specifically, they were informed that the New Jersey Public Service Electric and Gas Company planned to build a floating nuclear facility three miles off the coast of Little Egg Inlet (see Appendix A, Section VIII for exact wording). They were then asked if they would go to the specific beach at which they were being interviewed if the facility were built. This wording has the advantage of forcing respondents to consider a realistic rather than hypothetical situation; its primary disadvantage is that only one response is obtained from each person. Because of this disadvantage, the sample size for each New Jersey site is considerably smaller, leading to somewhat poorer reliabilities (see Appendix C).

The data from the New Jersey sites were generally consistent with that from the other three sites (see Table 4.2d). The largest differences were the 18.2% who indicated an unwillingness to return to Barnegat Light (20 miles away) and the 7.4% who indicated an unwillingness to return to Brigantine (8.5 miles away).

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Note that the Barnegat Light estimate is considerably more unreliable than the other New Jersey sites: The 18.2% avoidance figure is based on a sample of only 22 people. No explanation can be offered from the present data for the low avoidance figure at Brigantine. For the other New Jersey beaches, the distance decay curve was consistent with those obtained using hypothetical situations at the two Florida and Cape Cod sites. The New Jersey data do suggest that local media coverage of the planning and approval of the Atlantic Generating Station have had little effect on the respondents' intended future utilization of adjacent beach sites. However, there was no evidence of substantially greater knowledge or awareness of nuclear facilities in general or floating nuclear generating stations in particular in New Jersey than at the other three sites.

One interesting consideration is where beachgoers who are deterred from returning to a beach by a floating nuclear generating station would relocate. For example, if an individual indicated that five miles to the reactor is too close but ten miles is acceptable, he may simply relocate at the nearest site in the same beach area that is ten or more miles from the reactor.

Impact of Nuclear Regulatory Commission Approval

The impact of Nuclear Regulatory Commission hearings on a proposed floating nuclear plant and attendant media publicity are likely to have two effects. (1) Individuals will become more aware of the proposed location of the FNP and perhaps other nuclear facilities. The greatest media attention is likely to be in the local area; media in more distant areas are likely to give less publicity to the proposed power plant. Thus, the direct media impact on tourists will probably be small relative to that on the local population. (2) The extensive hearing and licensing process of the Nuclear Regulatory Commission will be publicized. Some respondents will become aware of the safety certification review by the Nuclear Regulatory Commission.

In order to assess the impact of knowledge of safety certification by the Nuclear Regulatory Commission, respondents at the four sites who had indicated that they would avoid a beach with an offshore nuclear generating facility were briefly informed of the safety certification by the Commission. They were then asked if they still intended to avoid the beach (see Appendix A, Sections VII and VIII for specific wording). As indicated in Table 4.3, between 40.3% and 50% of the respondents at the four interview sites who had previously indicated an

Table 4.3. Impact of NRC Approval of Offshore Siting on Respondents Initially Indicating Avoidance

	NW Fla (N=160)	NJ (N=156)	CC (N=197)	S Fla (N=154)
Would Not Change Decision	56.9%	50.0%	58.3%	59.7%
Would Change Decision	43.1%	50.0%	41.6%	40.3%

Table 4.4. Preference for Location of Coastal Reactor

	NW Fla (N=596)	NJ (N=585)	CC (N=564)	S Fla (N=541)
Onshore	8.6%	5.5%	10.6%	10.8%
Offshore	35.8%	33.8%	37.9%	42.3%
No Preference	54.4%	54.2%	48.8%	41.3%
Don't Know	1.2%	6.3%	2.7%	5.6%

unwillingness to return to the beach changed their intended behavior. The response to this question has two important implications: (1) It highlights the general impermanence of the original avoidance responses reported in the previous section, and (2) it indicates a lack of public awareness about Nuclear Regulatory Commission licensing procedures, suggesting that increased awareness could reduce avoidance of beaches with FNP's appreciably.

The degree to which awareness of NRC licensing procedures would exist among beach patrons after siting of a FNP is unknown, but the following points should be considered. Local residents who are aware of the plant are likely also to be aware of the hearing and licensing procedures preceding construction of the plant. Awareness among tourists is more difficult to infer. Distance of the tourist's residence from the vacation beach area, frequency of the visitor's trips to the area, length of stay during visits, and visibility of the FNP from the beach being visited are likely to influence the tourist's awareness of the plant and attendant licensing procedures. Given the lengthy period of time during which the licensing stages pass (in fact the licensing hearings for plant operation will probably continue after construction of the breakwater has begun) and the fact that the great majority of beach-goers are return visitors, many (if not most) tourists will have visited the beach area during the period of time that licensing publicity is not uncommon and may very well become aware of it. In short, there is reason to expect that if an individual is aware of the FNP he is likely to be aware of the licensing publicity preceding or accompanying it.

Locational Preference (Onshore vs. Offshore)

One potentially valuable source of information about the impact of future offshore nuclear plants is data from currently existing onshore plants. Indeed, Chapter 5 on analogous sites presents a discussion of these data. However, before such data are utilized, it is important to demonstrate that people do not have safety, aesthetic, and other concerns that lead them to have a distinct preference for onshore siting. Consequently, all respondents were asked to state their overall preference for onshore vs. offshore siting (see Appendix A, Sections VII and VIII for specific wording). As shown in Table 4.4, many respondents did not express a preference for onshore vs. offshore siting. For those who did express a preference (39.9% to 53.1%), the offshore location was clearly preferred (over 75% at all sites). This suggests that the impact of offshore nuclear reactors may be comparable to or slightly less than that of onshore reactors.

Information-Integration Tasks:
Relative Importance of Beach Attributes

The information-integration tasks provide important supplemental data to that considered in the previous sections. The information-integration tasks force the respondents to make trade-offs between the particular variables under consideration. Through this method, the relative importance of the variables in determining the desirability of a beach location may be estimated.

As explained in the preceding chapter, three different information-integration tasks were used in the present investigation. First, the "Buff" form assessed the relative importance of proximity to an offshore nuclear reactor of the beach and three beach characteristics in determining the desirability of beaches. The three beach characteristics employed were cleanliness, facilities, and crowding.

Second, the distance the person has to travel from his home to the beach site is likely to be an important determinant of beach choice (cf. Olsson, 1965). The "Blue" form allowed estimation of the relative importance of the proximity of the reactor to the beach and the distance from home to the beach as determinants of beach desirability. In addition, this data permits us to assess whether the impact of the proximity to the reactor on beach desirability would differ as a function of the distance from the respondent's home to the beach.

Third, one large scale, centralized alternative to nuclear generating stations is coal-burning plants. Since coastal coal-burning plants also may pose a threat to beach visitation, the relative impact of these two types of plants on adjacent beaches was assessed with the "Yellow" form. Note that as a result of difficulties in presentation, both the coal facility and the nuclear facility were described as being located onshore. As noted in a previous section, most respondents either had no preference between onshore vs. offshore nuclear facilities or prefered that they be offshore. Consequently, the present design may slightly overestimate the impact of an offshore nuclear plant relative to an onshore coal plant on the desirability of adjacent beaches.

Another approach to assessing the relative importance of beach characteristics and proximity of an offshore nuclear reactor was utilized in the "Goldenrod" form. This form utilized a technique which has the advantage of allowing the respondent to make judgments of beach desirability without constraining

The variables that he considers in making his choice. However, this technique has three disadvantages in the present case. (1) The utilization of real world information, in this case photographs of the beach sites, almost always implies that some of the variables will be highly correlated, increasing the error of estimate for the magnitude of effect of the variables. For example, across all of the beach sites, cleanliness and crowding would probably be correlated.

(2) Predictor variables that are not identified by the investigator will contribute to the subjects' judgments of the desirability of the beach, thus lowering the percentage of variance that is accounted for. Some of these predictor variables may be actual determinants of beach attractiveness for all or for a subset of the respondents, but which are outside the analysis (e.g., wave height). Others may be irrelevant characteristics of the beach that are salient in the particular sample photographs (e.g., an unusually unattractive person who happened to be prominent in the photographs), but which would not affect the person's ratings of attractiveness if they were able to view the entire beach rather than a small sample of it (cf. Ross, 1977). The two disadvantages discussed above are intrinsic to the technique.

(3) A final disadvantage in the present situation was that ratings of the beach characteristics under consideration (crowding, cleanliness, facilities, and extent of development) could not be obtained from the respondents themselves as a result of time constraints on the interview. Consequently, ratings of beach characteristics had to be obtained from a sample of students. This presents two potential problems: (a) The students may have different criteria for judging the beach characteristics than the actual respondents at the site. However, if the students' ratings can be assumed to be monotonically related to those that would have been made by the actual respondents, this problem is minimized (cf. Dawes & Corrigan, 1974). (b) Respondents would vary in their perception of beach attributes. For example, one respondent might consider a beach very crowded while another would consider it only moderately crowded. However, only the median of the students' ratings was used to characterize the particular attribute of the beach site. Thus, while the median of the student ratings may adequately characterize the average of the actual respondents' ratings of the attributes of the beach, it does not account for the variability of the respondents' ratings about the median rating. The result of this procedure is that considerable error of estimate is introduced into the ratings of the beach characteristics.

Information-Integration Tasks (Results)

Buff Form-There was slight variation among the four interview sites with regard to which attributes are most important in determining beach attractiveness, but in all cases proximity of an offshore reactor was least important of the variables considered (Tables 4.5a, b, c, d, e, f). Two separate analyses were performed, and both sets of results are presented. Tables 4.5a and b summarize the analysis of variance. To indicate the relative importance of the beach attributes, the proportion of total main effect sum of squares accounted for by each of the attributes is presented. At all four sites litter is most important, followed by facilities, crowding, and distance to reactor, with reactor proximity being far less important than litter and facilities.

Tables 4.5c, d, e, and f indicate similar results obtained through multiple linear regression analysis. The trends are the same, but the differences in relative importance (indicated by the standardized regression coefficients) of the attributes are less pronounced. The primary reason for the interval inconsistency between the two methods is that regression analysis gives an estimate of the linear relationship between the variables, whereas analysis of variance can detect both linear and non-linear relations. Since beach attractiveness increases logarithmically (rather than linearly) with distance of the beach from an offshore reactor, it is not surprising that the results obtained using the two techniques would disagree to some extent. The relative magnitudes of the importance of the beach attributes indicated by the analysis of variance should be considered more valid than the regression results. The regression data is presented for two reasons: 1) some readers may be more familiar with regression analysis than with analysis of variance, and 2) to provide a lower-bound (conservative) estimate of the relative importance of beach characteristics. (Both of the statistical procedures, along with all others presented in the report, are described in Appendix C.)

The most likely implication of this data is that most respondents would probably not be deterred from visiting their favorite beach by an offshore reactor unless another beach having the attributes they value were available.

Table 4.5a. Analysis of Variance Data, Buff Packet: Proportion of Main Effect Sum of Squares Accounted for by Each Independent Variable (N's ≈ 60)*

Variable	Site N Fla	 NJ	 CC	 S Fla
Litter	.46	.45	.52	.42
Crowding	.13	.17	.17	.10
Facilities	.39	.30	.28	.44
Distance from Reactor	.01	.08	.04	.04

* "≈" should be read "approximately equal to."

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Table 4.5b. Analysis of Variance Data, Buff Packet: Main Effect Marginal Means (20 pts max.)

Site	Variables and Levels				P
	Cleanliness				
	Unlittered	Littered			
PC	9.59	5.03			.00001
NJ	9.01	4.96			.00001
CC	9.35	5.28			.00001
S Fla	10.84	6.74			.00001
	Crowding				
	Moderate	Very			
PC	8.54	6.08			.00001
NJ	8.23	5.74			.00001
CC	8.47	6.16			.00001
S Fla	9.77	7.82			.003
	Facilities				
	Good	Poor			
PC	9.40	5.22			.00001
NJ	8.64	5.33			.00001
CC	8.81	5.82			.00001
S Fla	10.87	6.71			.00001
	Distance from FNP (in miles)				
	5	10	25	50	
PC	6.69	7.29	7.45	7.81	.002
NJ	5.81	6.76	7.22	8.14	.00001
CC	7.26	6.87	6.89	8.25	.13
S Fla	7.86	8.55	9.31	9.44	.295

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Table 4.5c. Multiple Regression Data, Buff Packet

Dependent Variable: Beach Attractiveness
(NW Fla, N = 59)

Variable	Simple r	Standardized Regression Coefficient	P
Litter	.40	.22	.001
Crowding	.22	.04	.271
Facilities	.37	.25	.001
Distance from Reactor	.06	.02	.617

Table 4.5d. Multiple Regression Data, Buff Packet

Dependent Variable: Beach Attractiveness
(NJ, N = 58)

Variable	Simple r	Standardized Regression Coefficient	P
Litter	.34	.22	.001
Crowding	.21	.06	.165
Facilities	.28	.19	.001
Distance from Reactor	.13	.08	.058

Table 4.5e. Multiple Regression Data, Buff Packet

Dependent Variable: Beach Attractiveness
(CC, N = 53)

Variable	Simple r	Standardized Regression Coefficient	P
Litter	.20	.11	.023
Crowding	.12	.13	.012
Facilities	.15	.07	.154
Distance from Reactor	.04	.03	.474

Table 4.5f. Multiple Regression Data, Buff Packet

Dependent Variable: Beach Attractiveness
(S Fla, N = 52)

Variable	Simple r	Standardized Regression Coefficient	P
Litter	.14	.06	.214
Crowding	.07	.06	.275
Facilities	.14	.12	.024
Distance Reactor	.04	.07	.143

Goldenrod Form. As feared, high intercorrelations (r's up to .92) did in fact exist among attributes of the beaches shown in the photographs. Thus, the multiple regression analysis was of no use for inferring the relative importance of the beach attributes. Inconsistencies also appeared in the data from site to site, probably attributable to the practice of employing attribute ratings from one sample to beach ratings of another sample.

