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NUCLEAR POWER AND THE PUBLIC:
ANALYSIS OF COLLECTED SURVEY RESEARCH

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NOVEMBER 1977

PREPARED FOR THE SAVANNAH RIVER OPERATIONS OFFICE OF THE U.S.
DEPARTMENT OF ENERGY (FORMERLY ENERGY RESEARCH AND DEVELOPMENT
ADMINISTRATION) UNDER CONTRACT EY-76-C-06-1830

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ACKNOWLEDGMENTS

This report presents a study conducted by Battelle Human Affairs Research Centers for the Savannah River Operations Office of the U.S. Department of Energy (formerly Energy Research and Development Administration) under contract EY-76-C-06-1830. The Principal Investigator was Stanley M. Nealey. The major substantive contributions to Chapters 3, 4, and 5 were prepared, respectively, by Joy Hammersla, William L. Rankin, and Barbara D. Melber. The authors acknowledge the comments and valuable assistance of John A. Hébert and Ronald W. Perry, also of the Human Affairs Research Centers. We also appreciate the contributions of Steven V. Topp of Savannah River Laboratories, John W. Bartlett of Battelle Northwest, and Kermit L. Garlid of the University of Washington who provided helpful comments on an earlier draft of this report.

The analysis and synthesis of research findings presented here were based on surveys and other attitude assessment studies conducted by earlier investigators. The authors gratefully acknowledge the cooperation of the many individual researchers, research organizations, and survey sponsors who provided the original data and permitted its inclusion herein.

EXECUTIVE SUMMARY

Introduction

This executive summary highlights the major findings of a comprehensive synthesis and analysis of over 100 existing surveys dealing with public attitudes toward nuclear power issues. Questions of immediate policy relevance to the nuclear debate are posed and answered on the basis of these major findings. For each issue area, we indicate those sections of the report in which more detailed discussion and presentation of relevant data may be found.

Does the Public Support Nuclear Power?

The survey data clearly indicate that a majority of the public favors the use of nuclear energy. In national probability studies conducted primarily during 1975 and 1976, approximately 60% of the public supported nuclear energy, with support levels ranging from 45% to 80%; approximately 23% of the public opposed nuclear power, with opposition levels ranging from 6% to 35%; and approximately 17% of the respondents were undecided, with undecided levels ranging from 11% to 32%. (See Section 3.1.2.6.)

The questions used to assess general nuclear power attitudes have been worded in various ways. Questions that asked whether nuclear power should be used to generate electricity (which is the current situation in the United States) tended to receive higher levels of support than did those concerning the building of more nuclear power plants. In addition, questions that referred to developing nuclear energy as a means of dealing with the energy crisis received greater support than did those in which nuclear energy was not placed in the context of energy shortages. (See Sections 3.1.1 and 3.1.2.)

A higher percentage of the public favored nuclear power in general than favored having a nuclear plant located nearby. The mean levels of

support and opposition to building a local nuclear plant were 55% and 31%, respectively, for the national surveys. However, respondents who lived near existing nuclear plants favored local nuclear power more than did the general public; the mean level of support from this group was 63%, and the mean level of opposition was 23%. (See Section 3.1.3.)

Is Support or Opposition to Nuclear Power Changing?

A major question regarding the public assessment of nuclear energy is whether support or opposition has changed in the recent past. The comparison of data collected at different times by five national survey organizations does not indicate any clear trend over time in support or opposition to nuclear power. Although fluctuations in support and opposition were common, consistent long-term changes were not found. Evidently, the increased media coverage and public debates regarding nuclear power in recent years have not significantly changed the public's general attitude about using nuclear power. (See Section 3.1.6.) Only among residents near a nuclear plant site have changes over time been noted. In several local surveys, favorability toward a nuclear power plant at a nearby site increased as the possibility of such a plant become a reality. (See Section 3.1.5.)

How Strongly Committed Are Nuclear Proponents and Opponents?

Nuclear power was supported by at least a plurality of respondents in all but one survey. However, when strength of commitment was assessed, the proportion of the population strongly opposed to nuclear power was equal to the proportion strongly in favor. (See Section 3.3.2.) Furthermore, data from an extended analysis of two major national surveys indicate that a high proportion of persons polled responded to various types of nuclear attitude questions in a consistently pronuclear or anti-nuclear manner. (See Section 6.3.2.) We conclude that there is some polarization of nuclear power attitudes, and that the degree of polarization is relatively high among both pronuclear and antinuclear respondents.

What Is the Leaning of the Undecided Respondents?

Responses from 11% to 32% of those polled in the national surveys were recorded as "don't know" responses, indicating that respondents had refused to choose between a pronuclear or antinuclear response to the general nuclear attitude questions posed to them. (See Section 3.1.2.) Such "don't know" responses may indicate either ambivalence or indifference toward the issue area. Ambivalent respondents may be leaning toward a pronuclear or an antinuclear position. Our statistical analysis of responses in two major nuclear surveys of 1975 and 1976 indicated that respondents recorded in the "don't know" category were ambivalent; that is, the "don't know" responses represented a middle or neutral position. This conclusion is based on the finding that the "don't know" respondents generally took positions on both specific nuclear issues and general energy issues that were in between the positions taken by pronuclear and antinuclear respondents. Response patterns of undecided respondents did not resemble response patterns of pronuclear respondents any more closely than they resembled response patterns of antinuclear respondents. Thus, these data show no indication that the "don't know" group is either latently pronuclear or latently antinuclear. (See Section 6.3.1.)

How Do Various Segments of the Public Feel about Nuclear Power?

Analysis of survey data according to sex, age, income, education, occupation, community size, and region of the country revealed no demographic group among whom opposition to nuclear power exceeded support. However, some groups consistently supported or opposed nuclear power more than did other groups.

Males and females differed more consistently and to a greater degree in their attitudes toward nuclear power (see Sections 3.2.1 and 6.3.3.1) than did segments of any other demographic classification. In the national surveys, mean support levels for nuclear power were 65% for men and 46% for women, the mean opposition levels were 21% for men and 28% for women, and the mean levels of undecided responses were 14% for men and 26% for women.

Although nuclear attitude differences among age groups were less pronounced, a clear trend of greater support for nuclear power among the middle-aged and less support among the young was found. (See Section 3.2.2.)

In general, support for nuclear power increased with educational level. Those with low educational attainment indicated greater opposition to nuclear power and were also more likely to be undecided than was the highly educated group. On the average, there was 13% more support for nuclear power among those with the highest educational attainment than there was among those with the lowest educational attainment.

Income level was also positively related to favorability toward nuclear power. Among the highest income group, the percentage of respondents favoring nuclear power ranged from 45% to 81%, with a median of 61%. Among the lowest income group, the percentage of respondents favoring nuclear power ranged from 28% to 53%, with a median of 39%. (See Section 3.2.4.)

Differences in support or opposition to nuclear power among respondents from different regions of the country were small in magnitude. However, consistent differences in support for nuclear power were found between residents of the Western states and those of the Northeastern section of the country. Usually, support among Western residents was about 10% greater than it was among Northeastern residents. (See Sections 3.2.7 and 6.3.3.1.)

Demographic findings have been generally consistent both across time and across the various research organizations.

What Are the Most Pressing Concerns of the Public Regarding Nuclear Power?

The dangers or perceived dangers associated with nuclear power have been a primary concern of the public throughout the history of nuclear power. The specific dangers most frequently volunteered by respondents included danger from nuclear power plant accidents and explosions, danger of radiation contamination from power plants, and danger from nuclear waste disposal. When given a list to choose from, respondents indicated the disposal of

radioactive wastes to be the greatest specific problem; it was perceived as more of a problem than radiation discharge, power plant accidents, power plant explosions, or thermal pollution. There is evidence of growing public concern over the nuclear waste issue. However, a majority of the respondents believed that technology could solve the safety problems associated with nuclear power, including the safety problems associated with radioactive waste disposal. (See Sections 4.2.2, 4.2.4, 4.2.5, 4.3., 4.4, and 4.5.)

What Are the Benefits the Public Expects from Nuclear Power?

The main reasons volunteered for supporting nuclear power were beliefs in its economic advantages (provides inexpensive electricity; provides employment), the belief that nuclear power pollutes less than other energy sources, and the belief that nuclear power is a needed source of energy. The relative emphasis of the pronuclear public on these benefits has changed over time. In 1960, the expected economic advantages of nuclear power were volunteered most often; in 1973, after the growth in environmental awareness and before the Arab oil embargo, the limited pollution associated with nuclear power was mentioned most frequently; since the oil embargo of the winter of 1973, the ability of nuclear power to fill the need for more energy has become the most commonly cited reason for support. However, in the 1975 and 1976 surveys in which all respondents (not just pronuclear respondents) were asked to volunteer advantages of nuclear power, economic advantages predominated. (See Sections 4.2.3, 4.2.4, 4.2.5, 4.7, and 4.8.)

What Is the Relationship of Specific Nuclear Issues to the General Assessment of Nuclear Power?

An analysis of the relationship between respondents' beliefs and opinions concerning specific nuclear power issues and their general attitudes toward the use and development of nuclear energy is of crucial importance to understanding the public's position on nuclear power. These relationships were directly assessed in the secondary analysis of two major surveys and indirectly assessed in the comparative survey review.

Although many of the specific nuclear power issues were found to be significantly related to a respondent's general position on nuclear power, a few issue areas were of particular importance. The evaluation of the safety of nuclear power was the single most important indicator of a respondent's general position on nuclear power. This finding is consistent with the conclusions based on the comparative analysis of surveys, where concern over safety was found to decrease public willingness to live near a nuclear plant, to decrease public willingness to allow the building of more nuclear plants, and to increase public willingness to cut back the present operating capacity of nuclear plants.

Economic assessments were next in importance. While pronuclear individuals considered nuclear power worthwhile if it cost the same as other sources, the antinuclear respondents felt that nuclear power must be considerably less expensive than other sources to be worthwhile. Furthermore, many pronuclear respondents believed nuclear power to be cheaper than other energy sources, whereas many of the antinuclear respondents believed nuclear power to be more expensive than other energy sources. Respondents' beliefs and attitudes about the reliability of nuclear power as a long-run source of energy, and about radiation leakage, waste disposal, and the polluting effects of nuclear power were also strongly related to respondents' general nuclear power attitudes. (See Sections 4.3.4, 4.3.5, 4.3.6, 4.3.7, 4.5.2, 6.3.3, 6.3.4, and 6.4.)

How Does Nuclear Power Compare with Other Energy Options?

The major findings concerning the general preferences of the public for specific energy sources are: (1) solar energy was favored by the largest majority of the public; (2) nuclear energy was consistently supported by a plurality or majority of the public; and (3) coal was the energy source alternative least preferred by the general public.

When specific aspects of the various energy alternatives were compared, nuclear power was considered less polluting of both air and water than oil or coal. Solar power was considered the safest option; nuclear power was

considered the most dangerous. Nuclear power was considered slightly more available than coal and much more available than oil. Respondents were inconsistent in their assessment of the comparative cost of the various energy sources. A majority considered nuclear power to be most likely to become less expensive in the future. In response to a somewhat different question, all the other energy options (e.g., solar energy, coal, hydro-electricity, natural gas, and oil) were chosen more frequently than nuclear energy as the least expensive. (See Section 5.4.)

A majority of the public considered conservation to be desirable. However, a majority of the respondents believed that conservation would reduce both the standard of living and economic growth. Furthermore, most of the public were fairly pessimistic about the likelihood that conservation efforts would have a substantial impact, even though a majority claimed that they would be willing to reduce their own levels of energy consumption. (See Section 5.5.)

What Is the Relationship of General Energy Perspectives to the Assessment of Nuclear Power?

An examination of the relationship between general energy orientations and nuclear power attitudes suggested contrasting energy perspectives. A perspective that favors an increase in the energy supply is associated with support for a wide range of energy alternatives, including an increase in nuclear power. (See Section 5.2.) A perspective that favors energy conservation is associated with support for environmental protection and less support for most energy options. (See Section 5.5.) Statistical analyses of data from some major nuclear surveys indicated that these perspectives, while predictive of general nuclear attitudes, are less important predictors than are attitudes toward specific aspects of nuclear power itself. (See Sections 6.3.3.2 and 6.3.3.3.)

Questions That Remain Unanswered

This extensive compilation of survey data indicates widespread support for nuclear power. Due to the nature of survey assessment methods, however, these data are limited to indications of general attitudes toward aspects of the nuclear power controversy that became salient prior to the data collection. Thus, data regarding some currently relevant topics, such as terrorism, proliferation, the breeder reactor, are not included.

These findings are also limited to the kinds of questions which have been posed by pollsters. Primarily, such questions are ones to which respondents can give quick replies. (See Sections 3.3.2 and 7.2.1.) Thus, measured decisions regarding complex alternatives, or thoughtful judgments from the public following information acquisition, are not found among these data. Indeed, careful perusal of the surveys to date indicates that the relationship between nuclear knowledge and nuclear power attitudes has been inadequately assessed. (See Section 3.3.3.) Also, question wording and/or the number and format of response options sometimes prevented confident interpretation of results. For example, most of the questions used to assess a respondent's general attitude toward nuclear power were worded so that an acquiescent response style would slightly inflate the estimate of the proportion of respondents favorable to nuclear power (See Sections 3.1.3.1 and 3.3.2.) Specific types of questions and aspects of survey reporting which foster clear interpretation of survey findings are suggested throughout the report. (See especially Sections 7.2.1 and 7.2.3.)

Despite these and other limitations of survey data (see Section 7.3.3), all persons interested and active in the formation and implementation of energy policies have much to gain from a careful study of survey results. Information from public opinion polls can contribute to each stage of the energy policy decision process. (See Section 7.3.4.)