Table 4.6 summarizes certain descriptive data which may be of some use, however. It presents the mean beach ratings (on a 20-point scale) for beaches without a FNP and the mean rating for the same groups of beaches with a FNP offshore. Distance to the FNP varied among beaches at a particular site. At the Panama City site, for example, the FNP was one, two, six, nine, 11, and 16 miles from the six beaches, respectively. At New Jersey the hypothetical FNP was located at the proposed AGS site. The table indicates that average beach attractiveness decreased between .89 and 1.45 points upon introduction of the FNP.

In view of two considerations, the decrease can be viewed as quite small, although no known behavioral interpretation of the 20-point scale is available: 1) The standard deviations of the beach ratings suggest that the with-without FNP variation was slight compared to overall variation in beach ratings stemming from all attributes. One may infer, for example, that roughly two-thirds of the beach ratings ranged from one standard deviation below the mean to one standard deviation above the mean. 2) The without FNP-with FNP sequencing of questions to the same respondent probably encouraged a negative reaction to the FNP.

Blue Form. Distance of a beach from one's home is also much more important than proximity of the beach to an offshore nuclear power plant (Tables 4.7a, b, c, d, e, and f). Differences among the sites are small enough to be attributed to sampling error. As with the Buff Form, both analysis of variance and regression data are presented, but greater confidence should be placed in Tables 4.7a and b.

Visual Impact of an Offshore Plant

Finally, the actual sight of a generating station three miles offshore may elicit safety, aesthetic, or other concerns that might not be raised if the station were not visible. An attempt was made to assess the visual impact of the plant utilizing a realistic photograph supplied by Offshore Power Systems. These data were collected by directly asking the respondents if they

Table 4.6. Goldenrod Data: Beach Ratings with and without FNP's (N's ≈ 60) (20.00 max.)

Site	Beach Description	Mean Beach Rating	Standard Deviation
PC	without FNP	13.47	4.58
	with FNP	12.58	5.42
NJ	without FNP	12.08	5.48
	with FNP	11.07	5.90
CC	without FNP	12.63	4.35
	with FNP	11.18	5.36
S Fla	without FNP	11.23	5.50
	with FNP	10.01	5.13

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Table 4.7a. Analysis of Variance Data, Blue Packet: Proportion of Main Effect Sum of Squares Accounted for by Each Independent Variable (N's = 60)

Variable	Site: N Fla	NJ	CC	S Fla
Distance from Home	.83	.96	.96	.93
Distance from Reactor	.17	.04	.04	.07

Table 4.7b. Analysis of Variance, Blue Packet: Main Effect Marginal Means (20 pts max.)

Site	Variables and Levels				P
	Distance from Home (in miles)				
	50	150	400	800	
PC	13.37	12.39	9.11	6.14	.00001
NJ	12.38	9.13	4.57	2.80	.00001
CC	10.97	8.61	4.61	3.27	.00001
S Fla	12.69	11.06	9.07	8.19	.00001
	Distance from FNP (in miles)				
	5	10	25	50	
PC	8.40	9.76	11.14	11.73	.00001
NJ	6.31	6.52	7.84	8.20	.001
CC	6.02	6.59	7.14	7.70	.02
S Fla	9.78	9.83	10.42	10.97	.54

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Table 4.7c. Multiple Regression Data, Blue Packet

Dependent Variable: Beach Attractiveness
(NW Fla, N = 57)

Variable	Simple r	Standardized Regression Coefficient	P
Distance from Home	-.44	-.38	.001
Distance from Reactor	.18	.23	.001

Table 4.7d. Multiple Regression Data, Blue Packet

Dependent Variable: Beach Attractiveness
(NJ, N = 56)

Variable	Simple r	Standardized Regression Coefficient	P
Distance from Home	-.49	-.42	.001
Distance from Reactor	-.11	.17	.001

Table 4.7e. Multiple Regression Data, Blue Packet

Dependent Variable: Beach Attractiveness
(CC, N = 57)

Variable	Simple r	Standardized Regression Coefficient	P
Distance from Home	-.43	-.39	.001
Distance from Reactor	.09	.13	.007

Table 4.7f. Multiple Regression Data, Blue Packet

Dependent Variable: Beach Attractiveness
(S Fla, N = 56)

Variable	Simple r	Standardized Regression Coefficient	P
Distance from Home	-.16	-.14	.009
Distance from Reactor	.05	.07	.190

would (a) go to the beach depicted in the photograph, (b) go to the beach if there were a reactor located three miles offshore, and (c) go to the beach in a second photograph of the same location, but which now depicted a generating station located three miles offshore.

This direct questioning method has the advantage of giving a direct estimate of avoidance rates. However, this method also has a number of disadvantages. In particular, the problem of demand characteristics (i.e. respondents might want to appear agreeable to the interviewer and give the "correct" response) might lead to an overestimation of the magnitude of the visual impact of the offshore plant. Additionally, because of the large size of the photograph, the background had to be cropped so that the photograph could be presented in the beach interviews. The plant therefore subtends a larger angle of the visual field than it would in the actual situation. As a result, the plant appears larger than it would if it were actually located three miles offshore (cf. Gibson, 1950: LeGrand, 1967). This overrepresentation of the visual prominence of the plant in the photograph may lead to an overestimation of its impact on avoidance.

As shown in Table 4.8, the proportion of the sample indicating an unwillingness to visit the beach in the photograph after being told only that there is a nuclear power plant three-miles offshore is very similar to data obtained in the "Avoidance" section of the interview. Impact in New Jersey seems greater with regard to the photograph, but it is more difficult to compare to the "avoidance" data. It is also possible that the beach in the photograph held less appeal for the New Jersey respondents.

In any case, unwillingness to visit the beach increased after seeing the artist's conception--4.2% in Cape Cod, 5.1% in south Florida, 5.8% in New Jersey, and 8.0% in north Florida. Thus, the "avoidance" data may be low estimates. As noted above, this is unlikely as a result of the problems of the visual prominence of the reactor in the photographs and demand characteristics of the direct question technique.

Information-Integration

Yellow Form. Proximity of either a coal or nuclear power plant is more important than the type (coal or nuclear) of plant (Tables 4.9a, b, c, d, e, and f). Both variables affected beach desirability, but proximity to the potentially unaesthetic or hazardous facility was consistently more important (by

Table 4.8. Visual Impact of Plant: Percent of Sample Indicating Unwillingness to Visit Beach with Offshore Plant

	NW Fla (N=142)	NJ (N=138)	CC (N=143)	S Fla (N=117)
Before Seeing Photo	22.0	32.6	27.2	25.6
After Seeing Photo	30.0	38.0	31.4	30.7

Table 4.9a. Analysis of Variance Data, Yellow Packet: Proportion of Main Effect Sum of Squares Accounted for by Each Independent Variable (N's = 60)

	Site			
Variable	N Fla	NJ	CC	S Fla
Type of Plant	.08	.02	.08	.01
Distance from Plant	.92	.98	.92	.99

Table 4.9b. Analysis of Variance Data, Yellow Packet: Main Effect Marginal Means (20 pts max.)

Site	Variables and Levels		P
	Type of Plant		
	Coal	Nuclear	
PC	7.34	9.27	.00001
NJ	8.37	9.18	.02
CC	8.75	10.62	.00001
S Fla	9.08	9.22	.86

Site	Distance to Plant (in miles)					P
	1	5	10	25	50	P
PC	3.55	6.30	8.35	10.51	12.80	.00001
NJ	4.10	6.69	8.81	10.99	13.27	.00001
CC	4.81	7.87	9.74	11.99	14.01	.00001
S Fla	4.63	6.94	8.97	11.49	13.73	.00001

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Table 4.9c. Multiple Regression Data, Yellow Packet

Dependent Variable: Beach Attractiveness (N Fla, N = 60)

Variable	Simple r	Standardized Regression Coefficient	P
Distance to Plant	.46	.51	.001
Type of Plant	.15	.20	.001

Table 4.9d Multiple Regression Data, Yellow Packet

Dependent Variable: Beach Attractiveness (NJ, N = 59)

Variable	Simple r	Standardized Regression Coefficient	P
Distance to Plant	.44	.44	.001
Type of Plant	.06	.06	.12

Table 4.9e. Multiple Regression Data, Yellow Packet

Dependent Variable: Beach Attractiveness (CC, N = 55)

Variable	Simple r	Standardized Regression Coefficient	P
Distance to Plant	.40	.41	.001
Type of Plant	.13	.14	.001

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Table 4.9f. Multiple Regression Data, Yellow Packet

Dependent Variable: Beach Attractiveness
(S Fla, N = 50)

Variable	Simple r	Standardized Regression Coefficient	P
Distance to Plant	.24	.26	.001
Type of Plant	.01	.03	.563

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a large margin) than what the facility actually was. Proximity to the coal plant reduced beach desirability slightly more than proximity to the nuclear facility. The implication is that although a coastal nuclear plant may reduce beach attractiveness, a coastal coal plant in the same location may reduce attractiveness by at least as much.

Energy Source Desirability

Response to an offshore nuclear plant might possibly be a function not only of the person's beliefs about the safety or aesthetics of the particular plant, but also a function of his overall attitude toward nuclear power relative to other sources of electric power. In all three interview sites, respondents clearly preferred nuclear power to coal and oil, but their first choices were solar and hydroelectric power (Table 4.10). This data will be related to "avoidance" data in a subsequent section.

Safety Concerns Mentioned

The respondents were asked to report any concerns they might have regarding the safety of an offshore nuclear generating facility (see Appendix A, Section IIA for exact wording of question). While some respondents did not express any concerns, others voiced one or more concerns about the safety of an offshore facility. The most frequently mentioned concern was day-to-day leakage of radioactivity (Table 4.11). Across all sites, a nuclear explosion was a distant second in terms of mention; there was, however, considerable variation from site to site. Sabotage ranked relatively high at the north Florida site, while storm damage ranked second at the New Jersey site. It is likely that the specific concerns mentioned and the judgment of their likelihood (see following section) reflect the amount of exposure the respondent has had to this concern through the media, personal experience, and discussion with others (cf. Tversky & Kahneman, 1973). Note that in many cases the respondent's exposure to the concern may not be representative of the actual occurence of the event in the real world (Slovic, Fischhoff, and Lichtenstein, 1976).

Judgments about Various Hazardous Events (Tables 4.12a, b, c, d)

Likelihood. The respondents were asked to assume that there was an operating nuclear reactor three miles directly offshore. They were then asked to indicate the likelihood of occurence of a number of potentially dangerous nuclear and non-nuclear events (see Appendix A, Section IIA for exact wording).

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Table 4.10. Median Ratings of Overall Desirability of Alternative Energy Sources (20 points possible) (N's ≈ 150)

	NW Fla	NJ	CC	S Fla
Solar	17.8	19.0	18.9	16.8
Hydro	16.2	15.4	15.9	16.8
Nuclear	14.7	12.4	13.9	14.8
Coal	8.0	9.8	9.3	9.5
Oil	7.2	9.6	9.7	7.1

Table 4.11. Percent of Sample Mentioning Various Safety Concerns
N's ≈ 150

Concern	N Fla	NJ	CC	S Fla
Day-to-day leaks	16.9	30.0	22.9	14.2
Sabotage	4.1	2.0	.7	5.0
Transportation Accident	.7	1.3	2.1	.7
Core Meltdown	0.0	.7	0.0	2.1
Nuclear Explosion	8.1	3.3	2.8	5.7
Storm Damage	.7	4.0	2.8	1.4

Table 4.12a. Median Ratings of Various Hazardous Events
(N Fla, N=148)

Event	Likelihood (20 pts Max)	Consequences (100,000 Max)	Overall Concern (20 pts Max)
Day-to-day leak	7.8	100	10.1
Sabotage	9.2	100	10.0
Transportation Accident	9.6	25	9.8
Storm Damage	13.9	25	10.5
Overheating	8.5	250	13.0
Nuclear Explosion	4.2	10,000	15.5
Hurricane	19.8	100	11.7
Sharks	13.8	10	5.0
Oil Spill	11.8	1	9.8
Tornado	17.7	25	10.2

Table 4.12b. Median Ratings of Various Hazardous Events (NJ, N=150)

Event	Likelihood (20 pts Max)	Consequences (100,000 Max)	Overall Concern (20 pts Max)
Day-to-day leak	8.8	250	12.4
Sabotage	9.7	1,000	10.2
Transportation Accident	9.9	100	11.9
Storm Damage	11.8	100	14.3
Overheating	8.0	1,000	14.9
Nuclear Explosion	4.6	10,000	15.5
Hurricane	19.5	50	7.8
Sharks	5.4	1	2.4
Oil Spill	15.0	1	10.5
Tornado	4.7	50	3.3

Table 4.12c. Median Ratings of Various Hazardous Events
(CC, N=144)

Event	Likelihood (20 pts Max)	Consequences (100,00 Max)	Overall Concern (20 pts Max)
Day to-day leak	5.3	500	10.3
Sabotage	7.8	500	8.5
Transportation Accident	10.0	50	10.3
Storm Damage	10.3	75	10.5
Overheating	9.6	750	13.9
Nuclear Explosion	4.5	20,000	15.1
Hurricane	19.6	25	9.7
Sharks	5.2	1	1.5
Oil Spill	14.9	1	10.0
Tornado	4.8	25	4.6

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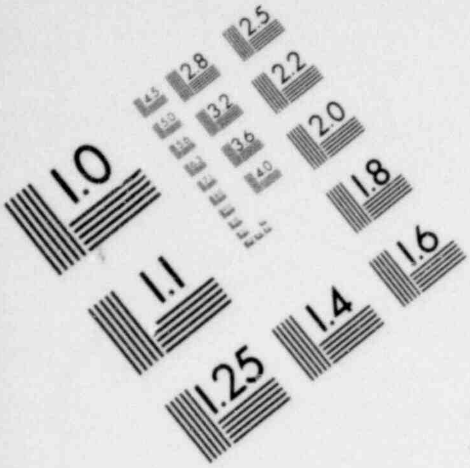


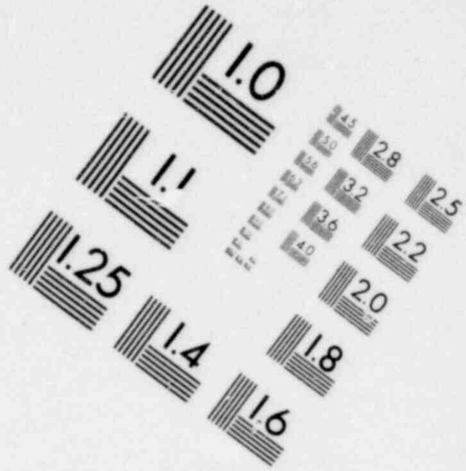
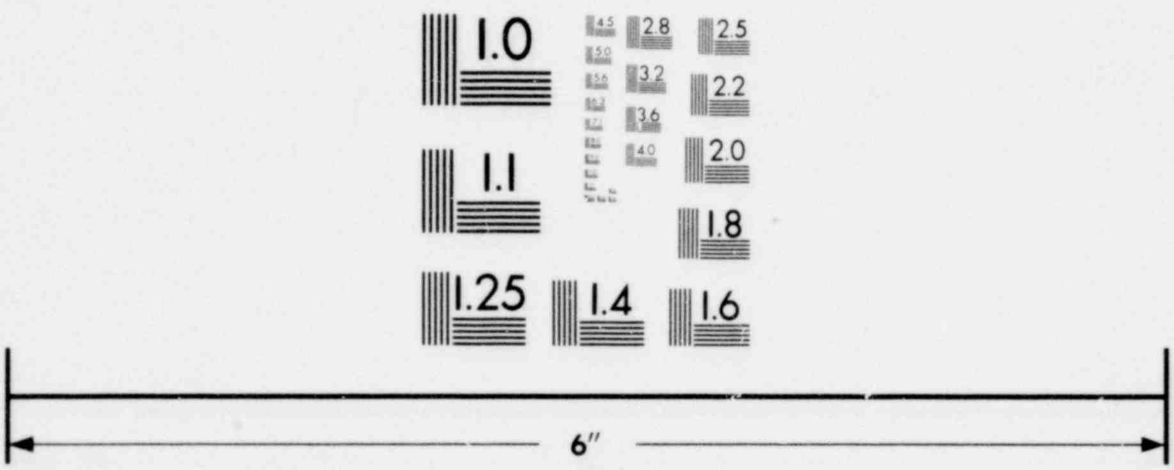
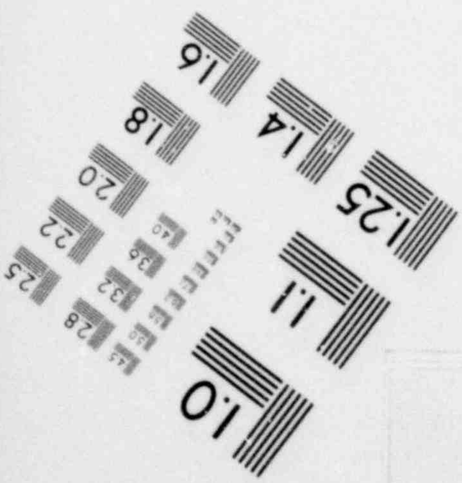
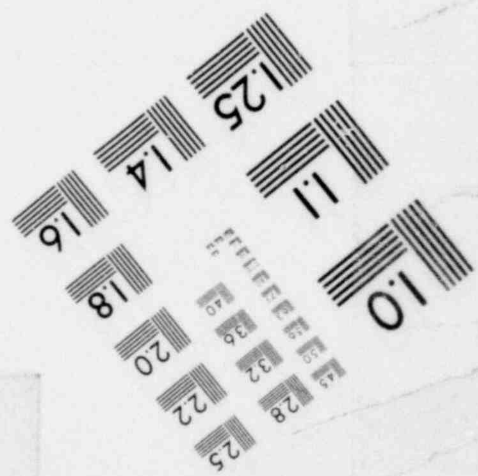
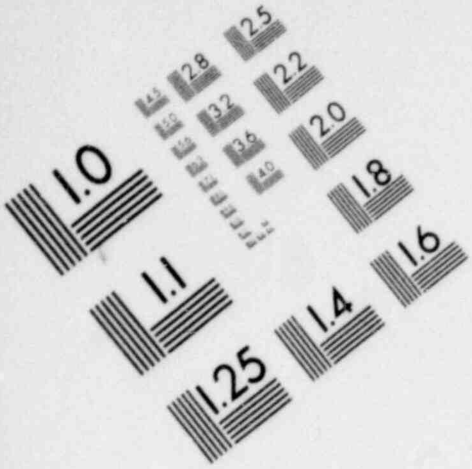


IMAGE EVALUATION TEST TARGET (MT-3)









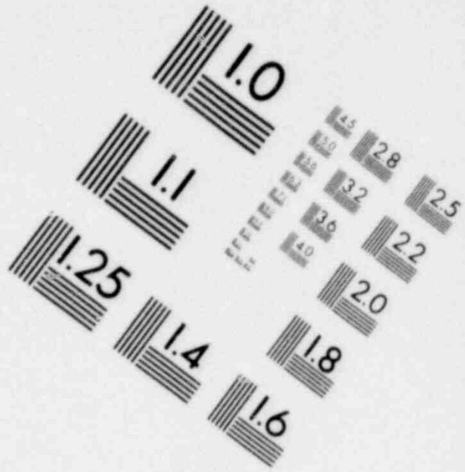
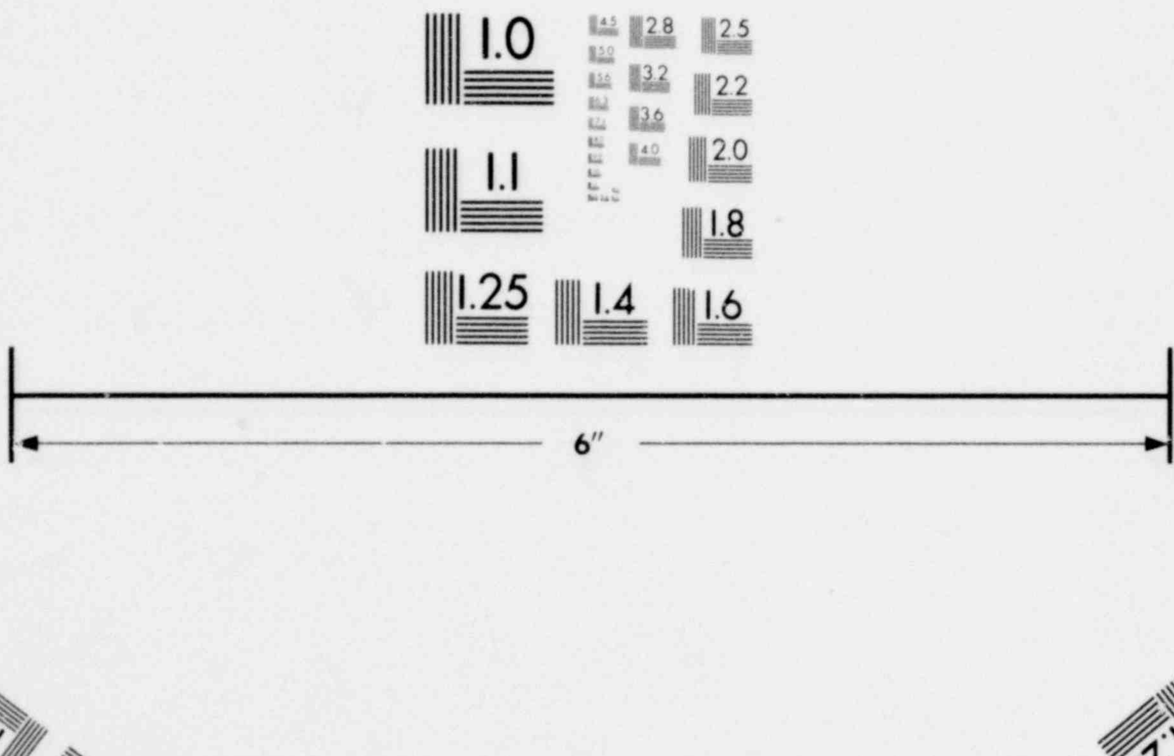
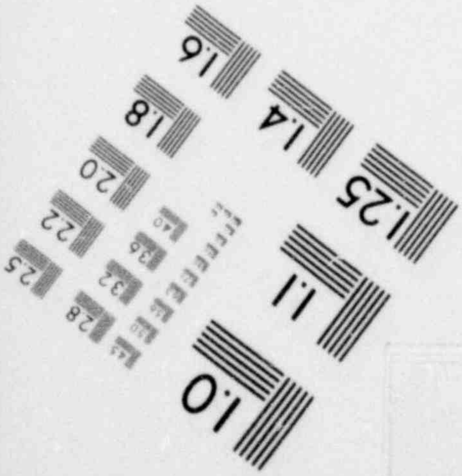


IMAGE EVALUATION TEST TARGET (MT-3)





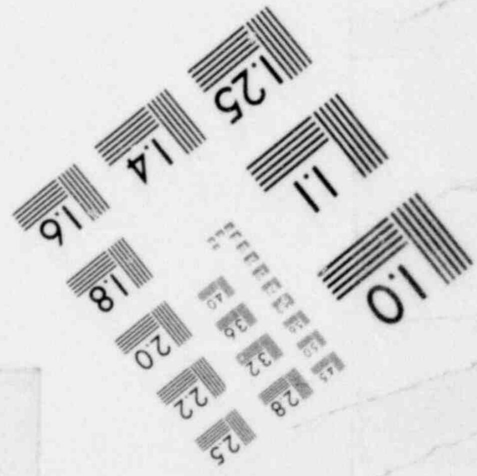


IMAGE EVALUATION
TEST TARGET (MT-3)

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Table 4.12d. Median Ratings of Various Hazardous Events (S Fla, N=141)

Event	Likelihood (20 pts Max)	Consequences (100,000 Max)	Overall Concern (20 pt Max)
Day-to-day leak	9.6	250	10.0
Sabotage	9.5	250	9.6
Transportation Accident	9.9	25	9.7
Storm Damage	14.3	50	10.4
Overheating	9.6	250	13.2
Nuclear Explosion	4.7	10,000	16.0
Hurricane	19.5	100	10.1
Sharks	10.8	10	5.0
Oil Spill	14.1	1	10.3
Tornado	14.6	75	9.8

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The respondents rated the non-nuclear events as being more likely than the nuclear events. At all four sites hurricane occurrence was rated highest with respect to likelihood. Oil spills were rated highly at all locations, being second in Massachusetts and New Jersey. Second at the two Florida sites, however, was tornado, rating almost as highly as hurricanes in north Florida. That figure may have been influenced by the respondent's personal experience with or hearing about tornado occurrences accompanying Hurricane Eloise in 1975. Shark attacks were regarded as extremely unlikely in Massachusetts and New Jersey.

The nuclear accident that was perceived to be most likely was that resulting from storm damage; four other events--transportation accidents, sabotage, overheating, and day-to-day leaks--were rated second and similar overall. A nuclear explosion, an impossible event, was rated as being least likely. Interestingly, only one of six respondents said this event would definitely not happen, whereas three percent said an atomic explosion definitely would happen.

Consequences

The previous section addressed the likelihood of events without respect to the respondent's perception of the consequences of the event if it did occur. For example, one respondent may perceive a tornado to be likely to occur, but unlikely to seriously injure or kill people. Another may perceive a tornado as being unlikely to occur, but as having great consequences for human life if it does occur. The present section of the questionnaire sought to specify this second aspect of the respondent's safety concerns: The consequences of the event for human life if it did occur.

Nuclear events were perceived to have more severe consequences for human life than non-nuclear events. The only exceptions were in north Florida where a hurricane was viewed as more severe than four of the six nuclear events and in south Florida where hurricanes were judged more severe than two of the nuclear events. At all sites, the nuclear explosion was considered to be by far the most severe accident. Within the nuclear category, other patterns were not apparent except that storm damage and transportation accidents were consistently rated low. Shark attacks and oil spills were rated lowest at all sites.

Overall Concern

Finally, the respondents rated their overall concern about the events. The overall concern presumably should reflect some

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combination of likelihood of occurrence and the consequences for human life if the event did occur. For example, a highly likely event with low consequences might lead to about as much concern as a much less likely event with higher consequences. Data from the north Florida site suggests that respondents differ widely in the tradeoffs they are willing to make between perceived likelihood and consequences of events in forming their overall concern.

The event causing greatest concern at all four sites was a nuclear explosion, followed by overheating. Nuclear events generally generated greater concern than non-nuclear events. The primary exceptions were that in north Florida hurricanes were more worrisome than four of the nuclear concerns, and at all four sites oil spills were comparable to several of the nuclear events. Sharks caused the least concern.

Knowledge (Table 4.13)

There was little difference between sites with respect to knowledge, although the Cape Cod sample scored slightly higher. The average number of correct responses was 2.8 out of six (Table 4.14). Guessing alone should have yielded an average of 1.5 correct. Although this difference is statistically significant, it does indicate a low level of knowledge about nuclear power.

A substantial majority of the respondents were aware that uranium is the fuel used in nuclear power plants (two-out-of-three to three-out-of-four). An even higher percentage recognized the term "fission" as being associated with atomic power (up to 82% in Cape Cod). About half the sample was aware that less than 10% of the electricity generated in the United States is produced by nuclear plants. Over one-third of the respondents believed that between 20% and 55% of the power is nuclear. Fewer than one-out-of-five of those interviewed knew that atomic waste can remain radioactive for over 10,000 years. One-fourth thought the maximum period was less than five years. The most commonly indicated "worst possible accident" was a nuclear explosion, with 39% to 46% of the sample so responding. Only 16% in south Florida, 17% at Cape Cod, 19% in north Florida, and 21% in New Jersey chose the correct response (core meltdown). Fewer than half the respondents identified plutonium as a harmful by-product of nuclear power plants. Of the six questions, this one elicited the highest frequency of "don't know" responses.