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1 INTRODUCTION

Concern with the role of energy in society has taken on major importance in recent years. The existence of and potential for energy supply problems has raised awareness that energy choices have significant political and social consequences. One particular energy alternative, nuclear power, has become an issue of growing social concern over the past several years as indicated by numerous national, regional, state, and local conferences on nuclear power issues; increased media coverage; and nuclear safeguard initiatives voted on in six states in 1976.

Public discussion of the issues surrounding nuclear energy has often taken the form of a debate. All sides of the issue often claim that they are speaking for the public (or some significant portion of the public) and they provide anecdotal material, case studies, newspaper clippings, and, at times, experimental or survey data to back this claim.

Over the past 20 years, numerous surveys commissioned by government, industry, and private groups have been conducted to determine public attitudes regarding nuclear power issues. These surveys vary widely in issue, scope, methodology, target population, and sponsorship. They include in-depth studies of attitudes toward nuclear power and general energy issues, assessments of nuclear attitudes as part of studies of general social, economic, and political concerns, and very brief assessments limited to general nuclear attitudes. Data have been collected by personal interview, phone contact, and mailed questionnaires. Populations range from national, state, and nuclear site probability samples to samples of special groups such as students or members of civic and environmentalist organizations.

Naturally, both the results and the conclusions drawn from these diverse efforts vary widely. No doubt some of these differences are due to actual changes in opinion over time or to real regional or demographic

differences, and therefore represent reliable and valid information about the public's attitudes, knowledge, opinions, beliefs, and policy preferences. As such, public survey results can be an important ingredient of public policy formation and policy evaluation. On the other hand, with such varied approaches, some results are inconsistent and do not constitute a basis for reliable inferences and valid conclusions. In this case, they may lend an air of respectability to specious conclusions and, at worst, they may seriously hamper the balanced assessment of the public stance on important policy issues.

Unfortunately, the "nuclear debate" has often featured exaggerated claims and exaggerated rebuttals. In this adversarial climate, survey data can be selected from among the diverse offerings to support nearly any position one wishes to take. In this situation there is a clear need for a careful synthesis and comparative analysis of survey findings.

The purpose of this report is to provide a comprehensive review and analysis of existing survey data that deal with public attitudes toward nuclear power issues. Our hope is that by making available in one report a comparative analysis of the findings of an extensive number of surveys, a clearer picture of the preferences and concerns of various sectors of the general public can be documented. When such comparative analysis enables conclusions to be drawn, such conclusions have a status not easily achieved by those drawn from any single survey. When collected survey findings do not permit confident conclusions, it is also useful to recognize this fact.

Chapter 2 describes in detail our methods of data acquisition and the range of variability of the survey data used in this report. Particular attention is given to the methodological considerations involved in drawing conclusions from a comparative analysis of variable survey data.

We have divided the comparative analysis of survey data into three major sections: (1) general nuclear power attitudes (Chapter 3),

- (2) attitudes toward specific nuclear energy issues (Chapter 4), and
- (3) attitudes concerning broad energy issues (Chapter 5).

The analysis of general nuclear power attitudes examines in detail the findings from the entire range of questions used by survey organizations to assess the general public's overall reaction to nuclear energy. Special attention is given to variation in question wording and in research organization results. An analysis of change in attitudes over time and of the relationship of pronuclear and antinuclear attitudes to demographic characteristics such as sex, age, income, education, and region is presented. This section provides information on the general level of support for and opposition to the utilization and development of nuclear energy.

Public attitudes toward specific issues or aspects of nuclear power are then examined. These aspects include safety, health, waste disposal, economics, uranium supply, nuclear power efficiency and reliability, safeguards and terrorism, and proliferation. The extent to which attitudes toward specific nuclear issues are presented as reasons for one's general attitude toward nuclear power is documented. The relative importance of these specific nuclear issues is analyzed, highlighting the public's assessment of the major advantages and major disadvantages of nuclear power. The ways in which public evaluation of specific nuclear issues have changed over time is also analyzed. Differences in specific attitudes between demographic groups is documented and compared to the demographic patterns reported in the analysis of general nuclear attitudes.

The analysis of public attitudes and perceptions concerning broad energy issues places attitudes toward nuclear power in the context of the public's assessment of the larger energy picture. This report analyzes public attitudes toward energy needs, various energy source alternatives, and energy conservation; further, it presents comparative evaluations of the characteristics of nuclear power and of nonnuclear alternatives. The differences and similarities between those with pronuclear and antinuclear attitudes are examined for a wide range of energy issues. The relationship of demographic characteristics to these

broader energy issues is analyzed and compared to the demographic relationship documented for attitudes toward general and specific nuclear power issues. In addition, changes over time are discussed throughout the analysis.

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A special secondary analysis utilizing complete data tapes was carried out for the 1975 and 1976 Louis Harris and Associates, Inc., nuclear attitude surveys. The results of this analysis are presented in Chapter 6. This chapter analyzes the Harris survey data with respect to the relationships between general nuclear attitudes and (1) demographic characteristics; (2) general energy attitudes; and (3) nuclear specific attitudes discussed in Chapters 3, 4, and 5. The focus of this analysis is to explore a number of hypotheses that attempt to explain the reasons for favorability and opposition to the use and development of nuclear power.

Finally, in the concluding chapter (Chapter 7), we highlight the major substantive findings documented in the comparative analysis of all the surveys and in the special secondary analysis of the two Harris surveys. The role of public attitude survey data in public policy formation is discussed with specific reference to the implications of the survey conclusions regarding public attitudes toward nuclear energy.

2 DESCRIPTION OF DATA ACQUISITION AND ISSUES OF INTERPRETATION

2.1 Data Acquisition

Our attempt to obtain all available research assessing public attitudes toward nuclear power issues included a special effort to incorporate surveys from the time of the first public awareness of nuclear energy in the 1940s to the present. Surveys dealing with nuclear power attitudes outside the continental United States were considered beyond the scope of this study and were excluded from this report.

Contacts with known and potential sources of survey data relevant to nuclear attitudes were initiated during the fall of 1976. This was during the period of nuclear safeguard initiative campaigns in six states: Arizona, Colorado, Montana, Ohio, Oregon, and Washington; it was a few months after the June 1976 initiative vote in California. Both pro- and anti-initiative campaign organizations were contacted in each state for information regarding surveys sponsored during the course of the campaigns. Citizen groups known to have interests relevant to nuclear energy were contacted, including: Center for Science in the Public Interest; Citizens Association for Safe Energy; Committee for Nuclear Responsibility; Committee to End Radiological Hazards; the Cousteau Society, Inc.; Environmental Action Foundation; Natural Resources Defense Council, Inc.; People's Lobby; Public Citizen, Inc.; Public Interest Research Group; Resources for the Future, Inc.; SANE--a citizens' Organization for a Sane World; Scientists' Institute for Public Information; Sierra Club; Task Force Against Nuclear Pollution; and Union of Concerned Scientists. A substantial number of utility companies were contacted, as well as business and industrial groups such as the Edison Electric Institute, Ebasco Services Incorporated, and the Atomic Industrial Forum. Contacts were also made with academic research groups and public

opinion survey organizations. Finally, relevant survey information and references from the Gallup Opinion Index, Current Opinion, and Public Opinion Quarterly were utilized to identify additional sources of survey data.

Our search for surveys on nuclear attitudes resulted in the release of over 100 relevant surveys, which form the data base for this report. These include 27 national probability samples, 45 state probability samples from 17 different states, 6 probability samples from 5 cities, 14 probability samples of residents near 11 different nuclear plant sites, and 11 special samples. These 11 samples are special in one or both of two senses. First, they are often nonprobability samples of special populations such as the League of Women Voters of Eugene, Oregon; state regulatory officials; or members of high school classes. Second, many of these studies have a primary purpose other than general public attitude assessment (e.g., a comparison of values and judgments relevant to nuclear energy from persons who are high versus low in acceptance of nuclear energy; a comparison of attitude assessment methodologies, etc.).

Data cited in specific survey reports from surveys conducted at different time periods have been included, even when complete reports of the surveys were not available. For example, the reports of nuclear attitude studies conducted by Louis Harris and Associates, Inc., in 1975 and 1976 included responses to some of the same or similar questions obtained in survey samples from previous years, and responses to questions on nuclear energy asked in the 1940s and 1950s were reported in studies conducted in later years. These data were useful in extending the time periods over which comparisons of responses to similar or identical questions could be made.

A few additional studies for which sufficient information was not available for the comparative analysis of survey findings nevertheless provided data that extended the survey findings to additional groups or content areas or that provided insights to possible explanations for nuclear attitude findings. These data are referred to and referenced in relevant sections of the text.

The survey review is limited to the analysis of data provided by the various organizations and groups that conducted or commissioned surveys concerning nuclear attitudes. The commissioning organizations were primarily private and public utility companies, government agencies, and business organizations involved in the nuclear industry. Although most survey data requested have been released for use in this study, there were a few instances where the data were not provided or arrived too late for inclusion in this report. To protect the confidentiality of the sponsors of proprietary survey research, surveys have been identified by the research groups that conducted the studies, and the specific names of the organizations that commissioned them have not been indicated.

2.2 Listing and Identification of Surveys

A coding system for the surveys obtained has been devised to provide easy reference for the data in this report. Each national survey was given a code name consisting of the name (or abbreviated name) of the researcher(s) or organization conducting the research. Following that, the date of data collection is indicated. For example, Becker (73/6) indicates a study by Becker Research Corporation in June 1973. When the survey sample was not national in scope, the location of the survey population is given preceding the date. For example, PubResp (AZ 76/8) indicates a survey conducted by Public Response Associates, Inc., in August 1976, with respondents from the state of Arizona.

Table 2.1 provides a listing of the surveys used in this analysis and specific information about them: the survey identification code, name of researcher(s), sample size, and method of data collection. The Annotated Survey Reference (see Appendix) consists of additional descriptive data about the surveys. The sampling procedure, population sampled, purpose and content of the survey, along with other information useful in interpreting the survey data, are included.

TABLE 2.1

SURVEYS BY SAMPLE SIZE AND RESPONSE MODE

Survey Identification	Survey Organization/Researchers	Sample Size	Response Mode ^a
<u>National</u>			
Battelle (76)	Battelle Memorial Institute, Human Affairs Research Centers, BNWL-1997, W.S. Maynard, et al.	465	group
Becker (73/6)	Becker Research Corporation	1,431	personal
Becker (74/5)	Becker Research Corporation	1,252	personal
Cambridge (75/5)	Cambridge Reports, Inc.	1,500	personal
Cambridge (75/8)	Cambridge Reports, Inc.	2,000	personal
Cambridge (75/12)	Cambridge Reports, Inc.	2,000	personal
Cambridge (76/4)	Cambridge Reports, Inc.		personal
Cambridge (76/7)	Cambridge Reports, Inc.	2,000	personal
Cambridge (76/10)	Cambridge Reports, Inc.	1,500	personal
Cambridge (76/12)	Cambridge Reports, Inc.	1,500	personal
CBS (70/4)	Columbia Broadcasting System, R. Chandler	900	telephone
Cousteau (75/7)	Cousteau Society	32,681	mail
Gallup (76/6)	Gallup Poll	1,524	personal
Harris (75/4)	Louis Harris & Associates	1,252	personal
Harris (76/7)	Louis Harris & Associates	1,497	personal

TABLE 2.1 (Continued)

Survey Identification	Survey Organization/Researchers	Sample Size	Response Mode ^a
NORC (74/5)	National Opinion Research Center J.P. Murray, M.G. Minor, R.F. Cotterman & N.M. Bradburn	400 ^b	personal
ORC (74/11)	Opinion Research Corporation M. Rappeport & P. Labaw	1,207	telephone
ORC (75/1)	Opinion Research Corporation M. Rappeport & P. Labaw	1,200	telephone
ORC (75/2)	Opinion Research Corporation M. Rappeport & P. Labaw	604	telephone
ORC (75/4)	Opinion Research Corporation M. Rappeport & P. Labaw	604	telephone
Roper (75/4)	Roper Organization, Inc.	approx. 2,000	telephone
Roper (75/6)	Roper Organization, Inc.	approx. 2,000	personal
Roper (75/8)	Roper Organization, Inc.	approx. 2,000	personal
Roper (75/10)	Roper Organization, Inc.	approx. 2,000	personal
Roper (76/6)	Roper Organization, Inc.	approx. 2,000	personal
Roper (76/8)	Roper Organization, Inc.	approx. 2,000	personal
Roper (76/10)	Roper Organization, Inc.	approx. 2,000	personal

TABLE 2.1 (Continued)

Survey Identification	Survey Organization/Researchers	Sample Size	Response Mode ^a
Roper (76/11)	Roper Organization, Inc.	approx. 2,000	personal
Sindlinger (60/6)	Sindlinger Company	1,300	telephone
<u>State</u> (alphabetically by states)			
Pub. Resp. (AZ 76/8)	Public Response Associates, Inc.	885	personal
Pub. Resp. (AZ 76/9)	Public Response Associates, Inc.	600	personal
Pub. Resp. (AZ 76/10a)	Public Response Associates, Inc.	600	personal
Pub. Resp. (AZ 76/10b)	Public Response Associates, Inc.	700	personal
Pub. Resp. (AZ 76/10c)	Public Response Associates, Inc.	600	personal
West (AZ 75/11)	M.R. West Company	775	personal
Field (CA 76/2)	Field Research Corporation	1,134	personal
Field (CA 76/3)	Field Research Corporation	1,034	personal
Field (CA 76/5)	Field Research Corporation	1,245	telephone
Field (CA 76/6)	Field Research Corporation	1,008 ^c	
Hamilton (CO 76/8)	William R. Hamilton & Staff	650	personal
Hamilton (CO 76/10)	William R. Hamilton & Staff	415	
Becker (CT, MA 76)	Becker Research Corporation	900	personal
IGR (AZ, NM, CO, VT) (Four Corners 76)	Institute of Government Research, Univ. of Arizona	3,578	mail

TABLE 2.1 (Continued)

Survey Identification	Survey Organization/Researchers	Sample Size	Response Mode ^a
Central (IN 75/11)	Central Surveys, Inc.	1,600	telephone
Iowa (IA 76/4)	The Iowa Poll	600	personal
Central (LA, TX 73/4)	Central Surveys, Inc.	800	personal
Central (MI, WI 77/3)	Central Surveys, Inc.	1,100	telephone
Nordhaus (MI 72/12)	Nordhaus Associates, Inc.	885	personal
Nordhaus (MI 73/5)	Nordhaus Associates, Inc.	896	personal
Navarro (MO 74)	Navarro Opinion Research	500	
Navarro (MO 75)	Navarro Opinion Research	500	
Becker (NH 75/7)	Becker Research Corporation	300	personal
Central (NH 71/10)	Central Surveys, Inc.	601	personal
Central (OK 75/3)	Central Surveys, Inc.	1,346	personal
Central (OK 76/3)	Central Surveys, Inc.	1,046	personal
Bardsley (OR 68/1)	Bardsley & Haslacher, Inc.	1,288	personal
Bardsley (OR 69/6)	Bardsley & Haslacher, Inc.	330	personal
Bardsley (OR 71/4)	Bardsley & Haslacher, Inc.	1,128	personal
Bardsley (OR 71/8)	Bardsley & Haslacher, Inc.	794	personal
Bardsley (OR 72/2)	Bardsley & Haslacher, Inc.	800	personal
Bardsley (OR 72/7)	Bardsley & Haslacher, Inc.	806	personal

TABLE 2.1 (Continued)

Survey Identification	Survey Organization/Researchers	Sample Size	Response Mode ^a
Bardsley (OR 75/3)	Bardsley & Haslacher, Inc.	804	personal
Bardsley (OR 75/7)	Bardsley & Haslacher, Inc.	1,319	personal
Bardsley (OR 76/8)	Bardsley & Haslacher, Inc.	1,047	personal
Bardsley (OR 76/12)	Bardsley & Haslacher, Inc.	601	personal
Bardsley (OR, WA 75/12)	Bardsley & Haslacher, Inc.	1,206	personal
Bardsley (WA 76/3)	Bardsley & Haslacher, Inc.	800	personal
Gilmore (WA 76/3)	Northwest Certified Surveys	600	telephone
GMA (WA 76/8)	Grant Morgan Associates Research Corp.	600	telephone
Summers (WA 76)	D. Summers & C. Ashworth	258	mail
Central (WI 75/6)	Central Surveys, Inc.	600	personal
IES (WI 73)	Institute for Environmental Studies, University of Wisconsin. M. Beane & J. Ross	264	group and personal

Local (alphabetically by cities)

Pendergrass (Albuquerque 74/5)	M.L. Pendergrass	143	mail
Harvard PTS (Boston 70/6)	Harvard University, Program on Technology & Society I. Taviss	201	personal
Kasperson (Boston 76/7)	Clark University, R.E. Kasperson	243	personal
Fischhoff (Eugene 76)	B. Fischhoff, P. Slovic, S. Lichtenstein, & S. Read	76	group
Kay (NYC 47/6)	L.W. Kay & I.J. Gitlin	345	group

TABLE 2.1 (Continued)

Survey Identification	Survey Organization/Researchers	Sample Size	Response Mode ^a
IGR (Phoenix 75/7)	Institute of Government Research, University of Arizona. J. Dettloff, A. Federhar, & H.M. Ingram	766	mail
IGA (Sacramento 76/6)	University of California, Davis, Institute of Government Affairs, A.J. Groth & H.G. Schutz	633	mail
Bardsley (San Diego 76/9)	Bardsley & Haslacher	802	personal
Central (San Diego 72/8)	Central Surveys, Inc.	600	personal
Battelle (Seattle 74)	Battelle Pacific Northwest Laboratories, BNWL-1787, J.B. Burnham, et al.	177	group
Mazur (Syracuse 77/3)	Social Science Program, Syracuse University A. Mazur & B. Conant	124	telephone
Central (Tulsa 74/1)	Central Surveys, Inc.	300	personal
<u>Site</u> (alphabetized by the power plant sites)			
Central (Black Fox 74/1)	Central Surveys, Inc.	240	personal
Central (Colorado River 74/4)	Central Surveys, Inc.	655	personal
Woodward (Hanford 75/2)	Woodward--Clyde Consultants	538	telephone
ORNL (Hartsville 75/2)	Oak Ridge National Laboratory, C.R. Schuller, et al.	350	personal
ORNL (Hartsville 75/8)	Oak Ridge National Laboratory, E.D. Sundstrom, et al.	288	personal
ORC (Indian Point 60/6)	Opinion Research Corporation	1,057	personal
Central (Marble Hill 76/11)	Central Surveys, Inc.	700	personal

TABLE 2.1 (Continued)

Survey Identification	Survey Organization/Researchers	Sample Size	Response Mode ^a
Central (Matagorda 73/3)	Central Surveys, Inc.	200	personal
Central (Matagorda 74/9)	Central Surveys, Inc.	200	personal
Central (Matagorda 76/5)	Central Surveys, Inc.	200	personal
Bardsley (Miles Lake 73/5)	Bardsley & Haslach, Inc.	354	personal
Metro (Oyster Creek 73/6)	Metro Study Corporation, J.S. Williams & S. Spiegel	366	personal
Becker (Pilgrim 76/3)	Becker Research Corporation	150	telephone
Central (St. Francis 72)	Central Surveys, Inc.	360	personal

NOTE: Where sample size or response mode were unspecified in data available, space is left blank.

^aGroup = the survey was administered to a group of people gathered for the purpose of filling out the survey. Personal = interviews were done face-to-face, usually at the home of the respondent. Telephone = interviews were conducted over the telephone; respondents were limited to those with telephone listings. Mail = respondents mailed in their questionnaires.

^bSamples of various sizes responded to different questions.

^cRegistered voters likely to vote.

2.3 Description of Variation of Survey Data

The surveys utilized in this study are extremely variable along several major dimensions. These include the survey content, the population sampled, the methods of data collection, the time period in which the surveys were conducted, the degree of information provided, and the research groups conducting the studies.

2.3.1 Survey Researchers and Commissioning Agencies

Twenty-nine different research organizations and five groups of independent researchers conducted the studies that are reported here. The researchers included such diverse groups as voluntary membership organizations, media organizations, and academic research centers. The majority of studies, however, were conducted by private survey research organizations. (See Table 2.1 for a complete listing.)

Sponsorship of these surveys was equally diverse. The sponsors included utility companies, government agencies, the nuclear industry, and occasionally media groups and voluntary organizations. About 25% of the national surveys were sponsored by businesses in the nuclear industry and 20% by government agencies, while 70% of the state surveys were commissioned by utility companies. Because many of these sponsoring organizations have vested interests in nuclear power, questions may arise about the objectivity of the research and the validity of results. Since, in most cases, the sponsors of the research commissioned known, reputable survey research organizations to conduct the studies, it is reasonable to have some confidence in the integrity of the results. Furthermore, when consistent research results are obtained by a diverse set of research organizations and sponsors, the confidence with which one can accept the results as indicative of the real attitudes of the public is greatly enhanced. It is in the case of inconsistent findings among researchers or sponsors that questions arise as to whether the

differences are true attitudinal or response differences among respondent groups or are in some way a function of the assessment procedure itself.

2.3.2 The Survey Instruments: Content and Design

There is wide variation in the survey instruments used, in terms of both the number of content areas addressed and the extent of questioning within each area. The majority of surveys included a nuclear attitude section along with assessments of such areas as attitudes toward energy needs and alternative energy options. Some surveys included nuclear questions among questions on a more diverse range of topics, such as general economics and political issues (e.g., Roper, Cambridge). The exact content of these other topics is not known to us in all cases. In a few instances, the surveys consisted entirely of one or two general nuclear questions.

The surveys that probed most deeply into the various aspects of nuclear power attitudes were the Louis Harris and Associates, Inc., studies in 1975 and 1976, and most of the site-specific studies. The Battelle Memorial Institute study of 1976 was the only one that focused on nuclear waste management issues.

Throughout this analysis, careful attention is given to the survey research techniques employed, including the wording and ordering of questions and the context of the questions in terms of the total range of topics assessed. In many cases, the influence of question wording is apparent only when comparisons of similar questions are made. For example, in Chapter 3 there is a detailed discussion of the impacts on response levels of subtle differences in the way in which general nuclear attitude questions are asked.

2.3.3 Survey Samples and Sampling Procedures

Generalizations that may appropriately be made on the basis of survey results are limited by (1) the population sampled in the survey,

(2) the degree to which the sample was representative of the population and was chosen in an unbiased manner, and (3) the size of measurement error, which may be calculated from the survey data and which is largely a function of the size of the sample. The surveys represented in this analysis varied along all three of these dimensions. A discussion of these variations is presented here in order to provide an understanding of the problems encountered in summarizing, analyzing, and drawing conclusions from the results of a large number of different surveys. This information will also aid the reader in interpreting the survey findings.

Most of the studies were probability samples of the adult population of the entire continental United States; a specific state, county, or geographic area; or area near a nuclear site. A few studies sampled only voters--where this difference is relevant to an evaluation of the findings, it is mentioned in the report. Sometimes the sample is representative of a population served by a specific utility company rather than the population of an entire geographic area. Some studies sampled only specific groups, while others sampled one or more special groups in addition to the general population. For example, the Cousteau Society exclusively surveyed their membership, while the studies by Louis Harris and Associates, Inc., included samples of various leadership groups along with a probability sample of the U.S. adult population. (Specific information on populations sampled is provided in the Annotated Survey Reference.)

A majority of the data analyzed in this report were collected according to scientific probability sampling methods, which yield samples of respondents approximating the population parameters. Where sampling was clearly nonrepresentative and nonrandom, or where sampling procedures were unspecified, this is noted in the discussion as well as in the Annotated Survey Reference.

Whenever responses from a sample of the population of interest are given, it is known that these will differ somewhat from the responses that would be obtained if the entire population had been surveyed. This

difference in response levels is termed the sampling tolerance or "error of measurement." This measurement error may be statistically calculated on the basis of the number of respondents in the sample, along with the diversity of responses and other information available in the survey results. For example, when 50% of a sample of 1,000 persons says "yes" to a question, it can be calculated that the measurement error is approximately 4.0, within 95% confidence limits. This means that, if the entire population had been surveyed, 95 times out of 100 the results would be within four percentage points above or below the 50% level obtained in the sample. Therefore, the percentage of the total population in agreement with the question may be assumed to be between 46% and 54% (at the 95% confidence level). For the same sample size, the measurement error would be smaller for questions with which 90% or 10% of the sample agreed. Approximate sampling tolerances for various sample sizes and various response levels are presented in Table 2.2. From this table, it is apparent that the measurement error is larger for small samples and for response levels that are closer to 50%.

Sampling tolerance levels become very important when one wishes to compare the results of one survey with the results of another. For example, suppose that in 1973, 32% of respondents opposed nuclear power and in 1975, 39% opposed. Does this indicate that opposition to nuclear power was greater in 1975 than in 1973? If the difference is within sampling tolerance limits, the difference may be "chance" variation, attributable to the fact that different samples of the population were polled in the two studies. If, however, the difference is greater than variation attributable to measurement error, one may conclude with confidence that the difference indicates a change in the degree of opposition among the population. Suppose that, in the example given, the two samples were both larger than 1,000. In that case, a difference of seven percentage points would occur by chance less than five times in 100 surveys. We can be quite confident (95% confident) that such a difference is not a happenstance, but does indeed indicate differences in responses to that question in 1973 versus 1975. If, however, the samples were small, say 100 persons in each sample, a difference as great as 16% could result from chance. Table 2.3 shows approximate sampling tolerances for differences between two surveys for samples of various sizes.

TABLE 2.2
RELIABILITY OF SURVEY PERCENTAGES

Size of Sample on Which Survey Result is Based	Approximate Sampling Tolerances for a Survey Percentage at or Near These Levels				
	10% or 90%	20% or 80%	30% or 70%	40% or 60%	50%
2,000	2%	3%	4%	4%	4%
1,000	2	3	4	4	4
700	3	4	4	5	5
500	3	4	5	5	5
300	4	6	6	7	7
200	5	7	8	8	9
100	7	10	11	12	13
(95 in 100 Confidence level)					

SOURCE: Adapted from Becker (73/6).

TABLE 2.3

SAMPLING TOLERANCES FOR COMPARISONS BETWEEN TWO SAMPLES

Size of Samples Compared	Approximate Sampling Tolerances for Differences Between Two Survey Percentages at or Near These Levels				
	10%	20%	30%	40%	
	or 90%	or 80%	or 70%	or 60%	50%
2,000 and 1,000	3%	4%	4%	5%	5%
2,000 and 750	3	4	5	5	5
2,000 and 100	7	10	11	12	13
1,000 and 500	4	5	6	7	7
1,000 and 250	5	7	8	8	9
1,000 and 100	8	10	12	13	13
500 and 100	8	11	13	14	14
250 and 100	9	12	13	14	14
100 and 100	10	14	16	17	17

(95 in 100 Confidence level)

SOURCE: Adapted from Becker (73/6).

Throughout this report, when comparisons are made between surveys, a consideration of sampling error (based on sample size) should be kept in mind. When differences in response levels are discussed, we have used the term "significant" to indicate a difference that is not likely to occur by chance more than 5% of the time. Generally, we have included probability values (e.g., $p < .05$) when statistical significance tests have been conducted. A probability of less than 0.05 ($p < .05$) indicates that the difference would occur by chance less than five times in 100. A probability less than 0.01 (indicated as $p < .01$) would occur by chance in less than one case of 100. Customarily, when p values are 0.05 or less, the variation is considered to reflect real differences in the response levels rather than chance variation, and is labeled statistically significant.