Table 4.13. General Knowledge about Nuclear Power (* denotes correct response) (N's ≈ 300)

Question	Response	NW Fla	NJ	CC	S Fla
		Percent Responding			
Fuel	Magnesium	6	3	6	8
	Coal	4	3	3	8
	Uranium*	67	72	75	67
	Bauxite	13	2	2	2
	Don't Know	11	20	14	15
Associated Term	Photosynthesis	6	3	4	6
	Fission*	73	75	82	68
	Gyroscope	5	4	3	6
	Flouride	2	4	2	6
	Don't Know	14	14	9	14
% of Electricity Generated	5-10%*	51	50	47	48
	20-25	25	23	35	28
	50-55	11	12	18	15
	75-80	2	3	2	3
	Don't Know	11	12	8	6
Max. Time Waste Radioactive	<5 yrs	25	22	26	32
	100 yrs	25	29	31	31
	1000 yrs	8	13	10	10
	>10,000 yrs*	22	16	16	17
	Don't Know	21	20	17	10
Worst Accident	Nuclear Explosion	45	39	46	44
	Core Meltdown*	19	21	17	16
	Ruptured Fuel Cell	17	12	14	20
	Damaged Isotope	6	9	6	8
	Don't Know	13	19	17	12
Harmful By-Product	Plutonium*	41	42	48	41
	Bauxite	6	5	5	7
	Barium	6	5	3	5
	Ozone	16	16	15	27
	Don't Know	30	32	30	20

Table 4.14. Median Score on Knowledge (Number of Correct Responses)

NW Fla	2.71
NJ	2.73
CC	2.97
S Fla	2.46

Table 4.15. Percent Aware of Nuclear Plants in Interview State (N's ≈ 300)

NW Fla	7.6%
NJ	33.7%
CC	40.5%
S Fla	20.4%

Table 4.16. Percent Aware of Nuclear Plants in Home State (N's ≈ 300)

NW Fla	45.3%
NJ	53.0%
CC	58.1%
S Fla	52.5%

Awareness of Operating Nuclear Plants

Only 7.6% of the north Florida visitors were aware that nuclear power plants are currently operating in Florida, while 33.7%, 40.5% and 20.4% of the respondents in New Jersey, Cape Cod and south Florida respectively, were aware that nuclear plants are operating in those states (Table 4.15). The huge difference between north Florida and the other sites is probably attributable to the facts that more of the north Florida visitors came from much farther away and the closest plant in Florida is over 250 miles from the north Florida interview site. Thus, they would have been exposed to less information about the Florida reactors. Forty-five percent, 53%, 58% and 53% interviewed in north Florida, New Jersey, Cape Cod and south Florida respectively, were aware of operating reactors in their home states (Table 4.16).

Confidence in Sources in Information (Table 4.17)

If public attitudes and beliefs are to be changed via provision of new information to alleviate misconceptions, the provider of information should be more successful if he has higher credibility with the receiver of the information. This is particularly important when two adversarial groups provide competing and apparently contradictory information. Confidence ratings of groups which could be providers of information about nuclear safety were consistent across interview sites. University scientists had highest credibility, followed by environmentalists, government scientists, the NRC, utility companies, news media, and elected officials.

Predictors of Response Data

Bivariate correlations, discriminant analyses, chi-square tests, and measures of association were computed in search of variables related to whether an individual would stop visiting a beach if a nuclear power plant were sited directly offshore (Tables 4.18 and 4.19). The best predictors among "nuclear attitudinal" variables were 1) overall desirability of nuclear power 2) confidence in the NRC, 3) concern about nuclear safety, 4) perceived likelihood of nuclear accidents. It is notable that knowledge about nuclear power did not predict responses to offshore siting. There were differences across sites, and the strongest relationship accounted for only 13% of the variance in the dependent variable. Other variables tested--primarily of a socio-economic, demographic, and vacation behavioral nature--

Table 4.17. Median Ratings of Confidence in Information Sources (N's ≈ 150)

Source	NW Fla	NJ	CC	S Fla
University Scientists	15.6	15.3	15.2	15.3
Environmentalists	13.6	14.7	12.5	14.8
Government Scientists	12.9	12.5	12.1	12.8
NRC	12.1	10.2	12.0	12.9
Utilities	9.9	9.7	9.6	10.2
News Media	9.7	10.0	9.6	9.8
Elected Officials	9.5	5.9	7.6	9.2

Table 4.18. Correlations with Intention to Return to Beach with Offshore Reactor *

	N Fla	NJ	CC	S Fla
Desirability of Nuclear Power (N's ≈ 150)	r=.36 (p=.001)	r=.03 (p=.37)	r=.35 (p=.001)	r=.27 (p=.001)
Confidence in NRC (N's ≈ 150)	r=.26 (p=.001)	r=.10 (p=.12)	r=.20 (p=.007)	r=.19 (p=.016)
Knowledge about Nuclear Power (N's ≈ 300)	r=.08 (p=.09)	r=-.03 (p=.17)	r=.03 (p=.18)	r=.02 (p=.20)
Concern About Nuclear Safety (N's ≈ 150)	r=-.13 (p=.06)	r=-.16 (p=.03)	r=.11 (p=.10)	r=-.01 (p=.45)
Subjective Likelihood of Nuclear Events (N's ≈ 150)	r=-.19 (p=.01)	r=.13 (p=.06)	r=.22 (p=.004)	r=.14 (p=.05)
Subjective Severity of Nuclear Events (N's ≈ 150)	r=-.05 (p=.26)	r=.01 (p=.46)	r=-.18 (p=.02)	r=-.27 (p=.001)

*Only correlations with $p < .05$ are conventionally accepted as being statistically reliable.

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Table 4.19 Chi-Square Probabilities for Selected Variables with Intention to Return to Beach with Offshore Nuclear Reactor*

	N Fla (N's ≈596)	NJ (N's ≈550)	CC (N's ≈540)	S Fla (N's ≈530)
Beach Location	$p(\chi^2)$=.16	.02	.87	.49
Sex	.01	.94	.02	.01
Age	.48	.61	.48	.67
Length of Stay	.49	.37	.85	.13
Visited Beach Before	.41	.99	.73	.72
Will Return	.45	.49	.96	.88
Visits Other Beaches	.07	.36	.58	.59
Favorite Place for Weekend	.55	.63	.72	.99
Income	.17	.39	.39	.08
Education	.11	.01	.73	.07
Residence (Local/ Out-of-Town)	.67	.38	.91	.44

*Only associations with $p \leq .05$ are conventionally accepted as being statistically reliable.

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did not predict well. Sex was related at three sites, and education played a role in two sites. Although those relationships exist, they are very weak, the largest measure of association (Goodman & Kruskal's Lambda) being only .05. There was no difference in responses between local residents and out-of-town visitors.

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Chapter 5

Analogous Situations

If there are cases where potentially hazardous or aesthetically unpleasing facilities analogous to offshore nuclear power plants have been sited in places where they have had the potential to disrupt tourism at beach areas, those situations should be relevant to the problem at hand. There are situations having a number of similarities, but the problem is finding cases with adequate similarity and which also have adequate data.

The preferable data would be suitable for time series analysis. One would plot the tourism figures for several years both before and after introduction of the facility analogous to the offshore nuclear plants and look for a change in the slope of the plot after the time that the facility was introduced. Figures 5.1, 5.2, and 5.3 represent three hypothetical situations. In the first there is an immediate drop in tourism, but the same growth rate resumes and the pre-facility level of tourism is eventually reached. Figure 5.2 represents a scenario in which tourism is immediately enhanced by the facility. In the final figure, the facility has no immediate apparent effect on the number of tourists, but the subsequent rate of growth in tourism is lower than that of the pre-facility period. Of course, there are other possibilities also.

A key condition necessary for inferring causality, however, is a "control" site. There could conceivably be changes in other factors affecting tourism, thus confounding one's ability to assess the true cause of a change in tourism. A control would consist of other tourist sites exactly the same as the study site <u>except</u> introduction of the facility. Thus if the same changes in tourism are observed at both the study site and the control sites, it is likely that the change in tourism is not attributable to the facility. On the other hand, if the same change does not occur at both sites, the difference is probably attributable to the facility.

Thus, ideal conditions for analogues are the following: 1) coastal communities having commercial tourism activity, 2) siting of a facility analogous to offshore nuclear power plants. (As stated in the third chapter, it was decided that the best existing analogy would be a coastal nuclear power plant near a tourist-oriented beach. The greatest deficiency in this analogy is

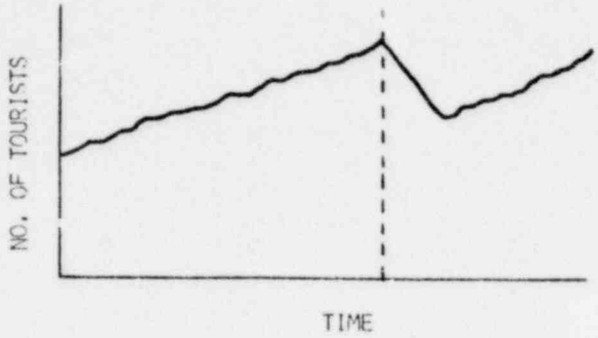

Figure 5.1. An immediate drop in tourism upon introduction of the facility (example)

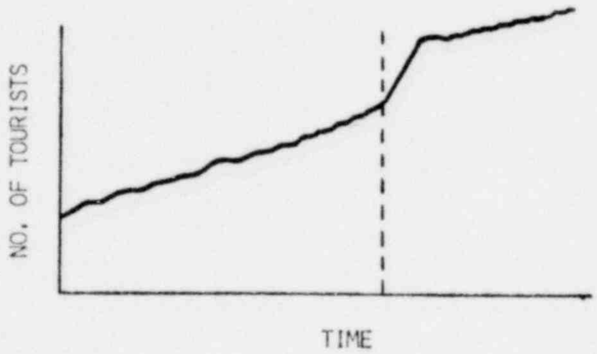

Figure 5.2. An immediate increase in tourism upon introduction of the facility (example)

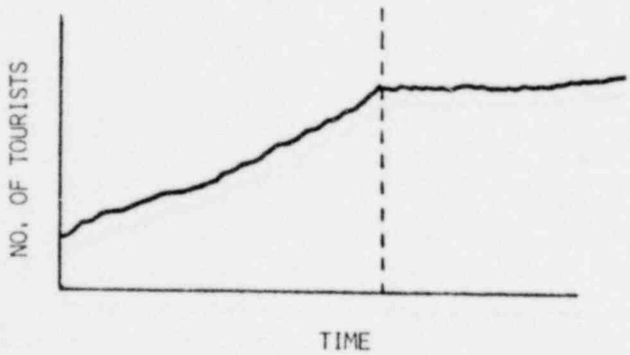

Figure 5.3. A slowdown in the rate of growth of tourism after introduction of the facility (example)

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the absence of the offshore location of the floating nuclear plants. The coastal nuclear power plant should be visible from at least part of the beach, and beach-goers should be aware of the existence of the nuclear facility.), 3) before-after commercial tourism data for periods of time sufficient for obtaining reliable estimates of the slopes of tourism-over-time plots and the variance of the slopes, and 4) control sites meeting the same conditions.

These ideal conditions are probably not satisfied by any existing situations, but four cases bearing certain similarities to the offshore reactor/tourism problem were investigated. The preceding discussion should serve as a guide to recognizing inadequacies in the situations described below.

St. Lucie, Florida

St. Lucie units one and two are located on Hutchinson Island, a barrier island facing the Atlantic Ocean across the Indian River from Ft. Pierce, Florida (see Figure 3.1). The reactor facilities are located on the "river" side of the island on Big Mud Creek, but the reactor complex, including the discharge and intake structures and the discharge and recirculation canals, extends to the Atlantic Beach. There is considerable beach recreation at nearby beaches, but development is not highly commercial. Due to the brief period of operation of the St. Lucie Plant (since 12/76), no systematically-collected before-after tourism data is available.

It should be noted, however, that beginning date of commercial operation may not be entirely significant. The period of construction and testing of the nuclear plant may affect public visitation at the beach also. For frequent visitors to the beach the construction and testing phase may provide a period of acclimation to the plant.

To obtain individuals' impressions of the plant and its effect on recreational activity at nearby beaches, 104 beach-goers were interviewed at locations ranging from places within view of the St. Lucie fence to a distance of approximately seven miles away, including Jensen Beach and Stuart Beach. (See Appendix B for items used in the interviews). Almost all the respondents (93) lived in the local area. This fact distinguishes them from tourists, which is both good and bad. The disadvantage is that tourists may react differently than local residents, primarily because the locals' community is deriving benefits from the plant due to an expanded tax base and employment. Thus they may be more tolerant of the plant. Of course residents may also perceive negative aspects of the plant which may not affect tourists, in which case the residents may be less tolerant of the plant. The advantage is that local residents are more likely to be familiar with the plant's existence and more likely to be aware of any impacts the plant has had on beach recreation. The latter point is important due to the fact that individuals avoiding the beach because of the reactor could not be interviewed.

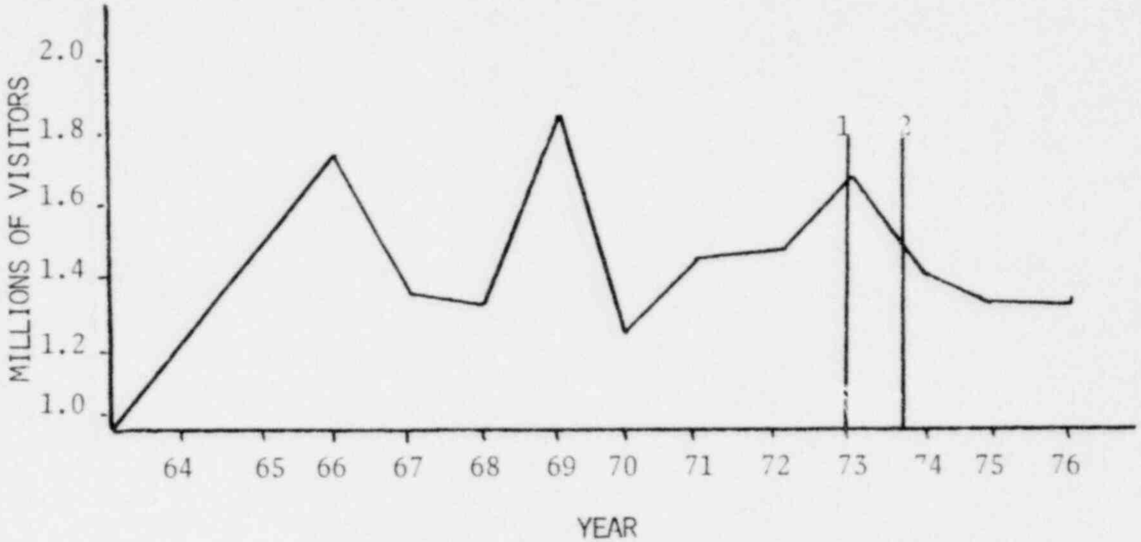
In fact 96 of the 104 people knew about the plant, and only seven said that it had ever affected their decision to visit the beach, having made them more reluctant about going. It should be obvious that the interview-at-the-beach procedure does not reach individuals who stay away from the beach because of the reactor. Of the 104 people interviewed, however, only five said they knew anyone personally who no longer visited the beach because of the plant. Five people also said they believed the reactor kept "many" people away. Thirteen respondents indicated a belief that the plant actually attracted people to the beach (due to perceived improvement in fishing and surfing).

In addition to the 104 interviews reported above, representatives of two beach-front motor hotels were contacted. The Sheraton is approximately two miles from the plant grounds, and the Holiday Inn is five miles away. Neither person had observed any decrease in business attributable to the plant.

Zion, Illinois

Zion units one and two began commercial operation in December, 1973 and September, 1974, respectively. They are located on Lake Michigan, adjacent to Illinois Beach State Park, near Zion, Illinois, approximately 40 miles north of Chicago. The beach abuts the plant fence, and the reactor buildings are prominently in view from several locations along the beach.

A lodge is located on the Illinois Beach State Park property approximately 1/4-mile south of the plant grounds. The lodge is not directly on the beach, and trees at least partially obscure view of the plant from the lodge. Figure 5.4 illustrates attendance at the park from 1964 to 1976. Although there has been a reported drop in attendance since operation of the units began, the decrease is in line with decreases ocurring in 1967 and 1970, thus making it impossible to conclude with certainty that the plant was the cause of the decrease. It should also be noted that attendance continued



1) Zion Unit one began operation 12/73

2) Zion Unit two began operation 9/74

Figure 5.4. Attendance at Illinois State Beach

1570 017

to increase after the units were constructed but before commercial operation began. Plant operation effects are confounded with variations in weather, openings of intervening recreational facilities, and an encephalitis "scare" in 1975. Management personnel associated with Illinois Beach State Park and the lodge perceived no adverse effect on visitation due to the plant.

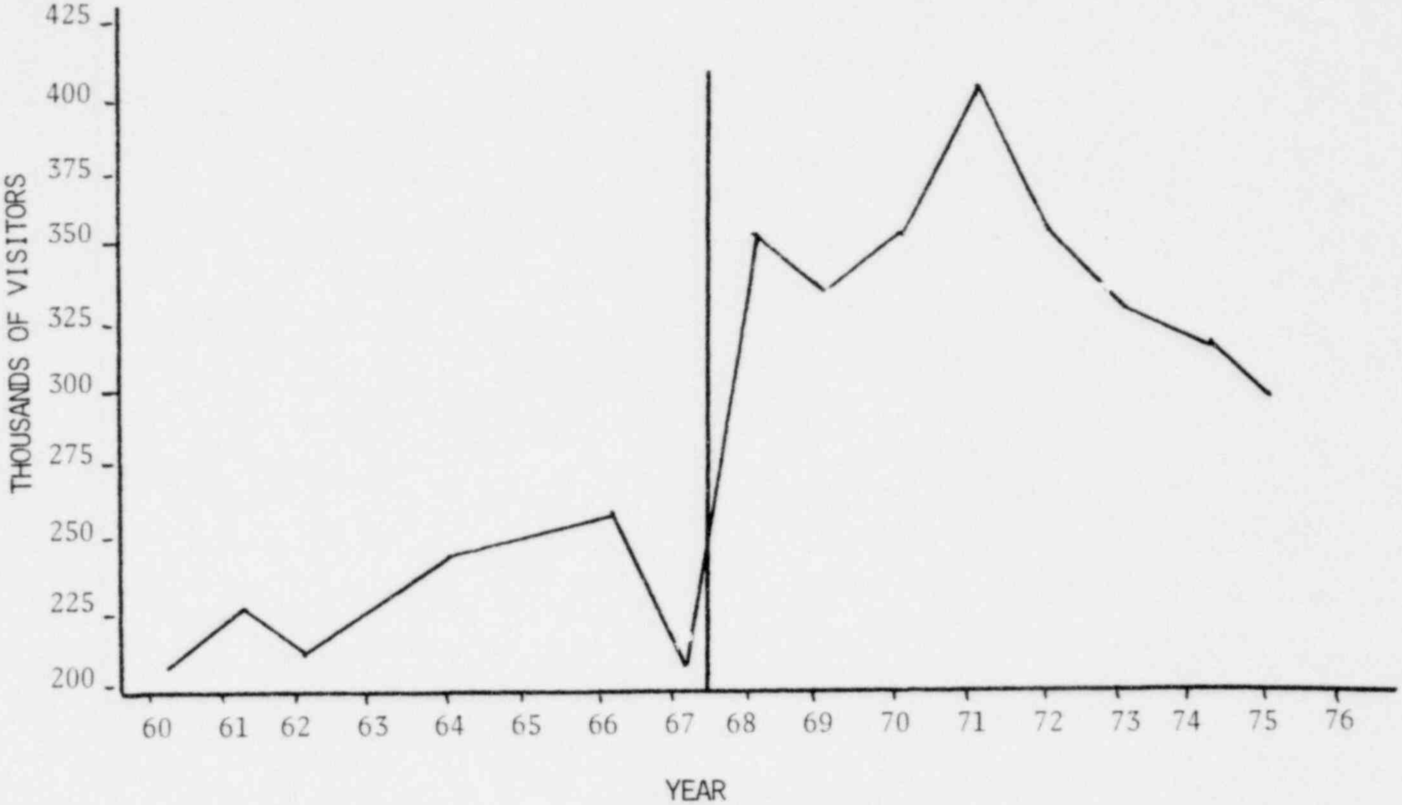
Fifty-six beach visitors were also interviewed near camping areas using the same questionnaire employed at St. Lucie. Seventeen were unaware of the nuclear plant, despite the fact that in some cases the reactor buildings were clearly visible from the respondent's location. No one said they had ever avoided the beach because of the reactor, although four people indicated an increased reluctance to visit there. Five people knew of others who avoided the beach because of the plant.

San Onofre, California

The San Onofre generating station has been operating commercially on the beach of the Pacific Ocean near San Clemente, California since 1968. San Clemente State Beach (three to five miles from the plant) has been operated by the state for a number of years before and after construction of the nuclear power plant. The plant is not visible from San Clemente State Beach. Figure 5.5 illustrates attendance data at the beach. Beach attendance continued to increase through 1971, more than doubling the pre-reactor figure. Attendance has decreased since 1971, probably due to the opening of alternative recreational opportunities. The data is also confounded with changes in counting procedures and delineation of park boundaries.

Representatives of the California Department of Parks and Recreation (Pendleton Coast Area Manager), the San Diego Coast Regional Commission, and the San Diego County Commission were contacted, and none believed there to have been any impact on recreation due to the plant. A common comment was that demand for recreation far exceeds the supply of opportunities in the area, thus possibly increasing people's tolerance of the nearby plant.

Due to poor weather, interviewing at the beach could not be completed. Only 15 interviews were obtained. Of that number, all but one were aware of the reactor, none had ever avoided the beach because of the reactor or knew of anyone who did. Ten of the respondents were residents of the San Clemente area, two were from out-of-state, and three were from elsewhere in California.



San Onofre became operational 1/68

Figure 5.5. Attendance at San Clemente State Beach

There is a beach (San Onofre State Beach) which is located immediately adjacent to the reactor site, but the state only obtained the land in 1972, thus providing no attendance figures before the plant's operation. The beach appears to be popular, however. Although the reactor is visible from some spots, it is not as prominent as the Zion plant.

Millstone, Connecticut

The Millstone nuclear power plant is located at Waterford, Connecticut near the beach of the Atlantic Ocean. Five miles away is Rocky Neck State Park, also on the Atlantic. Attendance data at Rocky Neck is shown in Figure 5.6. Attendance continued to increase after construction and operation of the plant. The decrease in 1972 was indicative of a statewide trend, possibly due to climatological variations. A new state park was also opened elsewhere that year. There is ongoing construction of Units 2 and 3 at Millstone.

Several individuals were questioned about the effects of Millstone:

1) Manager of the Rocky Neck Motel, located about two miles from Millstone at Niantic

2) A representative of the Fred Clark Agency, which manages rental cottages on Groton-Long Point, about six miles from Millstone

3) The owner of the area's largest charter fishing boat operation

4) Director of Ocean Beach Park in New London

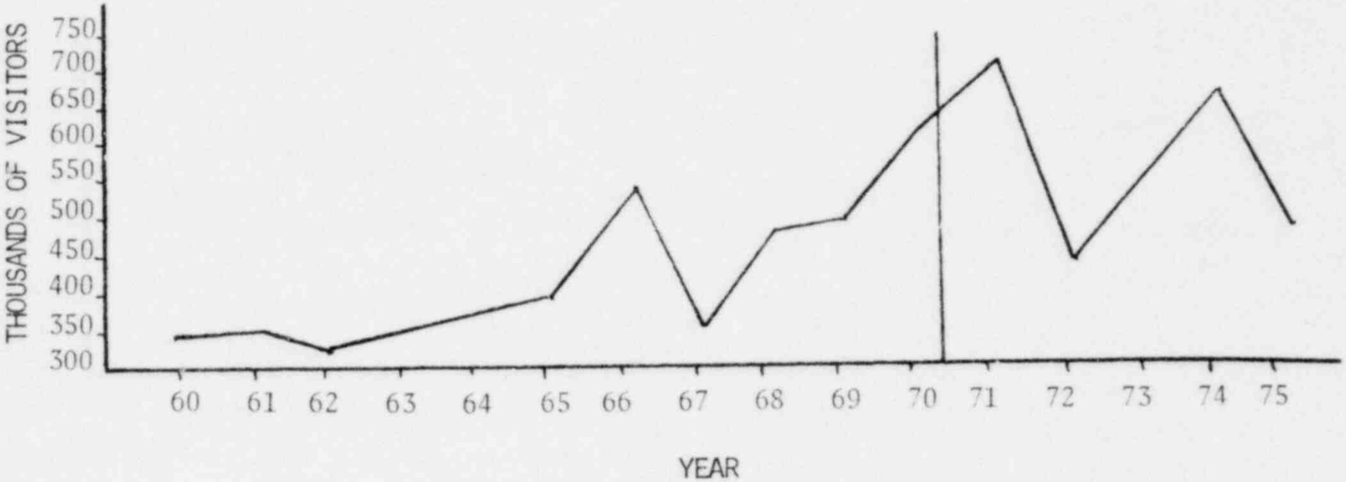
5) A representative of the Director of Tourism for the State of Connecticut

6) Tax assessor for Waterford

7) Director of Real Estate in the New London Tax Assessor's Office

8) A representative of the Southern Connecticut Regional Planning Association

9) Two representatives of the Southeastern Connecticut Chamber of Commerce Division of Tourism



Millstone began commercial operation 3/71

Figure 5.6. Attendance at Rocky Neck State Park.

10) Two representatives of the Tourist Information Center in Mystic, Connecticut

None of the people talked to reported any decreases in tourism or beach recreation resulting from the Millstone plant.

Fifty-six interviews were also collected at area beaches. Forty-one were at Rocky Neck, 10 were at Waterford beach, and five were at Pleasure Beach. The plant was not visible to respondents. Thirty-eight respondents were from Connecticut (outside the Waterford area), 10 were from Waterford, and eight were from Massachusetts or New York. Most of the people at Waterford Beach and Pleasure Beach were local residents.

Twenty of the respondents, almost all at Rocky Neck, were unaware of the plant at Waterford. Ten of those who knew of a nuclear plant in the general area didn't know the specific location. None of the respondents had ever avoided the beach because of the Millstone Plant or knew of anyone who had. Five people expressed an increased reluctance to visit the beaches, however.

Summary

It is difficult to draw conclusions from the analogous sites due to inadequate objective data for time series analysis and due to deficiencies in the analogues. At none of the analogous sites was the coastal nuclear plant as visually obvious as a floating nuclear plant would be at some points. (Awareness of the plant by beach visitors ranged from 64% and 70% at Millstone and Zion to 92% and 93% at St. Lucie and San Onofre.) Actual beach visitation trends are confounded by changes in record keeping practices, opening of competing recreation areas, broader changes in demand for recreation, and climatological variations. It appears from subjective response data, however, that if coastal nuclear power plants have had any impact at all on beach tourism and recreation, the impact has been very small.