Occasionally, a difference may be significant (i.e., unlikely to occur by chance) and yet be so small as to be unimportant. For example, suppose that in response to a specific question, 53% of females and 50% of males agreed. If there were as many as 1,000 males and 1,000 females sampled, this small difference of three percentage points would be statistically significant and we could conclude that males were slightly less likely to agree with the question. However, such a small difference between male versus female support is unlikely to be considered important, and is of little or no concern to consumers of survey data. Therefore, to indicate differences which are substantial enough to be of interest, the term substantive difference has been used in this report. Substantive differences indicate those that are not only significant (i.e., nonchance), but are also meaningful differences in response levels. (See Selvin, 1957, for a discussion of substantive and significant differences.)

Because sample size is so influential in determining measurement error, careful attention should be given to the sizes of samples on which survey results are based. The size of samples in the surveys analyzed here ranged from 100 to 2,000, with most of them large enough to provide for reasonably small measurement error. Over 80% of the national samples had sample sizes greater than 1,000, and approximately 85% of the state samples had sample sizes greater than 500 (53% between 500 and 1,000 and 32% more than 1,000).

2.3.4 Survey Data Collection Methods

The surveys also employed different techniques for data collection. Most studies--75% of the national surveys and over 90% of the state surveys--involved home interviews by trained interviewers. Some surveys were conducted by telephone and others used mailed questionnaires. Because respondents in a mail procedure are self-selected (i.e., they choose to mail in the questionnaire), there is a higher likelihood that the respondents do not represent the population of interest than with personal interviews. This is primarily due to differences in nonresponse patterns (Hansen and Hurwitz, 1946). Both Table 2.1 and the Annotated Survey Reference provide specific information about the data collection methods used in the surveys.

2.3.5 Time Frame of Surveys

The survey data utilized cover a time period from 1945 to 1977. Most of the data are very recent; for example, of the 27 national probability samples between 1960 and 1976, one each was from 1960, 1970, and 1973; three were from 1974; 11 were from 1975; and 10 were from 1976. The greater number of surveys in the last two years is primarily related to two factors. First, interest in attitude assessment in this area has increased phenomenally in the 1970s, especially as a result of nuclear safeguards initiatives and siting studies. Comparable increases are observable in media attention to nuclear energy. A systematic sampling of newspaper and magazine articles from 1972 to 1976 (Rankin, Nealey, and Montano, 1977) found more than twice as many nuclear-related articles in 1975-76 as in 1972-73. Second, numerous survey sources provided only their more recent surveys.

3 GENERAL ATTITUDES TOWARD NUCLEAR POWER

In this chapter the findings from a large number of diverse general nuclear attitude questions are examined in detail to determine the range and variability of support for and opposition to the use and development of nuclear power. Evidence concerning the stability or change in nuclear power attitudes over time is presented. In addition, the relationship of demographic characteristics including sex, age, education, income, occupation, community size and region, to general nuclear attitudes is analyzed. Finally, the meaning of pro, con, and undecided responses to general attitude questions is discussed.

3.1 Analysis of Response Levels to General Nuclear Questions

3.1.1 Classification of Questions Assessing General Nuclear Attitudes

A variety of question wordings and response formats were used to assess general nuclear power attitudes. For purposes of comparison, the general nuclear questions have been classified in three groups. The first group consists of four types of pro-con nuclear power questions, which are described below.

Type 1, questions about
nuclear feelings

These questions ask about
the respondent's general feelings
or opinions toward nuclear power.
These questions and responses to
them are given in Table 3.1.

TABLE 3.1
RESPONSES RE: GENERAL FEELINGS/OPINIONS
OF NUCLEAR POWER
(Type 1 Question)

Survey	Strongly Favorable	Somewhat Favorable	Somewhat Unfavorable	Strongly Unfavorable	Don't Know No Opinion
<u>National probability samples</u>					
Becker (73/6) ^a	28%	33%	9%	4%	26%
Becker (74/6) ^a	26	38	12	5	19
ORC (74/11) ^b	29	40	11	9	11
ORC (75/2) ^b	31	33	8	14	14
ORC (75/4) ^b	26	29	10	11	24
<u>State or area probability samples</u>					
West (AZ 75/11) ^c	34	39	11	11	5
Central (Marble Hill 76/11) ^d					
Indiana	20	38	15	13	14
Kentucky	14	35	19	15	17
Bardsley (OR 76/8) ^d	14	46	23	12	5
Bardsley (OR 76/12) ^e	26	38	21	13	2
Bardsley (WA 76/8) ^d	21	42	19	12	6

^a"What is your general opinion of nuclear power?"

^b"Taking into account all you have heard or read, how do you feel toward nuclear power plants in general?"

^c"What is your general opinion toward nuclear generating plants?"

^d"Overall, would you say your opinion of nuclear power is...?"

^e"Apart from Measure #9, is your overall opinion of nuclear power plants ...?"

Type 2, questions about
nuclear use

These questions ask whether
nuclear power should be used for
electricity. These questions and
responses to them are given in
Table 3.2.

Type 3, questions about
building nuclear
plants

These questions ask whether
nuclear power plants (or more nuclear
plants) should be built. These
questions and responses to them are
given in Table 3.3.

Type 4, questions about
nuclear plants and
energy needs

These questions ask whether
nuclear plants should be built in
order to meet the energy crisis.
These questions and responses to
them are given in Table 3.4.

Type 3 and Type 4 questions are the same except that Type 4 questions are tied to energy needs. Also, Type 4 questions, more than Type 3, imply an increase or acceleration of commitment to nuclear power. Other questions, which do not neatly fit into the above categories, will be discussed in the text where appropriate.

The second group of questions assessed attitudes toward a nuclear power plant in the respondent's own area. These questions do not vary as much in format as the more general pro-con power questions classified above. (Refer to Table 3.8 for exact wording of these questions.)

A third group of questions assessed attitudes toward specific nuclear sites. (Refer to Table 3.15 for exact wording of these questions.) Responses to these questions before the proposed site was announced, following publicity regarding the site proposal, and after the nuclear plant was "on-line" have been prepared (see Table 3.13) and will be discussed in the text.

TABLE 3.2

RESPONSES RE: SHALL WE USE NUCLEAR POWER
FOR ELECTRICITY?
(Type 2 Question)

Survey	Pro	Con	Undecided	No Opinion
<u>National probability samples</u>				
NORC (74/5) ^a	80%	20%		
Sindlinger (60/6) ^b	64	6	12%	18%
<u>State probability samples</u>				
Pub. Resp. (AZ 76/9) ^c	66	19	10	5
Pub. Resp. (AZ 76/10a) ^c	70	15	8	5
Pub. Resp. (AZ 76/10b) ^c	74	15	8	3
Pub. Resp. (AZ 76/10c) ^c	73	14	6	7
Navarro (MO 73) ^d [Reported in 75]	49	10	41	
Navarro (MO 74) ^d [Reported in 75]	52	15	33	
Navarro (MO 75) ^d	52	15	33	

^a"Do you agree or disagree with this statement: Nuclear power should be used to produce electricity?"

^b"Atomic power should be used to produce electricity."

^c"Forgetting this particular proposition, are you generally in favor or opposed to using nuclear power to generate electricity?"

^d"For many years, scientists have been talking about nuclear power as a source of energy. Do you think this is a good idea or not?"

TABLE 3.3

RESPONSES RE: SHALL WE BUILD NUCLEAR POWER PLANTS?
(Type 3 Question)

Survey	Makes			
	Pro	Con	No Difference	Don't Know
<u>National probability samples</u>				
Cambridge (74/10) ^a	59%	27%		14%
[Reported in 75/5]				
Cambridge (75/1) ^a	54	30		16
[Reported in 75/5]				
Cambridge (75/5) ^a	45	35		21
Cambridge (75/8) ^a	53	29		18
Cambridge (75/12) ^a	46	23		32
Cambridge (76/4) ^a	47	34		19
Cambridge (76/7) ^a	49	33		18
Cambridge (76/10) ^a	58	31		21
Cambridge (76/12) ^a	52	28		20
Harris (75/4) ^a	63	19		18
Harris (76/7) ^a	61	22		17
<u>State or area probability samples</u>				
West (AZ 75/11) ^a	69	23		8
Hamilton (CO 76/8) ^b	56	29		15
Hamilton (CO 76/10) ^b	54	31		15
Central (IN 75/11) ^c	35	14	34%	17
Bardsley (OR 71/3) ^d	45	33		22
Bardsley (OR 75/3) ^e	45	43		12
Bardsley (OR 75/7) ^e	54	41		5
Central (San Diego 72/8) ^f	65	19		16

NOTE: Responses converted to pro or con construction of nuclear plants, regardless of question wording.

^a"Do you generally favor or oppose the construction of more nuclear power plants?" (Very minor word changes in question used by Harris and West.)

^b"Should we restrict construction of nuclear generating plants or allow such plants to be built?"

^c"Do you favor building nuclear power plants in Indiana, or oppose them, or doesn't it make much difference to you either way?"

^dQuestion similar to e, except that it referred to a 5-year moratorium on construction.

^e"Some say that construction of nuclear power plants in Oregon should be delayed, while others disagree. How do you feel--would you favor or oppose a delay in the building of more nuclear power plants in Oregon?"

^f"One of the provisions in Proposition 9 would have prohibited construction of nuclear power generating plants in the state for five years. If you could have voted separately on this proposal, would you have voted for or against it?"

TABLE 3.4

RESPONSES RE: SHALL WE BUILD NUCLEAR POWER PLANTS
TO MEET ENERGY NEEDS?
(Type 4 Question)

Survey	Favor	Oppose	Not Sure/ No Opinion
<u>National probability samples</u>			
Gallup (76/6) ^a	71%	18%	11%
Harris (73/9) ^b [Reported in 75/4]	64	21	15
Harris (74/7) ^b [Reported in 75/4]	75	14	11
Harris (74/11) ^b [Reported in 75/4]	66	16	18
Harris (75/4) ^b	67	18	15
Harris (76/7) ^b	62	21	17
ORC (75/1) ^c	62	27	11
Roper (73/6) ^d [Reported in 75/6]	62	--	--
Roper (74/6) ^d [Reported in 75/6]	57	--	--
Roper (75/6) ^d	53	27	19
Roper (76/6) ^d	47	31	22
<u>State or area probability samples</u>			
West (AZ 75/11) ^b	62	24	14
Field (CA 76/5) ^e	69	19	12
Field (CA 76/6) ^e	74	16	10
Nordhaus (MI 72/12) ^f	68	9	23
Nordhaus (MI 73/5) ^f	71	14	15

^a"In order to meet the future power needs of the nation, how important do you feel it is to have more nuclear power plants--extremely important, somewhat important, not too important, or not at all important?"

^bAmong nine suggested solutions to the energy crisis "Speed up the building of new nuclear power plants."

^cAmong 24 suggested solutions to energy shortage "More nuclear power plants should be built."

^dAmong ten suggested solutions to energy shortage "Go into a greatly expanded program to develop atomic energy."

^eQuestion same as a except that it referred to California.

3.1.2 Analysis of Responses to Four Pro-Con Questions

3.1.2.1 Type 1, questions about nuclear feelings. Responses indicating general feelings and opinions regarding nuclear power are given in Table 3.1. Our data include the results of five national probability studies in which the question about general opinions and feelings toward nuclear power was asked. These studies were done by two different research organizations at five different points in time between 1973 and 1975. These data indicate that 55% to 69% (with a median of 64%) of the population was favorable to nuclear power. The percentage unfavorable to nuclear power ranged from 13% to 22%, with a median of 20%. The percentage undecided or with no opinion ranged from 11% to 26%, with a median of 19%.

Among the area surveys, four posed the Type 1 question in 1976 and one posed the Type 1 question in 1975. The range of support in these studies was 49% to 73%, with a median of 61.5%. The range of opposition was 22% to 35%, with a median of 32%. Undecided or no opinion responses ranged from 2% to 17%, with a median of 5.5%. The low of 2% with no opinion came from Bardsley (OR 76/12) after the state initiative campaign and vote. The fact that the range of undecided responses (designated DK for "don't know" throughout this report) in these area studies is lower than found in the national data is probably explained by the fact that these data are more recent and, except for the Central (Marble Hill 76/11) study, from states in which a nuclear initiative was on the ballot. The campaign publicity surrounding the initiatives probably increased knowledge of nuclear power issues and their salience for the public.

3.1.2.2 Type 2, questions about nuclear use. The question regarding the use of nuclear power to produce electricity was posed in two national studies, NORC (74/5) and Sindlinger (60/6), and in two states, Arizona and Missouri, in samples taken during 1973-76. Response distributions are given in Table 3.2. A median of 66% were favorable, with a range of 49% to 80%. The 80% favorable response, the highest pronuclear response

in any state or national sample, was obtained in the NORC (74/5) study at a time when oil shortages were salient; support for nuclear power may have been at an all-time high level. Additional factors that may account for the unusually high proportion of pronuclear responses in this survey are (1) the fact that "no opinion" or "undecided" responses were apparently not permitted and (2) the fact that the sample size was small (422), yielding a larger measurement error than other samples. The range of percentages indicating opposition to nuclear power was 6% to 20%, with a median of 15.8%.

Those indicating indecision or no opinion ranged from 11% to 41%.

Given the very general nature of the question, the large undecided percentage in four of the surveys is somewhat surprising. In neither of the states assessed is there yet a nuclear power plant, and none is expected to begin operation before 1981. The Arizona data show a low percentage of indecisive responses during the period sampled (September-October, 1976), which may be attributed to the publicity and campaign efforts surrounding the nuclear initiative voted on just after the final survey data were collected.

3.1.2.3 Type 3, questions about building nuclear plants. Questions regarding building nuclear plants are of two types:

1. Questions suggesting that we build (or build more) nuclear power plants.
2. Questions suggesting that we stop or delay construction of nuclear plants.