Chapter 6

Conclusions

The approach employed in this investigation was deliberately multi-faceted: 1) related literature was reviewed, 2) direct questions dealing with intended beach avoidance were asked, 3) information-integration tasks were administered to ascertain trade-offs among a variety of beach attributes, 4) questions were asked relating to variables which might modify a beach-goer's intended reaction to a FNP (e.g., NRC licensing, visual impact of an FNP, knowledge about nuclear power), and 5) tourism changes at beaches near selected coastal nuclear power plants were assessed. It was felt that none of the components viewed alone would provide adequate insight for projecting the impact on tourism which would result from offshore siting of nuclear power plants. In this final chapter an effort is made to integrate the various findings into an overall impression.

The authors are unaware of any grand equation suitable for combining the various facets of the study to produce a precise estimate of beach avoidance. Readers expecting a quantitatively rigorous and explicit integration of the components of the investigation will not find such a treatment here. It is the authors' opinion that such a procedure is beyond the responsible limitations of current behavioral research. Instead, where quantitative indicators of beach avoidance were elicited in the research, assessments of the validity of those estimates will be stated, and interpretations will be made concerning appropriate revisions of those figures. Readers may wish to make different interpretations of the results presented in this report and to place different importance on the various components.

The "avoidance" data, that is, specific questions asking whether the respondent would return to the site of the interview if a nuclear power plant were offshore, will be used as a beginning point for forecasting actual behavior. Between 22.8% and 26.5% of those interviewed indicated an unwillingness to return to the beach if the plant were sited directly offshore at a distance of three miles.

That response was to a question to which most individuals had given little if any prior consideration, therefore the avoidance estimates are almost certainly exaggerated (see Appendix D).

For the following reasons, the figures should be lowered considerably:

1) Proximity of an offshore nuclear reactor was revealed by information-integration experiments to be less important to an overall evaluation of beaches than other attributes of beaches. It is likely that when individuals are faced with actual rather than hypothetical decisions about returning to a beach with an offshore nuclear power plant, and consider alternative beach locations, few will be willing to sacrifice the advantages they perceived in the beaches they have chosen to visit in the past. Note that asking the direct question may maximize the likelihood that the respondent will comply with the apparent demand of the interviewer to give a conforming (avoidant) response.

2) The habitual nature of beach-going makes changes in beach preference unlikely. Pilot studies associated with this research revealed a strong bias to return to a beach when an initial visit proved favorable. Further instances have revealed a strong tolerance for at least temporary aesthetic disruption at one's preferred beach. Approximately 70% to 90% of the interviewees were returners, and 93.4% to 96.9% planned to return in the future.

3) "Intention to-behave" responses indicated that if individuals were aware of NRC approval of the plant, the impact on nearest possible beaches would be reduced by 40.3% to 50.0%. A large portion of beach visitors aware of the FNP would probably be made aware of NRC certification if a plant were actually sited offshore. Equally significant is the general instability of the original avoidance figures highlighted by these results.

4) There is no reliable evidence of reduction in beach visitation at the four analogous situations observed. Existing park attendance figures are inconclusive, interviews with officials and professionals in positions to observe the impacts on recreation from coastal nuclear power plants indicate there has been no effect, and beach visitors near coastal plants estimated that the nearby reactors have deterred less than five percent of the public from visiting the beaches.

5) Hazard perception and adjustment literature reflects a willingness of individuals and society to take risks such as living in flood-prone areas when adequate benefits are

associated with such risk-taking. This extension is tenuous, but the natural hazard experience should not be completely discounted.

Taking these factors into consideration it is unlikely that more than 5% to 10% of the current beach visitors would cease to visit their present beaches if a nuclear power plant were sited three miles offshore. The 5% to 10% interval represents a magnitude of only one-fifth to two-fifths of the preliminary avoidance figures of 22.8% to 26.5%. In the authors' judgment such a reduction is merited by the five considerations enumerated above. Note that the interval is for a likely upper limit of avoidance; impact might actually be less than 5%. That interval would apply at the facility's closest point to shore (three miles). Points farther up or down the beach would probably be lower by at least the same proportion of the original response figures (3% to 6% at five miles, 2% to 4.5% at 10 miles, 1.5% to 3.5% at 25 miles, and 1% to 2% at 50 miles). Judicious siting can minimize impact by taking this exponential distance decay curve into account. It should be considered that when extrapolating these figures to a large area of beach, the total impact over the entire expanse will probably be less than the sum of the impacts at the various distances. That is, some of the individuals who find beaches nearest the plant unacceptable may relocate at nearby beaches farther from the reactor.

Three notes of caution should be recognized when considering the reduction-in-tourism reported here. First of all, the visual impact of an offshore reactor is still an uncertainty to a large degree. An effort was made to assess that impact by showing photographs of an artist's conception of a beach with and without a reactor. That simulation leaves much to be desired, however. The panoramic view of the horizon which one experiences when actually looking out to sea was not captured by the photograph, almost certainly causing the reactor to appear more imposing in the photograph than it would in reality. The three-stage question used to elicit responses probably invited negative reaction to a biasing degree also. Furthermore, it is not known to any extent what the visual impact would be at distances farther down the coast. Out-of-town tourists visiting beaches from which the FNP is not visible may not even become aware of the plant's existence. These are conjectures, however, and there may actually be other factors not recognized here which make the visual impact even more pronounced than indicated by the responses in this questionnaire.

A second caution is that people had not given the hypothetical situations used in this study adequate consideration prior to being asked the questions. An attempt was made to rectify errors stemming from this deficiency by refining the original avoidance figures as indicated above.

The final point is probably the most crucial. The estimates reported here are likely to be accurate representations of public reaction if nuclear power plants were sited offshore immediately. There is no reason to assume that behavioral intentions will be the same in the future. Polls have shown public support for nuclear power to be relatively stable since 1969. However, the issue here is not support for nuclear power as an energy alternative, but willingness to tolerate a specific reactor off the coast of one's favorite beach. The greatest uncertainty in this regard is concern with safety. On one hand, a single major accident at a nuclear power plant could appreciably increase public apprehension about offshore plants. On the other hand, several years of safe operation of an offshore installation may recapture some individuals who had stopped visiting the beach when operation of the facility began. Equally uncertain are the effects of changes in public knowledge about nuclear power and changes in general support for nuclear energy. Knowledge was unrelated to response in this study, but attitude toward nuclear power was related.

In summary, based on multi-faceted information sources, the percentage reduction in tourism attributable to siting of nuclear power plants offshore would be small, but not necessarily negligible, at points close by. The stability of those impacts over time, however, depends upon the stability of current attitudes toward and beliefs about nuclear power and its safety.

23-478

Appendix A

Items Used in Primary Beach Interviews

I. Demographic Characteristics, Background Data: N=2400
Pink Form

1. Sex M F

2. Age refuse to answer _____
less than 20 _____
20-29 _____
30-39 _____
40-49 _____
50-59 _____
60 or over _____

3. What city or town do you live in?________________

4. Do you live there all year? YES NO
If no, where else do you live?________________

5. Where did your trip to the beach begin?___________
(Did you come straight from your home?)___________

6. How did you travel? plane, car, bus, train, other
____

7. How many days do you plan to stay?____________

8. Have you visited this beach before? YES NO
If yes, how many times per year?____________

9. Do you think that you will visit this beach in the future? YES NO
If yes, how often per year?____________

10. How many times in a year do you visit other beaches?
____

11. What kind of things do you like to do at the beach?
____

12. Have you ever been in an interview at the beach before? YES NO
If yes, when and where?______________________

13. When you take weekend trips for recreation, what's your favorite place to go?____________________
(Read: for example: the beach, mountains, other.)

25-479

14. When you take vacation trips for recreation, what's your favorite place to go?________________
(Read: for example: the beach, mountains, other.)

15. Which of the following describes your family income?

refuse to answer	____
up to 7500	____
7500-14999	____
15000-24999	____
25000-49999	____
more than 50000	____

16. Did you attend school beyond high school? YES NO

17. If yes, how much school did you complete?

1) trade school
2) some college
3) 2-year degree
4) 4-year degree
5) education beyond 4-year degree

18. Approximately how much do you spend each day on ______while you are at __________ beach?

lodging__________
food____________

II. Concerns about offshore nuclear plants? N=600 (White Form)

Let me tell you something about our study before we continue. As you may know there are several different ways of generating the electrical power we use each day. Many of my questions today are about various methods of generating electricity. Other types of questions will also be asked.
One of the newest ways to produce electrical power is by the use of nuclear or atomic power plants. In the future, some of these plants may be located about three miles off the coast of the United States.

A. Open-ended

1. Can you think of anything that would worry you about having a nuclear power plant located right out there three miles offshore?

1570 029

Are there any other concerns you might have about the operation of a nuclear power plant off the coast of ________________?

B. Ratings of Concern: Likelihood, Consequences, Overall

We have put together a list of concerns people have expressed about the safety of offshore nuclear power plants. We also have a list of other beach related safety concerns. These concerns are about events which some people believe might be dangerous to people who go to the beach.

I am going to read this list of events to you. I would like for you to rate each of the events as to how likely you thing it is to occur at this beach during the next thirty years. For those questions dealing with nuclear power, assume there is a nuclear power plant three miles offshore.

As I describe each event, please rate it using this twenty point scale (show scale). You can see that zero means you think the event will definitely not happen during the next thirty years. Twenty on the scale means you believe the event will definitely happen during the next thirty years.

Do you have any questions before I begin the list?

Now, how would you rate the likelihood of:

a. A day-to-day release of radioactive materials from the nuclear power plant ______

b. A hurricane occurring here during the next 30 years ______

c. A safety hazard as a result of sabotage to the nuclear power plant ______

d. A person being attacked by a shark at this beach during the next 30 years ______

e. An accident during the transportation of nuclear materials from the power plant ______

f. A major oil spill from an ocean tanker at this beach during the next 30 years ______

25-480

g. A bad storm causing damage to the nuclear reactor ______

h. A tornado occurring here in the next 30 yrs______

i. A sudden release of radioactivity due to overheating of the nuclear reactor ______

j. A major explosion of the nuclear reactor (like an atomic bomb) ______

2. I am going to read the list of events again. This time I want you to assume that each event does occur here at ________ during the next 30 years. Of course, you must continue to imagine there is a nuclear power plant three miles offshore. How many people do you think would be killed, injured, or suffer long-term damage to their health as a result of each event? Here are some numbers we would like for you to use in making your estimates.

(hand scale to respondent)

a. A day-to-day release of radioactive materials from the nuclear power plant ______

b. A hurricane occurring here ______

c. A safety hazard as a result of sabotage to the nuclear plant ______

d. Attacks by sharks here at this beach ______

e. An accident during the transportation of nuclear materials from the power plant ______

f. A major oil spill from an ocean tanker at this beach ______

g. A bad storm causing damage to the nuclear reactor ______

h. A tornado occurring here ______

i. Sudden release of radioactivity due to overheating of the nuclear reactor ______

j. A major explosion of the nuclear reactor (like an atomic bomb) ______

1570 031

3. In the last 2 sections you have told us 2 things: first how likely you believe certain events are to occur; and second, how bad you believe the consequences of those events would be if they did occur. In this section, we would like you to tell us your <u>overall</u> concern about each of these events. In doing this <u>you should</u> consider both things: how likely you believe the event is to happen, and, how bad you believe the consequences of the event would be if it did happen. Taking these 2 things together, rate your overall concern about each event.

As I read each event give your level of concern using this twenty point scale. Zero on this scale means you are not concerned about it at all. Twenty means you would be extremely concerned.

For those questions dealing with nuclear power assume there is a nuclear power plant three miles offshore.

a. A day-to-day release of radioactive material from the nuclear power plant. ______

b. A hurricane occurring here ______

c. A safety hazard as a result of sabotage to the nuclear power plant ______

d. Attacks by sharks here at _____beach ______

e. An accident during the transportation of nuclear materials from the power plant ______

f. A major oil spill from an ocean tanker at this beach ______

g. A bad storm causing damage to the nuclear reactor ______

h. A tornado occurring here ______

i. A sudden release of radioactivity due to overheating of the nuclear reactor ______

j. A major explosion of the nuclear reactor (like an atomic bomb) ______

25-481

III. Desirability of Energy Options: N=600 (Green Form)

Suppose additional electric power is needed to meet rising demand. A number of different sources of energy are available. We would like you to rate each of the following sources. Please answer using this scale (show scale). As you can see, zero on the scale means that you think the energy source is very undesirable--that is, you do not like that method at all. On the other hand, twenty means that you believe the energy source is very desirable --that is, you like that method very much.

a. Solar power ______

b. Coal burning electric generators ______

c. Oil burning electric generators ______

d. Nuclear generators ______

e. Hydroelectric generators (dams) ______

IV. Confidence in Sources of Information: N=600 (Green Form)

Here is a list of people and groups who give information to the public on the question of nuclear risks and safety. We would like for you to rate how much confidence you have in each of them. Please answer using this scale (show scale). As you can see, zero on the scale represents no confidence, that is, you have no confidence in that group. On the other hand, twenty means that you have complete confidence. (Please alternate the order in which you read the list).

Regulatory agency (Nuclear Regulatory Commission) ______

Electric Utilities Company ______

Environmentalists ______

Newspapers and T.V. ______

Government Scientists ______

University Scientists ______

Elected Representatives such as Senators and Congressmen ______

V. Visual Impact Questions: N=600 (Green Form)

A. Here is a photograph of a beach. Assume that it has the facilities that you like and is close to your home. Would you go to this beach?

Yes_____ No_____ Don't Know_____

B. Assume that there is a nuclear power plant three miles offshore from this beach. Once again, assume the beach has the facilities that you like and is close to your home. Would you go to this beach?

Yes_____ No_____ Don't Know_____

C. Here is a photograph of what the beach would look like if there were a nuclear power plant three miles offshore. Assume that the beach has the facilities that you like and is close to your home.