Questions and response distributions for the Type 3 question are shown in Table 3.3. National data are all of the "build more" type. They include nine Cambridge studies made between 1974 and 1976 and two Harris studies made in 1975 and 1976. Comparison of data from Harris and Cambridge is thus very appropriate, since the time frame and the question are nearly identical (see Fig. 3.3).

The range of approval for nuclear power was 45% to 63% in these national studies, with a median of 53%. The range of opposition was 19% to 35%, with a median of 29%. The Cambridge samples were consistently more opposed and less favorable than were the Harris samples. An explanation for this difference has not been found. The demographic composition of both the Harris and the Cambridge samples were compared, and no major differences were observed. The Harris surveys focused on energy shortages and power issues exclusively, while the Cambridge studies included an extensive section on nuclear power along with a few questions on other topics. However, a comparison of the content and order of questions in these surveys reveals nothing which would appear to account for the consistent differences in survey results.

Among the area studies, the Type 3 question was used eight times (see Table 3.3). In two of these, questions were in the general format of the Harris and Cambridge questions; i.e., "shall we build nuclear plants?" In the other survey samples, the question was phrased to ask about a delay, restriction, or cessation of nuclear plant construction. The range of support for nuclear construction was 35% to 69% in area studies, with a median of 54%. The range of opposition was 14% to 43%, with a median of 30%. The 35% favorability is distinctly lower than the percentage indicating favorability in any other study, regardless of the format or focus of the question. In this study (Central, IN 76/11), respondents were given the option of indicating, "It makes no difference," which was chosen by 34% of the people. If we include "It makes no difference" with "don't know," then, for this sample, we would have a high of 51% "don't know." It would appear, therefore, that some of those responding "It makes no difference" would have indicated either a pro or con position had the response options been the same as in other surveys. Thus, it is possible that the pro or con categories in the other surveys are partially inflated by persons who really do not care whether or not nuclear plants are built. The interpretations of pro, con, and unsure responses are discussed in Section 3.3 of this report.

If Central (IN 75/11) is eliminated, the state and national data are very comparable: 45% to 69% pronuclear in state studies versus 45%

to 63% pronuclear in national studies (medians of 54% and 53%); 19% to 43% antinuclear in state studies versus 19% to 35% antinuclear in national studies (medians of 31% and 29%).

Although the wording of the question could have, and probably did, influence responses, such influence is not obvious from the data. When the question asked about construction, the range of responses was 35% to 69% in favor. When the question asked about delay or restriction, 45% to 65% indicated no restriction; i.e., they were favorable toward nuclear construction.

3.1.2.4 Type 4, questions about nuclear plants and energy needs.

These questions were assessed in two ways. Some surveys included a list of options for solving energy problems, among which was a suggested increase or acceleration of the construction of nuclear power plants. In other surveys, separate questions about building nuclear plants were preceded by qualifiers such as, "to meet energy needs" Table 3.4 provides the exact wording of the questions, and gives the responses for each survey in which the Type 4 question occurred.

The data presented here include results from 11 national studies--all but one of which asked the question in a list of options--and from five area studies. The national data were obtained between 1973 and 1976 and the area data were obtained between December 1972 and 1976. These time periods are comparable. The range of support for increased construction of nuclear plants was 47% to 75%, with a median of 65%. The range of opposition was 9% to 31%, with a median of 19%.

These data permit comparison of attitude assessments that were made at the same time by various research organizations, whose questions differed from one another. Note that two reputable national polling organizations, Roper and Gallup, polled the public in June 1976, with very different results. Gallup (76/6) found 71% favorable, 18% unfavorable, and 11% undecided; Roper (76/6) reported 47% favorable, 31% opposed, and 22% undecided. One may assume that the format of the question contributed in large part to the disparate findings. The Gallup question, for which

response options were "extremely important," "somewhat important," "not too important," and "not at all important," may have increased the salience of importance by repeating the word in all responses. In addition, the options did not provide respondents with clearly comparable alternatives for indicating support or opposition. By contrast, the Roper response options were "should" or "should not." We might suggest that had the options in the Gallup question given more equally balanced alternatives for indicating pro versus con views (such as "extremely important" and "somewhat important" versus "somewhat unimportant" and "extremely unimportant"), the percentages indicating support versus opposition might have been more nearly comparable to those obtained by Roper. An alternative explanation is that, when respondents were given a series of possible solutions to the energy crisis, as in the Roper sample, their support for the nuclear option was diminished by the salience of alternative means of alleviating the energy problem. Unfortunately, information regarding the other questions posed to respondents in the Gallup study is unavailable to us, and therefore the context in which respondents considered the Gallup question is unknown. The difference between the Gallup (76/6) and the Roper (76/6) findings indicate the caution one should use in interpreting the findings of any one survey or survey question.

3.1.2.5 Analysis of findings by experience with nuclear power plants. Five Cambridge and two Harris national probability samples examined pro and con attitudes for portions of the population living near a nuclear power plant (see Table 3.5). The Cambridge studies reported responses from (a) respondents with no nuclear plants near them, (b) those in the area of nuclear plants, and (c) those who are potential nuclear plant neighbors. Means (across the five time intervals) of the percentage favoring and opposing nuclear plants for each of these groups are shown in Table 3.5. The data show small differences in the direction of more support and less opposition from nuclear plant neighbors and potential neighbors than from the total sample. Analysis of variance tests indicated that these differences are not significant.

TABLE 3.5

FAVORABILITY TOWARD NUCLEAR POWER
BY PROXIMITY TO NUCLEAR POWER PLANT

Survey	Favor Nuclear Plants				Oppose Nuclear Plants			
	Total Public	No Nuclear Plant	Nuclear Plant Neighbors	Potential Nuclear Plant Neighbors	Total Public	No Nuclear Plant	Nuclear Plant Neighbors	Potential Nuclear Plant Neighbors
Cambridge (75/5) ^a	45%	44%	48%	44%	35%	35%	37%	31%
Cambridge (76/4) ^a	47	42	47	51	34	43	32	34
Cambridge (76/7) ^a	49	50	48	49	33	30	36	33
Cambridge (76/10) ^a	48	46	46	51	31	32	33	30
Cambridge (76/12) ^a	52	51	52	54	28	30	30	23
$\bar{x}$ for Cambridge	48.2	47.0	48.2	49.8	32.2	34.0	33.6	30.2
Harris (75/4) ^b	63	--	63	--	19	--	23	--
Harris (76/7) ^b	61	--	70	--	22	--	21	--
$\bar{x}$ for Harris	63.0		66.5		20.5		22.0	

^a"Do you generally favor or oppose the construction of more nuclear power plants?"

^b"In general, do you favor or oppose the building of more nuclear power plants in the U.S.?"

The Harris (76/7) data showed significantly more support among nuclear plant neighbors than among the general public ($p < .005$). In 1975, however, an equal level of support (63%) was found in both groups. Opposition among nuclear plant neighbors exceeded that of the general public by 23% to 19% in Harris (75/4). This difference is small and not significant. The experience of living near a nuclear power plant does not seem to have had much effect on attitudes toward the construction of nuclear power plants in general. The effect of residence near a nuclear plant on attitudes toward location of nuclear plants nearby and toward a specific nuclear plant in one's own community are discussed in Sections 3.1.3.2 and 3.1.5 respectively.

3.1.2.6 Conclusions regarding support and opposition to nuclear power from the four general pro-con nuclear power questions. The percentage ranges, means, and medians of responses to the pro-con nuclear power questions are shown by question type and by national and area studies in Tables 3.6 and 3.7. The percentage favoring nuclear power greatly exceeded the percentage opposed, usually by a factor of two or three to one regardless of the type of question.

In general, there was more support and less opposition for the Type 2 question than for any of the others. This may be partly explained by the question itself, which asked whether we should use nuclear power for electricity. This question did not inquire into the respondents' pro or con feelings. Nor did it mention, imply, or evoke images of nuclear power plants which may be more objectionable than the simple idea of using nuclear energy for electrical power. Since nuclear power is currently being used for electricity, opposition to this question would imply elimination of current power--presumably an undesirable occurrence.

A comparison of the ranges of response levels for the four question types is provided in Fig. 3.1. Sizable margins between levels of support and levels of opposition for Type 1, 2, and 4 questions are shown. For the Type 3 question, however, levels of opposition and levels of support overlap. This question, regarding the construction of more nuclear power plants, is the one on which people are more nearly evenly divided.

TABLE 3.6
SUPPORT FOR NUCLEAR POWER
RANGES, MEANS AND MEDIAN FOR GENERAL PRO/CON QUESTIONS

Question Type	Range	Mean	Median
<u>Type 1, nuclear feeling question</u>			
National surveys (5)	55-69%	62.6%	64.0%
State surveys (6)	49-73	61.2	61.5
<u>Type 2, nuclear use question</u>			
National surveys (2)	64-80	72.0	72.0
State surveys (7)	49-74	62.3	66.0
<u>Type 3, building nuclear plants</u>			
National surveys (11)	45-63	53.4	53.0
State surveys (8)	35-69	52.9	54.0
<u>Type 4, nuclear plants and energy question</u>			
National surveys (11)	47-75	62.4	62.0
State surveys (5)	62-74	68.8	69.0

TABLE 3.7
OPPOSITION TO NUCLEAR POWER
RANGES, MEANS AND MEDIAN FOR GENERAL PRO/CON QUESTIONS

Question Type	Range	Mean	Median
<u>Type 1, nuclear feeling question</u>			
National surveys (5)	13-22%	18.6%	20.0%
State surveys (6)	22-35	30.7	32.5
<u>Type 2, nuclear use question</u>			
National surveys (2)	6-20	13.0	13.0
State surveys (7)	10-19	14.7	16.0
<u>Type 3, building nuclear plants question</u>			
National surveys (9)	19-35	28.3	29.0
State surveys (8)	14-43	29.1	30.0
<u>Type 4, nuclear plants and energy question</u>			
National surveys (9)	14-31	21.4	22.6
State surveys (5)	9-24	16.4	16.0

FIGURE 3.1

RANGES OF PERCENTAGES FAVORING AND OPPOSING NUCLEAR POWER
IN RESPONSE TO FOUR QUESTION TYPES

An interesting comparison may be made between the Type 3 and Type 4 questions. Both ask whether nuclear plants should be built--or whether more should be built. The Type 4 question, however, suggests the qualifier, "in order to meet energy needs," or demands, or crisis. In the data we have, there was clearly more support and less opposition expressed to this question than to the Type 3 question. For national samples, the mean favorable responses were 53.3% versus 62.4% for the two questions. For area samples, the mean percentages of pronuclear respondents for the two questions were 52.9% versus 68.8%. Both of these differences are statistically significant ($p < .05$). Opposition to the Type 3 question was greater than to the Type 4 question for both national and area samples, with means of 28.3% versus 21.4%, and 29.1% versus 16.4%, respectively. The latter difference (between area samples) is significant ($p < .05$), although the former is not. Apparently consideration of the energy crisis enhances favorability toward building nuclear plants and decreases the percentage opposing such construction.

3.1.3 Attitudes toward a Nuclear Plant Nearby

3.1.3.1 Analysis of responses regarding a nuclear plant nearby.

Questions about having a nuclear plant nearby have been asked more frequently than any others. This probably reflects the salience of the question, both for those interested in the development of nuclear power plants and for the general public. Consideration of the location of a nuclear plant in one's own neighborhood is likely to evoke a more strongly held, more emotional, opinion than considerations such as the use of nuclear power to supply energy needs, the use of nuclear technology to produce electricity, or the building of nuclear plants in general.

Fourteen different national probability samples, taken from 1960 to 1976; and 15 area studies, taken from 1972 to 1977, addressed this issue. The questions used to assess attitudes regarding having a nuclear plant nearby are given in Table 3.8. The Harris and Sindlinger studies used two different questions to assess essentially the same attitude;

TABLE 3.8

QUESTIONS USED TO ASSESS ATTITUDES TOWARD A NUCLEAR PLANT NEARBY
(National Samples Listed Alphabetically)

Survey	Question
Becker (74/5) Becker (73/6)	Suppose your electric company announced that it planned to build a nuclear power generating plant in this general area producing electric power by means of atomic energy. Would building this kind of plant be all right with you or would you oppose it?
Gallup (76/6)	As of today, how do you feel about the construction of a nuclear power plant in this area--that is, within five miles of here? Would you be against the construction of such a plant in this area, or not?
Harris (75/4)	Would you personally favor or oppose having nuclear power as the main source of energy for the electric power you use in your community? If you had to decide right now, would you favor or oppose your community building a nuclear power plant to meet all the electric power needs for home and business use?
NORC (74/5)	What (is/would be) your reaction to having an electric plant fueled by nuclear energy located here in your (city/town/county)--that is, here in (name)?
ORC (75/2) ORC (75/4) ORC (74/12)	How would you feel about having a nuclear power plant within 20 miles of where you live?
Sindlinger (60/6)	What would your reaction be to having an atomic powered electrical plant located here in your city, that is, here in (name)? What would your reaction be to having your household electricity supplied from an atomic power plant?

responses to the variant wordings of the question may therefore be compared. In the Harris (75/4, 76/7) surveys, there was essentially no difference in the percentage who favored "having nuclear power as the main source of energy for the electric power you use" and those who favored "your community building a nuclear power plant to meet all the electric power needs." However, Sindlinger (60/6) respondents were more favorable toward "having your household electricity supplied from an atomic power plant" than they were toward "having an atomic powered electrical plant located here in your city" by 68% versus 58%. Responses to the nuclear plant nearby questions are given in Table 3.9 for national studies and in Table 3.10 for area studies. The percentage favorable to a plant nearby ranged from 42% to 68% in the national studies, with a median of 52%; and from 27% to 62% in the area studies, with a median of 44.5%. The range of opposition was from 9% to 45% for the national data, with a median of 29.2%; and from 13% to 51% in the area data, with a median of 23.5%. In seven of the area studies, respondents were given an option of indicating that "It makes no difference either way." An average of 32.5% of the respondents chose this response option when it was offered (see Table 3.10).