Yes_____ No_____ Don't Know_____

VI. Information-Integration Tasks: Beach Attractiveness

A. Photographs of beaches: N=240 (attributes specified by respondents) (Goldenrod Form)

B. Two-variable case I: N=240 (Yellow Form)

1. Proximity to power plant (1, 5, 10, 25, 50 miles)

2. Type of plant (coal, nuclear)

C. Two-variable case II: N=240 (Blue Form)

1. Proximity of offshore nuclear plant to beach (5, 10, 25, 50 miles down the beach and 3 miles offshore)

2. Proximity of beach to home (50, 150, 400, 800 miles)

D. Four-variable case: N=480 (Buff Form)

1. Proximity of offshore nuclear plant (see C.1 above)

2. Quality of facilities at the beach (good, poor)

25.482

3. Crowding at the beach (moderate, very)

4. Cleanliness of the beach (littered, unlittered)

(The above outlines the tasks. The following 4 pages are the actual instructions used in executing them.)

A. Photographs of Beaches (Goldenrod Form)

I'm going to show you photographs of some beaches in the _________ beach area. I'll show you several pictures of each beach, and its location in the ______ area. We would like for you to rate each beach on the following scale (show scale).

0 means a <u>very undesirable</u> beach, one that you would <u>never</u> go to, given a chance.

20 means a <u>very desirable</u> beach, one that you would <u>always</u> go to if you had the opportunity.

(Get ratings of each picture. Pictures should be presented in a randomized order. Record the rating adjacent to the picture number. Be sure to identify the location of the site on the map.
****

Let me tell you something about our study before we do the next set of ratings. As you may know, there are several different ways of producing the electricity we use each day. One of the newest ways to produce this electrical power is by the use of nuclear or atomic power plants. In the future, some of these plants may be located off the coast of the United States. They will be located about 3 miles off the coast.

Imagine that such an offshore nuclear generating station is located at the point indicated by "NP" on the map. I'm going to show you the sets of pictures again. Could you please rate how desirable you would find each of the beaches that I showed you before if a nuclear generating facility were located 3 miles off the coast at point NP. (Show picture and map. Verbally indicate the total distance down the coast from the site to the reactor. Record the rating adjacent to the picture number.)
****

1570 035

Just glance at the set of pictures now. Can you tell me what factors were important in making your ratings of each beach? Did you notice anything that made one beach more desirable than other? (Write down list of factors).

B. Two-Variable Case I (Yellow Form)

Let me tell you something about our study before we do the other section of this questionnaire. As you may know there are several different types of electrical power generating plants in use today. An example of one type of generating plant would be those that use coal as a fuel. Another type is the nuclear power plant. Many of these sources of our electricity are located at or near the beach for one reason or another.

I'm going to read to you some statements describing some imaginary beaches. The beaches are all the same in appearance and quality. All are very nice beaches. However, each one has some type of electrical power generating plant located at some distance from it. I'll tell you the type of generating plant and where it's located in relation to the beach in question. As I describe each beach you are asked to rate it on this twenty point scale. As you see, zero on the scale means that you find the beach very undesirable; that is, you would never visit such a beach. The other end of the scale, twenty, means that you find the beach to be very desirable. That is, you would always visit that beach, given the opportunity. As a practice example how would you rate the following beach on the scale I have given you?

> A nuclear power plant is located on the beach right next to you.

OR

> A coal burning power plant is located on the beach right next to you.

As another practice example, how would you rate the following beach on the scale I have given you?

25-483

A coal burning plant is located on the beach east of you 500 miles.

OR

A nuclear power plant is located on the beach east of you 500 miles.

These examples are more extreme than those I'm going to read you in a minute. Remember, the beaches are all the same except for their distance and some type of power plant.

Now we will begin. As I read each description you tell me how you would rate the beach by giving me a number between zero and twenty.

C. Two-Variable Case II (Blue Form)

Let me tell you something about our study before we do the other section of this questionnaire. As you may know there are several different types of electrical power generating plants in use today. One type is the nuclear power plant. In the future it is anticipated that some of these plants will be located off the coast of the United States. I'm going to read you a series of statements describing some imaginary beaches that have such offshore nuclear power plants located at some distance from them. These beaches are all the same in appearance and quality. All are very nice beaches. However, each one does have an offshore nuclear power plant located at some distance from it. I'll tell you how far the imaginary beach is from the nuclear power plant and how far you had to travel from your home to get to the beach. As I describe each beach, you are asked to rate it on this 20 point scale. As you see, zero on the scale means that you find the beach very undesirable. That is, you would never visit such a beach. The other end of the scale, twenty, means that you find the beach to be very desirable. That is, you would always visit that beach given the opportunity.
As a practice example how would you rate the following beach on the scale I have given you?

1570 037

You have to travel [illegible] than one-half mile from your home to get to the beach. A nuclear power plant is located 3 miles offshore 200 miles down the beach.

As another practice example how would you rate the following beach on the scale I have given you?

You have to travel 1500 miles from your home to get to the beach. A nuclear power plant is located 3 miles offshore directly opposite the beach.

These examples were more extreme than those I'm going to read you in a moment. Now, we'll begin. Remember, the beaches are all the same except for their distance from your home and from the nuclear power plant. As I read each description you tell me how you would rate the beach by giving me a number between zero and twenty.

D. Four-Variable Case (Buff Form)

Let me tell you something about our study before we do the other section of this questionnaire. As you may know there are several different types of electrical power generating plants in use today. One type is the nuclear power plant. In the future it is anticipated that some of these plants will be located off the coast of the United States. I'm going to read you some statements describing some imaginary beaches that have such offshore nuclear power plants located at some distance from them. I'll tell you how far the imaginary beach is from the nuclear power plant. I'll also give you information on the facilities, cleanliness, and crowding conditions of each imaginary beach. As I describe each beach, you are asked to rate it on this twenty point scale. As you see, zero on the scale means that you find the beach very undesirable. That is, you would never visit such a beach. The other end of the scale, twenty, means that you find the beach to be very desirable. That is, you would always visit that beach given the opportunity.

As a practice example, how would you rate the following beach on the scale I've given you?

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A nuclear power plant is located 3 miles directly offshore. The facilities at this beach are very poor. The beach is extremely crowded. There is much litter on the beach.

As another practice example, how would you rate the following beach on the scale I've given you?

A nuclear power plant is located 3 miles offshore and 500 miles down the beach. The facilities at this beach are very good. The beach is not at all crowded. There is no litter on the beach.

These examples were more extreme than the ones I'm going to read you in a moment. Now we'll begin. As I read each description you tell me how you would rate the beach by giving me a number between zero and twenty.

VII. Response to Siting at Specific Beach (Fla. and Mass.): N=1800

A. If there were a nuclear generating station located 3 miles offshore--out there (point directly toward seaward horizon)--do you think it would affect your decision to come to this beach?

Yes_____ No_____ Don't Know_____

If "yes", Do you think it would keep you from coming here?

Yes_____ No_____ Don't Know_____

If "yes", What if the plant were 3 miles offshore and 5 miles down the coast; would that keep you from coming here?

Yes_____ No_____ Don't Know_____

If "yes", 10 miles? Yes_____ No_____

25 miles? Yes_____ No_____

50 miles? Yes_____ No_____

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If "yes" to first part of above question:

B. Now again suppose there's a nuclear generating station 3 miles offshore. What if you learned that the plant had been approved and declared safe by the U.S. Nuclear Regulatory Commission--those are the people responsible for deciding whether or not the Federal government should permit the plant to be located out there. In that case, would you come to the beach here?

Yes_____ No_____

C. Suppose a nuclear power plant were to be put in this area, say five miles down the coast from here.

The plant could either be put right on shore or it could be put three miles offshore. Would it matter to you, with respect to your decision to come to this beach, where the nuclear plant was put?

No_____ Yes, prefer onshore_____

Don't Know_____ Yes, prefer offshore_____

VIII. Response to Siting at Specific Beach (N.J.): N=600

A. The New Jersey Public Service Electric and Gas Company has plans to put a nuclear generating station about three miles off the coast from Little Egg Inlet. (show map)

That's about _____miles from here. If they did put the power station there, do you think it would affect your decision to come to this beach?

Yes_____ No_____ Don't Know_____

If "yes", would it keep you from coming here?

Yes_____ No_____ Don't Know_____

Ocean City	-22 miles
Margate City	-17 miles
Atlantic City	-13 miles
Brigantine Beach	-8 1/2 miles

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Beach Haven	- 5 miles
Surf City	-13 miles
Barnegat Light	-20 miles

If "yes" to first part of above question:

B. What if you learned that the above plant, which will be 3 miles offshore, ____ miles from here, had been approved and declared safe by the U.S. Nuclear Regulatory Commission--those are the people responsible for deciding whether or not the Federal government should permit the plant to be located out there. In that case, would you come to the beach here?

Yes____ No____

C. This plant, which will be ____ miles down the beach could either be put right on shore or it could be put three miles offshore, as planned. Would it matter to you, with respect to your decision to come to this beach, where the nuclear plant was put?

No____ Yes, prefer onshore____

Don't Know____ Yes, prefer offshore____

IX. Knowledge of Nuclear Power Generation: N=1200

Now we would like to ask you a few questions about nuclear power itself.

1. What fuel is used for nuclear power generation?

Magnesium ____
Coal ____
Uranium ____
Bauxite ____
Don't Know ____

2. Which of the following words is associated with nuclear power?

photosynthesis ____
fission ____
gyroscope ____
flouride ____
don't know ____

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3. What percent of the total electricity produced today in this country comes from nuclear power?

5-10% _____
20-25% _____
50-55% _____
75-80% _____
don't know _____

4. Radioactive wastes from nuclear plants remain dangerous for a maximum period of:

less than 5 years _____
100 years _____
1000 years _____
more than 10,000 years _____
don't know _____

5. The worst accident which can occur in a nuclear plant now operating is:

an explosion (nuclear) _____
core meltdown _____
ruptured fuel cell _____
damaged isotope _____
don't know _____

6. Which of the following is a harmful by-produce of nuclear power generation?

plutonium _____
bauxite _____
barium _____
ozone _____
don't know _____

7. Do you know of any nuclear generating stations currently operating in this state?

Yes_____ No_____ Don't Know_____

If "yes", where?______________________________

8. Do you know of any nuclear generating stations currently operating in the state where you live?

Yes_____ No_____ Don't Know_____

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If "yes", where?______________________________

IX. I.D. Information: N=2400

Interviewer Name______________________________

Date________________

Time________________

Interview Site__________(City)__________

__________(Weather)__________

__________(Crowding)__________

Subject No.__________

Comments:

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Appendix B

Items Used in Analogous Site Beach Interviews

Plant Site Questionnaire I

1. How long have you been coming to this beach?____________

2. How often do you visit here?__________________________

3. Where do you live?_______________

4. Do you know of any power plants nearby? Yes____ No____

****If No, go to 13.

5. If yes: Where is it located?_________________

6. Also if yes: Do you know what kind of power plant is it? Yes____ No____

7. If yes: What kind?__________________

8. Does the plant affect your decision to visit this beach? Yes____ No____

9. Has it ever affected your decision to visit this beach? Yes____ No____

   If yes, how?_____________________________________

10. Do you know anyone personally whose decision to come to this beach has been affected by the plant being nearby? Yes____ No____

11. Do you think it (the plant) keeps many people from coming to this beach? Yes____ No____

12. Do you think it (the plant) attracts many people to this beach? Yes____ No____

13. Sex M___ F___

14. Age Refuse to Answer ___
    less than 20 ___
    20-29 ___
    30-39 ___
    40-49 ___
    50-59 ___
    60 or over ___

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15. Which of the following describes your family income?

Refuse to Answer	____
up to 7,500	____
7,500-14,999	____
15,000-24,999	____
25,000-49,999	____
more than 50,000	____

16. Did you attend school beyond high school? Yes____ No____

17. If yes, how much school did you complete?

Trade school	____
Some college	____
2-yr degree	____
4-yr degree	____
beyond 4-yr degree	____

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Appendix C

Brief Summary of Statistical Procedures

Brief Summary of Statistical Procedures

Reliability of Parameter Estimates

The proportions, "averages," regression coefficients, etc. reported here (generically referred to as parameters) are exact only for the sample of respondents for which they were computed. The goal of the study, however, is to assume that the people included in the sample are representative of all beach-goers at the sites from which the sample was chosen. This larger group is referred to as the "population," and if one is to generalize to the population from a random sample taken from it, he must recognize the limitations under which he must operate.

Essentially, for a given parameter (say, a proportion), one would like to know how close the sample estimate is to the actual value for the entire population. The larger the sample (all other things being equal), the more likely it is that the sample estimate will be the same as the true population value.

Contrary to popular belief, the number of people needed for a "good" sample estimate is almost totally unrelated to the number of people being generalized to. That is, one needs almost the same number of people in the sample regardless of whether there are 50,000 people in the population or 500,000.

The other characteristic of the sample data that affects its "reliability" for generalizing to the population is the amount of variation there is among the answers given by people in the sample. For example, if 50% of the people in a sample are in favor of nuclear power and 50% are opposed, that is the maximum amount of variation, or disagreement, that can exist in the responses. Ninety percent in favor would indicate very little disagreement, or "variance," in the responses. All other things (like sample size) being equal, a sample estimate with low variance in the data is a better approximation of the population parameter.

To indicate what can be inferred from a certain sample estimate to a population parameter, statisticians make the following sort of statements: If one takes "many" additional samples of the same size and computes confidence intervals having endpoints within 3% of the value of the parameter estimates in each, the true parameter value will fall within 95% of the confidence intervals computed. (The temptation is to say that one is 95% "sure" that the sample estimate is within 3% of the population value, but technically this is incorrect.) The "95% of the confidence intervals" phrase is called the "confidence level" of the estimate, and the "within 3% of the sample estimate" phrase refers to the "reliability" or "confidence interval width" of the sample estimate.

One would prefer that the confidence level be as high as possible and that the confidence interval width be as small as possible. For example, an estimate with a 95% confidence interval and 5% width is preferable to a 90% confidence interval and 5% width. However, once a sample has been taken, one must choose a confidence level or an interval width and then compute the other. For example, one may say, "I want a 99% confidence interval. What is the width of that interval for my sample?" Or, conversely, one may say, "I want a confidence interval with end points within 3% of the value of my sample estimate. What would be the confidence level of that interval?"

For a given sample, increasing the confidence level will increase the width of the confidence interval (an undesirable consequence), and decreasing the width of the interval will decrease the confidence level (also an undesirable consequence). Thus, the trade-off between confidence level and interval width is a value judgment to be made by the user of the data.

Table 8.1 provides a "look-it-up" tool for assessing what can be inferred from sample estimates of proportions presented in this report.

Table 8.1. Confidence Interval Widths for Selected Sample Sizes, Variances, and Confidence Levels for Proportions**

	95% Confidence Level			99% Confidence Level		
N	p=.5 *	.75	.90	.5	.75	.90
60	13%	11%	8%	17%	14%	10%
150	8%	7%	5%	11%	9%	6%
240	6%	5.4%	4%	8%	7%	5%
300	5.6%	4.9%	3%	7%	6%	4%
600	4%	3%	2%	5%	4.5%	3%
2400	2%	2%	1%	3%	2%	1.6%

*In this table "p" denotes the proportion of the sample giving a certain response. It should not be confused with the "p" or "P" used elsewhere in the report to denote significance probabilities.

**For convenience and ease of interpretation, the values in this table are approximate, being derived from the normal approximation to the binomial distribution. Exact values can be found in numerous handbooks such as A. Hald, Statistical Tables and Formulas (New York: Wiley, 1952).

Correlation

Correlation provides an index of the degree of linear relationship between two variables. The correlation coefficient (r) provides information about the direction and the degree of the relationship between two variables. The direction of the relationship is indicated by the sign (+ or -) of the correlation coefficient. A positive correlation indicates that high values of variable 1 tend to be associated with high values of variable 2, while low values of variable 1 tend to be associated with low values of variable 2. As an example, in the yellow form there is a positive correlation between distance to plant and ratings of beach attractiveness. This indicates that the further the plant is located from the beach, the more attractive the respondent perceives the beach to be. In contrast, a negative correlation indicates that high values of variable 1 tend to be associated with low values of variable 2, while low values of variable 1 tend to be associated with high values of variable 2. For example, in the blue packet, there is a negative correlation between distance to home and ratings of beach attractiveness. The further the beach is located from the respondent's home, the lower its perceived attractiveness will be.

The degree of the relationship between the two variables is indicated by the magnitude of the correlation coefficient. Correlations may range between -1.0 and +1.0: -1.0 indicates a perfectly linear negative relationship, 0.0 indicates no relationship, and +1 indicates a perfectly linear positive relationship between the two variables. The square of the correlation coefficient gives an indication of the proportion of variance in variable 2 that is accounted for by variable 1. Thus, a correlation of .5 indicates that 25% of the variance in variable 2 is accounted for by variable 1. The remaining variance is due to all other variables not considered in the analysis and error of measurement.

Note that the correlation coefficient assumes a linear relationship between the two variables. So long as there are not major departures from a linear relationship, the correlation coefficient provides an adequate index of the relationship between two variables. However, if the relationship is clearly not linear, other measures of the relationship should be used.

Multiple Regression

Multiple regression is an extension of correlation to the case where there are two or more variables (X_1, X_2, etc.) that are

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being used to predict a criterion variable (Y). For example, distance to reactor (X_1) and cleanliness of beach (X_2) might be used to predict beach attractiveness (Y). Multiple regression finds the best linear combination of X_1 and X_2 with which to predict Y.

At least four statistics from a multiple regression analysis may be reported. (1) The multiple correlation coefficient (R) gives the magnitude of the relationship between the best linear combination of the predictor variables and the criterion variables. It may be interpreted in the same manner as the simple correlation coefficient described above, except that it represents the relationship between the combination of the predictor variables and the criterion variable. Thus, R^2 indicates the amount of variance in variable Y that is accounted for by the best linear combination of the X variables. Note that R is always positive in sign. (2) The simple r gives the relationship between a single predictor variable and the criterion, disregarding all of the other predictor variables. The simple r corresponds exactly to the correlation coefficient described above. (3) The regression coefficient (sometimes termed partial regression coefficient) gives an index of the relationship between two variables with the influence of other specified variables removed. For example, at actual beaches the amount of litter and the level of crowding would tend to be related. A multiple regression analysis could be performed in which crowding and litter were the predictor variables and beach attractiveness was the criterion variable. The regression coefficient for litter would provide an index of the relation between litter and beach attractiveness with the effect of crowding statistically removed (held constant). Another way of conceptualizing this result is as an index of the effects of litter on beach attractiveness after the effects of crowding have been eliminated. A statistical test is normally performed on the regression coefficients to determine whether the effect is reliable (see section on statistical tests below). (4) The regression coefficient tells "for a 1 unit increase in X, Y will increase (or decrease if the coefficient is negative) by B units (where B is the regression coefficient)." Thus, regression coefficients are not directly comparable because the variables may be measured on different scales. To overcome this a statistical operation is performed on the regression coefficients to produce "standardized regression coefficients," which means their scales have been standardized. The coefficients are then comparable, so that if the standardized regression coefficient of X_1 is equal to 5, and for X_2 it is equal to 2.5, one may infer that X_1 has twice the influence on Y as X_2.

Statistical Tests

As mentioned above with respect to parameter estimates, we are not interested in simply making statements about the spec'fic sample of peo,le who completed the survey. Rather, we are intereste. in making a general statement about the larger population of people (e.g., Cape Cod South Shore beachgoers) of whom our sample is representative. To make this generalization, statistical tests are employed that permit us to determine whether a relationship apparent in the sample can be said to hold for the entire population. Two types of questions may be answered: (1) Does the population value of the obtained sample statistic differ from 0 (or some other specified value)? (2) Do the population values of two (or more) obtained sample statistics differ from each other? Consider a hypothetical example. Suppose that for a sample of people the mean (average) rating of desirability of nuclear plants is 12, while the mean rating of coal plants is 10. Whether these two statistics are different for the entire population of people depends on the variability and number of people in the sample. If everyone in the sample rates nuclear 12 and coal 10, then it is more likely that people in the population rate nuclear higher than coal. However, if people in the sample differ in their ratings (e.g., both coal and nuclear receive ratings from 0 to 20 from various people in the sample), then it is less likely that the population will agree. Similarly, if the sample contains a large number of people, it is nore likely that the relationship will generalize to the population than if the sample is small. In the present example, the statistical test would give us the probability of obtaining a sample with the mean ratings for coal and nuclear being different by two (12 minus 10) if in fact the mean ratings are actually equal in the whole population under consideration. If there is a chance of less than .05 that the sample means could be 10 and 12, given that the means for coal and nuclear did not differ in the entire population, then the effect is termed "statistically significant". The lower the probability associated with a statistical test, the more likely it is that the effect indicated in the sample is true for the entire population.

In selected cases in the report, the significance level (p) of correlation coefficients, regression coefficients, and chi-square tests (see section below) are presented. The reader may perform a general rule-of-thumb significance test to see whether various parameters (such as proportions) are different in the population by comparing confidence intervals. If the confidence intervals for two sample estimates do not overlap, it can generally be inferred that those parameters differ in the population. The "test" is a very conservative one, having a significance probability less than one minus the confidence level (e.g. less than 1-.95).

Chi-square

Chi-square is a particular type of statistical test that is employed to determine whether there is a relationship between two variables. Specifically, chi-square is used when each variable consists of two or more categories. For example, if variable 1 were sex (male or female) and variable 2 were recreational preference (beach, mountains), a chi-square test would be employed. The test would tell us whether there is any association between sex and recreational preference in the example above, and a significance probability is reported.

Analysis of Variance

Analysis of variance is the name for a complex family of statistical tests that permit us to assess the effects of one or more variables on a criterion variable. This analysis permits us to specify the effect of each independent variable (predictor) both alone and in combination with the other independent variables on the criterion variable. This statistical technique is best utilized when each predictor variable has a small number of values and the value of each predictor variable changes independently of the value of the other predictor variables. This technique is especially suited to the analysis of the information integration tasks in the present research.

An example will be helpful in illustrating the interpretation of this type of analysis. In the yellow packet, subjects gave ratings of a series of hypothetical beaches that varied in their proximity to a coal or a nuclear generating facility. Each subject made a series of ratings of beaches that were described as having a coal plant 5, 10, 25, or 50 miles down the beach or a nuclear plant 5, 10, 25, or 50 miles down the beach. Thus, 8 ratings in all would be made by each subject, representing the possible combinations of the 4 distances and the 2 types of plants. Analysis of variance permits us to answer three questions in the present case. (1) Does the distance down the beach to the plant (regardless of type) have an effect on the ratings of beach attractiveness? (2) Does the type of plant (regardless of its location) have an effect on the ratings of beach attractiveness? (3) Does the combination of distance and type of plant have an effect on the ratings of beach attractiveness in addition to the simple effects identified in (1) and (2)? For example, if the beach rating for the coal plant became increasingly positive as the distance to the plant increased, while the beach ratings did not change as the distance to the nuclear plant increased, the two variables would have an effect in combination (or interaction). As is the case with other statistical tests, the probability that the obtained results could be due to sampling error is associated with the statistical tests that answer each of the three questions above. Those tests for which this probability is less than .05 are taken as statistically significant results.

Analysis of variance also permits a comparison of the relative size of the effects of each variable. By computing the ratio of the "sum of squares" (the estimate of relative size of effect) of two factors, their relative importance may be estimated. For example, if the sum of squares for distance were 500 and the sum of squares for type of plant were 100, we would estimate that distance was approximately 5 times as important as type of plant in determining beach rating. In applying this comparison, caution should be exercised since the relative importance estimates also reflect the range of the variable that was employed in the experiment.

Appendix D

Predicting Actual Behavior from Verbal Responses

Predicting Actual Behavior from Verbal Responses

For at least forty-three years various social scientists have questioned the validity of inferring behavior from attitudes (La Piere, 1934). During that period numerous researchers have attempted to test the utility of attitudes in predicting behavior, and an alarming number have concluded there to be a weak if any relationship (Wicker, 1969). The methodologies have generally adhered to the following model: 1) observe a behavior (such as the way an individual responded to questions concerning his support for environmentalism); 2) infer an attitude (say, the individual's attitude toward environmentalism is positive); 3) infer a behavior that should be consistent with that attitude (say, joining the Sierra Club or some other environmentalist organization); and 4) testing to see whether the individual actually performs the inferred behavior. If the person is in fact a member of such an organization (in the example), it would be concluded that his behavior was consistent with his attitude. Otherwise, it would be concluded that the attitude had no relationship to the behavior.

Many of these studies have been criticized recently by a number of authors (Kiesler and Munson, 1975; Dillehay, 1973). Kiesler, Collins, and Miller (1969) have pointed to issues of measurement reliability, item difficulty, category width, change in attitude object, change in salience of various attitudes toward the attitude object, factor structure of attitude and behavioral syndromes, and non-attitudinal contributions to the response as being causes for discounting the apparent inconsistencies reported in many of the studies. Essentially what Kiesler, Collins, and Miller seem to be saying is that the measures of behavior tested for in many of the studies should not have been expected to bear any close resemblance to the measures of attitude to which they were compared.

There do appear to be "other variables" which can influence one's behavior in a direction inconsistent with one's attitudinal predisposition to act in a certain manner, however (Wicker, 1971; Rokeach and Kliejunas, 1972). To maximize the likelihood of having a verbal response correspond to an actual behavior of interest, there are ways to collect verbal measures which take the "other variables" into account implicitly. Fishbein and Ajzen (1975) have endorsed the measurement of "intention to behave" as the best correlate to real behavior, as was measured in the "Response" section of the questionnaire employed in this investigation (see Appendix I, Section VII). Political polls, for example, which ask which candidate the respondent will vote for are generally consistent with actual vote figures (within the margin expected due to sampling error), provided the polls are taken very near to the time of the vote.

The preceding example illustrates four important points in predicting behavior. First of all, it is easier to forecast group (or aggregate) behavior than individual behavior. Thus, while the studies mentioned in the first two paragraphs above test for consistencies in behavior by individuals, political polls attempt to predict aggregate behavior. If 500 people who said they would vote for Smith end up voting for Jones, and another 500 people who said they vote for Jones end up voting for Smith, the inconsistencies will not invalidate the aggregate vote forecast from the poll. The inconsistencies would affect correlations employing individual level data, however. It is aggregate rather than individual verbal-behavioral consistency that is important in the investigation of the problem addressed by this report.

Two other important criteria are well stated by Fishbein and Ajzen (1975):

> Only when the intention is measured at the same level of specificity as the behavior and has not changed between time of measurement and observation of the behavior, will it be highly predictive of the behavior in question. (p. 372)

The intention to behave measured in the "Response" section of the questionnaire employed here is exactly the same level of specificity as the behavior being forecast. The relevance of possible changes in behavioral intentions with the passage of time is addressed in the "Conclusions" chapter of this report.

A final point worthy of mention has been demonstrated by Snyder and Swann (1976). The correlation between attitude and behavior is greater if the individual has given careful consideration to the attitude before expressing it. The absence of this condition in responses to the hypothetical situations described in this investigation was a major reason for not taking the "Response" data at face value.

The information-integration tasks employed tend to make the respondent consider his responses to hypothetical situations in a manner more similar to the way in which he would in making a "real-world" behavioral decision. Louviere and his associates have recently demonstrated the ability to predict aggregate behavior from information-integration tasks with correlations on the order of .95 (Louviere et al, 1977; Piccolo and Louviere, 1977).

In summary, verbal measures can be relied upon for forecasting actual behavior in certain situations when certain methodological precautions are taken. It is the authors' contention that the situational and methodological conditions have been satisfied in this investigation.

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