Overall, the survey results indicate support for a nuclear plant nearby, with wide margins between percentages favorable and those opposed. The two exceptions, the Gallup national sample and the Iowa study, are of special interest, since they are the only two questions in the entire body of data in which opposition to nuclear power exceeds support.

The nearly even proportion of respondents that favored versus opposed a nuclear plant nearby in the Gallup study (42% versus 45%) is especially striking since, in the same survey, the percentage responding favorably to the construction of more nuclear plants was a noticeably high 71%. (See discussion of this response level in Section 3.1.2.4.)

TABLE 3.9
ATTITUDES TOWARD A NUCLEAR PLANT NEARBY
NATIONAL PROBABILITY SAMPLES

Survey	Question	Pro	Con	DK
Becker (69) ^a	In this general area	50%	27%	23%
Becker (70) ^a	In this general area	43	30	27
Becker (71) ^a	In this general area	50	28	22
Becker (72) ^a	In this general area	53	28	19
Becker (73/6)	In this general area	56	21	23
Becker (74/5)	In this general area	55	28	17
Gallup (76/6)	Within 5 miles of here	42	45	13
Harris (75/4)	Nuclear as main energy source for community	54	24	22
Harris (76/7)	Nuclear as main energy source for community	49	31	20
Harris (75/4)	Have community build nuclear plant for <u>all</u> electricity	55	27	18
Harris (76/7)	Have community build nuclear plant for <u>all</u> electricity	51	35	14
NORC (74/5)	In own city	67	33	--
ORC (74/12) ^b	Within 20 miles	52	39	9
ORC (75/2)	Within 20 miles	49	43	8
ORC (75/4)	Within 20 miles	45	38	17
Sindlinger (60/6)	In your city	58	20	21
Sindlinger (60/6)	Have household supplied from atomic power plant	68	9	23

^aData from Becker (73/6).

^bData from ORC (75/4).

TABLE 3.10

ATTITUDES TOWARD A NUCLEAR PLANT NEARBY
STATE AND AREA PROBABILITY SAMPLES

Survey	Pro	Con	Makes No Difference	Don't Know/ No Opinion
Iowa (IA 76/4)	33%	51%	--	16%
Central (IA, TX 73/4)	54	13	--	33
Central (MI, WI 77/3)				
Michigan 1976	29	20	35%	16
Michigan 1977	27	19	37	17
Central (OK 75/3)				
Oklahoma 1972	50	13	--	37
Oklahoma 75/3	44	15	29	12
Central (OK 76/3)	36	16	27	19
Bardsley (OR 68/1)	49	23	--	28
Bardsley (OR 69/6)	43	22	--	35
Bardsley (OR 71/4)	45	31	--	24
Bardsley (OR 72/7)	46	33	--	21
Bardsley (OR 75/7)	58	29	--	13
Bardsley (WA 76/8)	49	36	--	15
Central (WI 75/6)	52	25	--	23
Central (MI, WI 77/3)				
Wisconsin 1976	29	24	32	16
Wisconsin 1977	30	20	35	15
IGA (Sacramento 76/6) ^a	44	38	--	18
Bardsley (San Diego 76/9)	62	31	--	7

NOTE: Questions asked whether respondent would favor or oppose a nuclear plant in her/his own county or area. The Iowa survey specified "within 25 miles."

^a"In favor of building more nuclear power plants and OK if one were in my area."

The Gallup question included two factors that may account for the unusual degree of opposition to a plant nearby. First, respondents were asked about a plant within five miles of their residences--a more precise and closer location than those suggested in other national surveys. Second, the question was worded so that a "yes" response indicated opposition to such a plant. Thus any "yea-saying" bias would increase the percentage indicating opposition toward nuclear power. Note that most other questions are asked neutrally: e.g., "What is your reaction? . . ." and "How would you feel"

The question asked in the Iowa study is similar to those used in other studies, "Would you favor or oppose having a nuclear power plant constructed within 25 miles of your home?" The report of the study in the Des Moines Register in July 1976, indicated that Iowa already had one nuclear power plant and another plant had been proposed for construction near Des Moines. A major campaign launched against the proposal may have influenced the survey outcome.

3.1.3.2 Attitudes toward a plant nearby by experience with a nuclear plant nearby. The Harris studies provide responses from the total public and also from residents near three nuclear plants (Indian Point, New York; Morris, Illinois; and San Onofre, California) to the question about having nuclear power as a main energy source. At the time of the first Harris survey, Indian Point had been on-line for 13 years; Morris, 15 years; and San Onofre, 6 years.

The effect of living in the vicinity of a nuclear power plant on attitudes toward having such a plant nearby is greater than the effect on nuclear attitudes in general (see Table 3.5 and discussion in Section 3.1.2.5). Table 3.11 shows Harris data indicating that, in response to the question about having nuclear power as the main source of energy, nuclear plant neighbors are significantly more in favor ($p < .01$) and less opposed ($p < .01$) than the general population.

TABLE 3.11

FAVORABILITY TOWARD A NUCLEAR PLANT NEARBY
BY EXPERIENCE WITH A NUCLEAR PLANT NEARBY

Response	Harris 75/4		Harris 76/7	
	Total Population	Nuclear Plant Neighbors	Total Population	Nuclear Plant Neighbors
Favor	54%	61%	49%	64%
Oppose	24	22	31	23
DK	22	17	20	13

NOTE: "Would you personally favor or oppose having nuclear power as the main source of energy for the electric power you use in your community?"

3.1.4 Comparison of Responses by Same Respondents to Variant Question Forms

3.1.4.1 Comparison of attitudes toward nuclear power and attitudes toward a nuclear plant nearby. Ten of the national survey samples asked respondents one of the general pro-con nuclear questions and also asked about receptivity toward a nuclear plant nearby. Responses to these questions are compared in Table 3.12. In every case, the percentage endorsing nuclear power nearby was significantly smaller than the percentage endorsing nuclear power in general. Also, the percentage opposing nuclear power nearby was significantly greater than the percentage opposing nuclear power in general.

Data from Becker (74/6) indicate that 32% of persons strongly or somewhat favorable toward nuclear power in general (Type 1 question) would oppose construction of a nuclear plant in their area. These persons favor nuclear power, but want it located somewhere else.

It may be that many Americans perceive nuclear power as an energy source that does not need to be located near residential areas. The Harris (76/4) and (76/7) studies posed a number of suggested advantages

TABLE 3.12
COMPARISON OF ATTITUDES TOWARD NUCLEAR POWER
AND TOWARD A NUCLEAR PLANT NEARBY

Survey	Pro		Con	
	Nuclear Power ^a	Nuclear Plant Nearby ^b	Nuclear Power ^a	Nuclear Plant Nearby ^b
Becker (73/6)	61%	56%	13%	21%
Becker (74/5)	64	55	17	28
Gallup (76/6)	71	42	18	45
Harris (75/4)	63	55	19	27
Harris (76/7)	61	51	22	35
NORC (74/5)	80	67	20	33
ORC (74/11)	69	52	20	39
ORC (75/2)	64	49	22	43
ORC (75/4)	55	45	21	38
Sindlinger (60/6)	64	58	6	20

^aWording of questions regarding nuclear power are given in Table 3.1 for Becker and ORC surveys, Table 3.2 for NORC and Sindlinger surveys, and Table 3.3 for Harris surveys.

^bWording of questions regarding location of a nuclear plant nearby are given in Table 3.8.

of nuclear power, including "Building nuclear power plants away from heavily residential areas and still bringing cheaper power to people where they live." This was ranked as a major advantage by 72% and 68% of the people in 1975 and 1976 respectively.

3.1.4.2 Comparison of responses to other question and context differences. Among the survey assessment of general nuclear attitudes, the most comprehensive and complex exploration of responses to various formulations of questions was provided by the Harris (75/4) and (76/7) studies. In each of these, respondents answered a basic pro-con nuclear question four times in response to four variations in question format and questionnaire context. Responses to these questions are shown in Table 3.13. The Harris questionnaire, consisting of over 100 questions, began with a section about perceptions of energy needs. The Type 4 question was presented among other potential solutions to the energy crisis. Respondents were then asked to consider three sources of energy (oil, coal, and nuclear power) and to answer nine questions about specific characteristics of these sources such as cost and safety. This was followed by the Type 3 question regarding construction of nuclear plants. A respondent was then asked to support his pro or con position with reasons, to consider main advantages of nuclear power, and then to respond to a question about nuclear power as the main energy source. Another series of questions regarding the advantages and disadvantages of nuclear power plants, judgments of problems associated with them, evaluations of risks worth taking, acceptance of nuclear energy under various hypothesized economic advantages and disadvantages, etc., followed. Finally, respondents were asked the fourth question, regarding the construction of a nuclear plant for all the electricity needs of their community.

A high degree of consistency was found in responses to the four questions. Only the consideration of location of nuclear power in the respondent's vicinity appeared to significantly affect the degree of support for nuclear power. In Harris (75/4), there appeared to be a small but significant ($p < .05$) decrease in support for the Type 3 versus the Type 4 question (the second question in the survey), but this

TABLE 3.13

RESPONSES TO DIFFERENT QUESTIONS
REGARDING CONSTRUCTION OF NUCLEAR POWER PLANTS

Question	Harris (75/4)			Harris (76/7)		
	Pro	Con	DK	Pro	Con	DK
From list of suggestions to solve energy crisis:						
"Speed up the building of new nuclear power plants."	67%	18%	15%	62%	21%	17%
"In general, do you favor or oppose the building of more nuclear power plants in the United States?"	63	19	18	61	22	17
"Would you personally favor or oppose having nuclear power as the main source of energy for the electric power you use in your community?"	54	24	22	49	31	20
"If you had to decide right now, would you favor or oppose your community building a nuclear power plant to meet all the electric power needs for home and business use?" (Asked after respondent had answered numerous questions re: the safety, risks, advantages, disadvantages, etc. of nuclear power plants.)	55	27	18	51	35	18

was not the case in Harris (76/7). The nuclear power nearby questions received similar levels of support, although there was a small but significant ($p < .05$) increase in opposition on the last question.

The fact that the various considerations and question formulations presented to Harris respondents yielded quite consistent results appears to indicate that these various questionnaire items elicited indications of the respondents' underlying attitudes toward the topic, uninfluenced by questionnaire format. Since the same respondents replied to the question variations, it is possible that the consistency resulted from a tendency of survey respondents to exhibit attitudinal consistency throughout an assessment instrument. It may be that, once having expressed a pronuclear or antinuclear stance, respondents hesitated to vary from that position.

3.1.5 Attitudes toward a Nuclear Plant at a Specific Nuclear Site

Our compilation of surveys includes 14 that were made in the area of 11 different nuclear plant locations. These provide information about the attitudes of residents in the area toward the proposed and actual construction of a nearby nuclear plant. In addition, Harris (75/4, 76/7) sampled residents near three different nuclear sites in two different years, and a number of area surveys included subsamples of residents near nuclear plants. Altogether, the survey collection includes 46 measures of the attitudes of residents in the vicinity of 20 different nuclear plant sites or proposed sites. The responses from these residents, together with the locations, dates of questioning, and types of question asked are indicated in Table 3.14. Also, a list of the questions is given in Table 3.15. Approval of the proposed nuclear plant ranged from a low of 10% (asked of residents on an Indian reservation regarding possible plant placement within the reservation) to a high of 80%. The median was 56.5% approval with a median disapproval of 18.7%. The range of approval is much wider than has been found on more general nuclear questions. This is partly a function of the decreased reliability of measurement of these smaller samples. Also, it probably

TABLE 3.14

ATTITUDES TOWARD SPECIFIC NUCLEAR SITE

Site	Population Sampled	Survey Source	Question	Date of Data	Pro	Con	Makes No Difference	Don't Know/ No Opinion
<u>Before population is aware of site proposal</u>								
Black Fox, OK	residents in 25 mi radius	Central (Black Fox 74/1)	favor/oppose site	74/1	37%	4%	50%	9%
Black Fox, OK	Tulsa residents (25 mi away)	Central (Tulsa 74/1)	"	74/1	44	3	44	9
Matagorda, TX	residents in county	Central (Matagorda 73/3)	"if...in this area..."	73/3	49	17		34
Trojan, OR	"	Bardsley (OR 68/1)	in your general area	68/1	59	13		28
<u>After publicity re. proposed plant</u>								
Matagorda, TX	residents in county	Central (Matagorda 74/9)	favor/oppose site in county	74/9	80	11		9
"	"	"	live within 5-10 mi	74/9	70	14		5
"	"	Central (Matagorda 76/5)	"this nuclear plant"	76/5	79	12		9
"	"	"	live within 5-10 mi	76/5	63	19		6

TABLE 3.14 (Continued)

Site	Population Sampled	Survey Source	Question	Date of Data	Pro	Con	Makes No Difference	Don't Know/No Opinion
Colorado River area	residents in SE Cal. & SW Ariz.	Central (Colorado River 74/4)	Vidal Site	74/4	54	6	28	12
"	"	"	Blythe Site	"	35	7	46	12
"	residents on Indian reservation	"	Site on reservation	"	10	25	43	22
"	residents in SE Cal. & SW Ariz.	"	live within 5-10 mi	"	59	29 ^a		12
Fulton, MO		Navarro (MO 75	Approve this... plant	1973	50	11		39
"		"	"	1974	52	15		33
"		"	"	1975	48	19		33
St. Francisville, LA	residents within 20 mi	Central (St. Francisville 72	plant--good or not good	1972	73	2		24
Hartsville	residents of county	ORNL (Hartsville 75/2)	good thing or not	75/2	68	24		9
			permit construction	"	65	25		10

TABLE 3.14 (Continued)

Site	Population Sampled	Survey Source	Question	Date of Data	Pro	Con	Makes No Difference	Don't Know/ No opinion
Hartsville	residents of county	ORNL (Hartsville 75/8)	permit construction	75/8	68	31	Don't know	not accepted
Indian Point, NY	"	ORC (Indian Point 60/6)	good idea or bad	1955	60	7		33
				1960	63	5		32
Seabrook, NH	New Hampshire residents	Becker (NH 75/7)	approve or disapprove of construction	75/7	69	12		19
	Rhode Is. residents	"	"	75/7	56	22		22
Marble Hill, IN	Jefferson County, IN; location of plant	Central (Marble Hill 76/11)	good thing or not	76/11	41	30		29
	Louisville, KY, area-- downstream from plant	"	"	"	22	32	21	25
Miles Lake, OR	residents of county	Bardsley (Miles Lake 73/5)	favor/oppose plant	73/5	54	32		14
Trojan, OR	"	Bardsley (OR 75/7)	"	70/8	53	19		28
	"	"	"	75/7	79	19		2
	residents of state	Bardsley (OR 75/7)	"	70/8	43	22		35

TABLE 3.14 (Continued)

Site	Population Sampled	Survey Source	Question	Date of Data	Pro	Con	Makes No Difference	Don't Know/ No Opinion
Trojan, OR	residents of state	Bardsley (OR 71/4)	favor/oppose plant	71/4	49	21		30
	"	Bardsley (OR 71/8)	"	71/8	48	22		30
	"	Bardsley (OR 72/2)	"	72/2	56	16		28
	"	Bardsley (OR 75/2)	"	75/2	66	23		11
Boardman, OR	"	Bardsley (OR 72/2)	"	72/2	61	17		22
" or Eastern Oregon site	2 counties nearby	Bardsley (OR 75/7)	"	75/7	75	20		5
<u>After plant on line</u>								
Oyster Creek, NJ	residents nearby	Metro (Oyster Creek 73/6)	plant--good or bad	73/6	39	20	18 both good and bad	23
			build another plant	"	47	39		14
Hanford, WA	"	Woodward (Hanford 75/2)	encourage more atomic-related industry	75/2	78	12		10
Indian Point, NY	"	Harris (75/4)	main energy source	75/4	54	30		16
	"	Harris (76/7)	"	76/7	48	34		18
Morris, IL	"	Harris (75/4)	"	75/4	57	25		18
		Harris (76/7)	"	76/7	66	20		14

TABLE 3.14 (Continued)

Site	Population Sampled	Survey Source	Question	Date of Data	Pro	Con	Makes No Difference	Don't Know/ No Opinion
San Onofre, CA	"	Harris (75/4)	"	75/4	72	11		17
		Harris (76/7)	"	76/7	80	14		6
Pilgrim, MA	Residents of Plymouth, MA.	Becker (Pilgrim 76/3)	Would 2 additional nuclear units be all right?	74/6	62	19		19
	"	Becker (Pilgrim 76/3)	Shall 2nd nuclear plant be built?	76/3	56	31		13

^aCorrected percentage.

TABLE 3.15

QUESTIONS USED TO ASSESS ATTITUDES TOWARD CONSTRUCTION OF A
SPECIFIC NUCLEAR POWER PLANT AT A SPECIFIC LOCATION (Listed Alphabetically)

Survey	Question
Bardsley (OR 68/1) Bardsley (OR 69/6)	Would you favor or oppose having an atomic power plant built in your general area?
Bardsley (OR 71/4) Also asked 70/8 Bardsley (OR 71/8) Bardsley (OR 72/2) Bardsley (OR 72/7) (implied) Bardsley (OR 75/2) Bardsley (OR 75/7)	As you probably know,...is building the Trojan Nuclear Power Plant in Columbia County. Generally, do you approve or disapprove of the construction of the Trojan nuclear plant?
Bardsley (OR 71/4)	How strongly do you (approve) (disapprove) of the Trojan nuclear power plant--very strongly, somewhat strongly, or not too strongly?
Bardsley (OR 72/2)	Coming back to nuclear plants, would you generally approve or disapprove of having a nuclear power plant built in _____ county? (Name of own county)
Bardsley (OR 72/2)	Have you heard or read anything about plans to build a nuclear power plant near Boardman in Eastern Oregon? (Preceded question above)
Bardsley (OR 72/2)	(Show circled site on map) Would you generally approve or disapprove of having a nuclear plant built here? (near Boardman in Eastern Oregon)
Bardsley (OR 75/7)	It has been proposed that a second nuclear plant be built at this approximate location in Eastern Oregon. Would you generally approve or disapprove of a nuclear plant here?
Bardsley (Miles Lake 73/5)	How would you feel about having a nuclear power plant built on Miles Lake--would you generally favor or oppose it?
Becker (NH 75/7)	As you say (as a matter of fact), construction will soon begin on a nuclear generating plant in Seabrook. Do you approve or disapprove of the plans to build a nuclear plant in Seabrook, New Hampshire?

TABLE 3.15 (Continued)

Survey	Question
Central (Black Fox 74/1)	Do you favor building a nuclear power plant there, or oppose it, or doesn't it make any difference to you either way?
Central (Colorado River 74/4)	<p>Would you have any objections to living within five to ten miles of a nuclear plant?</p> <p>Do you favor building a nuclear power plant at that location, or oppose it, or doesn't it make much difference to you either way? (near Vidal)</p> <p>Do you favor building a nuclear power plant somewhere near Blythe, or oppose it, or doesn't it make much difference to you either way?</p> <p>(Asked only on Indian Reservation) If ...proposed to build the nuclear power plant somewhere here on the reservation, would you favor, or oppose it, or wouldn't it make much difference to you either way?</p>
Central (Marble Hill 76/11)	<p>(Indiana) ...proposes to build a nuclear power plant at Marble Hill. Do you think a nuclear power plant would be a good thing or a bad thing for this area?</p> <p>(Kentucky) ...proposes to build a nuclear power plant at Marble Hill. Do you think a nuclear power plant at that location would be a good thing or a bad thing for the Louisville area, or wouldn't it make any difference to you either way?</p>
Central (Matagorda 73/3)	If someone proposed to build a large electric power plant to produce electricity from atomic energy in this area, would you favor, or oppose such a plant?
Central (Matagorda 74/9)	<p>The electric company serving you is planning to build a nuclear power generating plant in this county. Do you favor or oppose the construction of nuclear power plant in this county?</p> <p>(Asked of all except those who oppose the plant above) Would you have any objections to living within five to 10 miles of a nuclear power plant?</p>

TABLE 3.15 (Continued)

Survey	Question
Central (Matagorda 76/5)	<p>As you probably know, a nuclear power generating plant is being built in this county. Do you favor or oppose the construction of this nuclear power plant?</p> <p>(Asked of all except those who oppose the nuclear plant above) Would you have any objections to living within five to ten miles of a nuclear power plant?</p>
Central (OK 76/3)	<p>If your local electric company proposed to build a nuclear power plant to produce electricity from atomic energy somewhere in this county, would you favor such a plant, oppose it, or wouldn't it make much difference to you either way?</p>
Central (St. Francisville 72)	<p>Do you think building the nuclear power plant near St. Francisville will be a good thing for this area, or not good?</p>
Central (Tulsa (74/1)	<p>...plans to build a nuclear power generating plant about 25 miles east of Tulsa near Inola. Do you recall seeing or hearing anything about that?</p> <p>Do you favor building a nuclear power plant there, or oppose it, or doesn't it make any difference to you either way?</p>
Harris (75/4)	<p>Would you personally favor or oppose having nuclear power as the main source of energy for the electric power you use in your community?</p>
Harris (76/7)	<p>If you had to decide right now, would you favor or oppose your community building a nuclear power plant to meet all the electric power needs for home and business use?</p>
Metro (Oyster Creek 73/6)	<p>Do you think the plant has been good or bad for the area?</p> <p>There has been a recent proposal to build another nuclear power plant in the area. Would you be for or against this idea?</p>
Navarro (MO 75)	<p>...has announced plans to build a nuclear power plant near Fulton, Missouri. Do you approve of this plan to build a nuclear power plant?</p>

TABLE 3.15 (Continued)

Survey	Question
ORC (Indian Pt. 55)	Similar to below
ORC (Indian Pt. 60/6)	As you may know,...is building an atomic power plant beside the Hudson River at Indian Pt. to supply more electricity to the city and Westchester County. As far as you are concerned, do you think it is a good idea, or not such a good idea for the company to do this?
ORNL (Hartsville 75/2)	<p>In general, do you think that the proposed plant will be a good thing for Hartsville or not?</p> <p>If it were up to you, would you permit construction of the TVA power plant in Hartsville?</p>
ORNL (Hartsville 75/8)	If it were up to you, would you permit construction of the TVA power plant near Hartsville?
Woodward (Hanford 75/2)	As you know, atomic energy research and development by the U. S. government has been going on here for many years. Some people are saying that it would now be a good idea to encourage more industries to come in and develop plants related to atomic energy. Other people are opposed to this. What is your opinion--do you favor or oppose encouraging more development of atomic energy-related industry in this area?

reflects differences in the salience of the question for respondents, the diversity of locations and situations sampled, and the fact that the relationship of respondents to plant site varies greatly across these samples. Effects of this latter variation are illustrated in the Metro (Oyster Creek 73/6) sample. Residents in the township receiving most of the tax revenue from Oyster Creek Plant were much less likely to see it as contributing to environmental blight or recreational detriment than were residents outside that township. Similarly, in the Becker (NH 76/7) study, New Hampshire residents approved the construction of Seabrook by 69% (versus 12% opposed), whereas the Rhode Island residents approved by a smaller (56% to 22%) margin.

Sometimes the relationship and question differences are confounded, making interpretation very difficult. For example, residents of Jefferson County, Indiana, in which the Marble Hill nuclear plant was located, indicated 41% approval of the plant. In the same survey, residents of Louisville, Kentucky, downstream from the plant, indicated only 22% approval. The Louisville respondents, however, were given an option of indicating "makes no difference," to which 21% responded. This leaves open the question of the degree to which differences in approval reflect attitudinal differences between the two respondent groups and the degree to which they show the effect of different response options.

Attitudes toward a hypothetical situation do not always accurately reflect attitudes toward the actual situation or event when it occurs. In psychological studies, McGuire (1960) found that when persons became convinced of the likelihood of an event, their evaluation of the event became more positive. This would suggest that responses to the possibility of a nuclear plant near one's home might be more positive if one knew there was to be a nuclear installation than if the matter were simply a hypothetical possibility. Accordingly, data were examined in two ways to see whether attitudes of residents in a specific area became more favorable toward the presence of a nuclear power plant after the announcement of the construction plans. In Table 3.14 responses are reported in three groups: respondents who were unaware that a nuclear plant was planned for their area, respondents who were aware of the site plans, and respondents who lived near an operating nuclear plant. The median favorable percentage for respondents unaware of the planned nuclear plant was 46.5%. The median for respondents who were aware of the plant proposal was 56.5%, and the median for respondents near operating nuclear plants was 57% favorable. Although these medians are in the hypothesized direction, a chi-square test based on the median of the total samples failed to find significant differences between samples taken before, during, and after construction of the nuclear plant.

A better test of the hypothesis would be to compare attitudes of the same residents toward the same site before, during, and after plant construction. Our survey compilation provides data for residents near two nuclear sites, responding to the same or similar questions at various stages of the site development. These provide a good means of assessing attitudinal changes toward the plant over time. Such changes among residents near the Matagorda, Texas, nuclear plant are graphically illustrated in Fig. 3.2. In March 1973, prior to announcement of the proposed site, 49% of the respondents indicated that they would approve the location of a nuclear plant in their area. Eighteen months later, after the community residents were aware that a plant was to be constructed in that area, 80% indicated approval. This high level of approval was also apparent as the plant was under construction two years later.

FIGURE 3.2

ATTITUDES OF MATAGORDA COUNTY RESIDENTS TOWARD MATAGORDA, TEXAS, NUCLEAR PLANT

NOTE: Date from Central (Matagorda 73/3, 74/9, and 76/5).

^aPrior to announcement of proposed site. "If someone proposed to build a large electric power plant to produce electricity from atomic energy in this area, would you favor or oppose such a plant?" (The same question regarding a coal or oil plant was also asked.)

^bProposed nuclear site had been announced; 90% of citizens were aware of it. "Do you favor or oppose the construction of a nuclear power plant in this county?"

^c"As you probably know, a nuclear generating plant is being built in this county. Do you favor or oppose the construction of this nuclear power plant?"

Similar data for residents near the Trojan Nuclear Power Plant are shown in Fig. 3.3. In this case, at the time of first assessment, residents were aware that the Trojan plant was planned. The increase in approval during Trojan construction was not as dramatic as at Matagorda. Similar, but smaller, increases in approval of the Trojan plant were found in samples of the total population of the state of Oregon. These are shown in Fig. 3.4. For all three respondent groups, large increases in favorability occurred.

We have repeated samples from residents near other nuclear power sites: Fulton, Hartsville, Indian Point, Morris, Pilgrim, and San Onofre. In none of these are there preawareness or preproposal data. Unfortunately, many of these samples were small, resulting in high measurement error terms. None of the differences observed over time in these locations is statistically significant. Thus, these survey data provide only partial support for the suggested increase in favorability toward a nuclear plant nearby as the plant moves from a possibility to a reality. For all the sites surveyed, two locations showed significant increases in support and six did not. In none was a significant decrease in support observed. Only at Indian Point have substantial changes in opposition been noted. The 1955 and 1960 studies showed opposition levels of 5% and 7% respectively, whereas by 1975 and 1976, levels of opposition had risen to 30% and 34%. However, the question used in the more recent years was quite different from the earlier question (see questions in Table 3.15).

Any interpretation of favorable responses to the construction of a nuclear plant in an area should take into consideration several factors. First, nuclear plants are not randomly assigned to locations. A plant is unlikely to be located where strong opposition is anticipated. Second, the announcement of a proposed plant is usually accompanied by considerable educational and public relations activity, which may be expected to enhance the plant's acceptance. Third, assessment of attitudes toward the plant after construction or after operation has begun probably will include respondents who have moved into the area because of employment opportunities. (In two surveys, researchers avoided this bias by

FIGURE 3.3

ATTITUDES OF COLUMBIA COUNTY RESIDENTS TOWARD TROJAN NUCLEAR POWER PLANT

NOTE: Data from Bardsley (OR 75/7).

^a"Would you favor or oppose having an atomic power plant built in your general area?" (76% knew there were plans to build an atomic power plant; 60% knew it was to be located in Columbia County.)

^b"Generally, do you approve or disapprove of the Trojan Nuclear Plant?"

^cAt the time this question was asked, the plant was nearly complete and respondents were reminded that it would begin operation in about six months. The question was the same as in previous survey.

FIGURE 3.4

ATTITUDES OF OREGON RESIDENTS TOWARD TROJAN NUCLEAR PLANT

NOTE: "Generally, do you approve or disapprove of the Trojan Nuclear Power Plant?" Data from Bardsley (OR 75/7).

sampling only residents who had lived in the area a specified length of time.) Similarly, any persons reluctant enough about nuclear power to move out of the area would not be represented in postconstruction surveys. All of these factors may partially account for the survey results, which indicate that attitudes toward a nuclear power plant in a specific area tend to be more favorable after the plant is constructed than before.

3.1.6 Analysis of Attitudes toward Nuclear Power over Time

3.1.6.1 Analysis of stability and change in response levels.

Attempts to assess changes in attitudes over time from survey data are fraught with difficulties. First, when wordings of the questions differ from survey to survey and/or from time to time, it is impossible to know how much of the observed variations can be attributed to question variations and how much to attitudinal changes. Second, differences in sampling and interview procedures among time intervals or among research organizations may result in different reported levels of support or opposition. The data available for this analysis involve both of these problems. Samples taken in the same time periods by different research organizations showed relatively stable differences in response levels, even when the questions were quite similar. For example, Harris and Cambridge data regarding the Type 3 question were consistently different (see Section 3.1.2.3 for discussion). When the questions were dissimilar, as in the Roper (76/6) and Gallup (76/6) questions regarding the construction of nuclear power plants to alleviate energy shortages, an enormous difference in support levels occurred (see Section 3.1.2.4).

In addition to these factors, responses to survey questions may reflect very temporary fluctuations in attitudes influenced by the current sociopolitical context (e.g., publicized reactor shutdowns, national policy statements, sit-in demonstrations).

The best data for assessing the stability or change in attitudes over time are obtained from identical questions posed to a sample of the

same population by the same research organization, with measurements at the same time intervals. This sort of trend data is available for a number of general pro-con questions as well as for questions regarding the location of a nuclear plant in the respondent's community. Responses over time to the various questions will be considered, after which the time data will be summarized, and conclusions and interpretations of these will be presented.

The Becker data (see Fig. 3.5) indicate a slight increase in support for nuclear power in general between 1973 and 1974, and some fluctuation in support for a nuclear plant nearby over a six-year period, from 1969 to 1974 (see Table 3.9). There was slightly more support for locating a plant nearby in the three more recent years than in the three earlier ones. The ORC studies from December 1974 to May 1975 show a consistent decrease in favorable nuclear feelings (Type 1 question) and a decrease in support for a nuclear plant nearby. Opposition levels fluctuated over the three time intervals.

The Cambridge data (see Fig. 3.6), collected at quarterly intervals from late 1974 through 1976, indicate considerable fluctuation in nuclear attitudes, which--according to Cambridge researchers--were much more volatile than most attitudes assessed by the organization. They attributed the fluctuation to a lack of knowledge about nuclear power among the general population. They suggested that this lack of knowledge makes the public particularly responsive to news releases, public events, or other attitudinal influences. There was no clear upward or downward trend across time for support levels: both recent and early samples yielded support levels above and below the Cambridge median of 52%.

The Harris (75/4) and (76/7) data include responses to four different questions: Type 3, questions about building nuclear plants; Type 4, questions about nuclear plants and energy needs; and two questions about nuclear plants nearby (see Table 3.13). In addition, these recent reports include data collected in 1973 and 1974 on the Type 4 question (see Table 3.7, in which these data are reported). Between 1975 and 1976, levels of support declined and levels of opposition increased for

FIGURE 3.5

GENERAL OPINION TOWARD NUCLEAR POWER
(Type 1 Question)

NOTE: "What is your general opinion of nuclear power?" (Becker)
"...how do you feel toward nuclear power plants in general...?"
(ORC).

FIGURE 3.6

SHALL WE BUILD NUCLEAR POWER PLANTS?
(Type 3 Question)

NOTE: "Do you generally favor or oppose the construction of more nuclear power plants?" (Cambridge) "In general, do you favor or oppose the building of more nuclear power plants in the U.S.?" (Harris)

all four questions. The data for 1973 and 1974 indicate earlier fluctuations in both support and opposition, with opposition showing a continuous increase since 1974.

The Roper data (Type 4 question) include four annual samples, from 1973 to 1976, and indicate a continuous decline in support during this period (see Fig. 3.7). Data regarding opposition for the 1973 and 1974 samples were not available to us, but the opposition increased slightly (from 27% to 31%) between 1975 and 1976.

Responses to a Roper question, not classified with the other pro-con questions, but relevant to continuation of nuclear power research, indicated stable support across two time intervals, August 1974 and August 1976. The question listed a number of technological developments over the past 20 years, and requested respondents to indicate whether they wished each to continue, whether it had gone far enough now, or whether development had already gone too far. One of the items was "Nuclear power for peaceful purposes." In both samples, 70% favored continued development of nuclear power.

Time interval data are also available from studies in five different states. In Oregon, data regarding building a nuclear plant nearby from five different samples between 1968 and 1975 indicate fluctuation in support levels, with the recent 1975 study much higher than previous levels (see Table 3.10). Successive support levels were 49%, 43%, 45%, 46%, and 58%. This survey focused on responses to an upcoming local vote regarding suspension of the Trojan Nuclear Power Plant and on an anticipated nuclear initiative, which appeared on the state ballot in 1976. These factors may have contributed to the increased level of support and decreased DK responses indicated. In the same survey (Bardsley, OR 75/7), responses to the Type 3 question indicated greater favorability than they had in a survey taken just four months earlier (Bardsley, OR 75/3), in which the percentage supporting nuclear construction was the same as it had been in 1971 (see Table 3.3). Oregon studies prior and subsequent to the initiative vote in November 1976

FIGURE 3.7

TO MEET ENERGY NEEDS, SHALL WE BUILD NUCLEAR PLANTS?
(Type 4 Question)

NOTE: Should we "Speed up the building of new nuclear power plants?" (Harris) Should we "Go into a greatly expanded program to develop atomic energy?" (Roper)

^a Data for percentage opposed in 1973 and 1974 were not given in the Roper studies released for this project.

showed quite consistent feelings about nuclear power (Type 1 question). Support levels were 61% and 64%, with opposition at 35% and 34% before and after the initiative vote respectively.

Data collected during the initiative campaign in California showed a significant ($p < .01$) increase of five percentage points (from 69% to 74%) between May and June in support of construction of nuclear plants to meet energy needs [Type 4 question (see Table 3.4)].

State data unrelated to voter propositions are available from Michigan, Missouri, and Wisconsin. In Michigan, there was a slight increase (from 68% to 71%) in pronuclear attitudes between December 1972 and May 1973, in response to the Type 4 question. Later survey data reported in Central (MI, WI 77/3) indicate stability of support for construction of a nuclear plant nearby at the relatively low levels of 27% and 29%; this is attributable partly to the presence of a "makes no difference" response option, which was chosen by 35% and 37% of respondents. The same Central survey reported similar low levels of support in Wisconsin, with no change over the two time periods.

Data from Missouri regarding use of nuclear power for electricity (Type 2 question) show consistent support levels of 49% and 52% over the three-year period, 1973 to 1975, with an increase in opposition from 10% in the first sample to 15% in the two later ones.

No analysis of nuclear attitudes over time would be complete without some consideration of the entire time period since the "discovery" of nuclear power--1945 to the present. In a review of survey data relevant to nuclear power attitudes (Erskine, 1963) a total of 186 nuclear attitude questions posed to the public in national polls were identified. Only seven of these questions were related to peacetime uses of atomic energy. Four questions are relevant to this analysis, as they provide data regarding nuclear power attitudes useful for comparison with the more recent data.

In September 1945, a NORC survey asked, "Some say splitting the atom will prove the greatest invention in 1,000 years. Do you agree or think they exaggerate?" A majority of 56% agreed, 25% disagreed, and 19% were undecided. In the same survey, respondents were asked, "In the long run, do you think people everywhere will be better off or worse off because somebody learned how to split the atom?" Over half thought people would be better off; 22% thought we would be worse off; 6% thought it would make no difference; and 20% did not know. One year later, this same question was repeated. The percentages who thought it would make no difference and who did not know remained the same. However, those who thought we would be better off decreased to 37% and those thinking we would be worse off increased to 38%. Two years later in 1948, an AIPO survey asked, "Will atomic energy do more good than harm?" A plurality of 42% thought it would do more good, 23% thought it would do more harm, and 35% did not know. By 1956 a more specific question about nuclear power was asked by AIPO: "Would you be afraid to have a plant located in this community which was run by atomic energy?" Most (69%) of the respondents expressed no fear, 20% were fearful, and 11% did not know.

Although only the latter question is similar to the pro-con nuclear questions from recent surveys, these data provide indications of the levels of support, opposition, and uncertainty about nuclear power from an earlier time period. In four of the five samples, a large plurality were favorable to nuclear power. The range of support was from 37% to 69%; the range of opposition, 20% to 38%; and the range of DK responses (including those indicating that it made no difference), 11% to 35%. These response distributions are very comparable to those presented in Section 3.1.2.6.

3.1.6.2 Summary of general nuclear attitudes over time. Altogether, there are 19 instances, including 11 from national samples, in which the same question was repeated over various time intervals. In seven of the national studies, a decrease in support over time was noted; in two no change was indicated; and in two an increase was obtained. In the eight

instances of repeated questions over time among state samples, four revealed increases in nuclear support and four showed no change in support levels.

In order to obtain a further indication of the degree to which nuclear power attitudes may be changing over time, the median levels of support and opposition from all the national and area samples for the general pro-con questions were computed. When responses above and below median support levels for 1976 were compared with those for all previous years, no significant difference was found. Similarly, a comparison of support for 1975 and 1976 with support levels of all previous years yielded no statistically significant difference. When comparisons were made using national data only, the difference between 1976 and all previous years and the difference between 1975 plus 1976 and all previous years were not statistically significant. Similarly, comparisons for levels of opposition indicated no significant changes during these time periods. Separate analyses have been done for the questions regarding a nuclear plant nearby. No significant differences in levels of support or opposition for recent versus earlier data were found on this question.

The evidence clearly indicates no particularly decisive trend of increase or decrease in nuclear support or opposition. Since there have been enormous changes in the use of energy, in awareness of nuclear power and nuclear power issues, in the development of nuclear technology, and in other aspects of society during these 30 years, the relatively stable basis of support and opposition to nuclear power over this time period is surprising. Perhaps this is attributable to the origin of pronuclear or antinuclear power attitudes in more basic values, which change very slowly. Another possibility is that over these years nuclear power has been salient for only a small percentage of the population. Most people have had very little direct experience with the nuclear power option or its effects upon their lives. Becker (73/6, 74/5) found that about 60% of the public had heard "only a little" or "nothing at all" about nuclear power plants. As the public becomes more aware of nuclear power generating operations, there may be greater changes in nuclear power attitudes.

3.2 Analysis of Responses by Demographic Groups

In order to ascertain which segments of the population were more supportive or more opposed to nuclear power, responses were analyzed according to the following demographic classifications: sex, age, educational level, income, occupation, size of community, and region of the country. The demographic analysis is limited by the amount of such data provided by the surveys. In some surveys, no demographic data were collected; in others, such data were collected but were not made available for this project. Some survey reports provided demographic classifications of responses for only a few items, or for only a few demographic categories. Therefore, some demographic analyses (e.g., sex) are more extensive, and lead to more confident conclusions than others (e.g., occupation). The discussion presented in this section is based on responses to the general nuclear questions. The demographic characteristics of those responding in various ways to specific aspects of nuclear power and to other related topics will be presented in Chapters 4 and 5 respectively.

3.2.1 Analysis by Sex

Sex differences in response to nuclear power questions were more clear-cut and consistent than those associated with any of the other demographic classifications. Male and female responses for the national probability samples are shown in Tables 3.16 and 3.17 for the general pro-con and nuclear plant nearby questions, respectively. Means of responses to the various questions and for the total body of surveys are also included in the tables. Although both male and female respondents favored nuclear power, males were much more supportive, somewhat more opposed, and much less uncertain than were females. This is true for all the general nuclear questions, across all time periods sampled.

Males and females appear to have responded similarly to the variations in question types. Both sexes were less supportive of constructing

TABLE 3.16

FAVORABILITY TOWARD NUCLEAR POWER BY SEX

Survey by Question Type	Males			Females		
	Pro	Con	DK	Pro	Con	DK
<u>Type 1 question: Feelings/</u> <u>opinions about nuclear power</u>						
Becker (73/6)	70%	12%	18%	53%	13%	34%
Becker (74/5)	73	15	12	54	20	26
$\bar{X}$ for Becker	71.5	13.5	15.0	53.5	16.5	30.0
<u>Type 2 question: Use of</u> <u>nuclear power for electricity</u>						
Sindlinger (60/6)	74	5	21	54	6	40
<u>Type 3 question: Building more</u> <u>nuclear power plants</u>						
Cambridge (75/5)	57	29	15	34	40	26
Cambridge (75/8)	63	24	13	39	34	27
Cambridge (76/4)	60	26	14	34	42	25
Cambridge (76/7)	60	28	13	40	36	23
Cambridge (76/10)	59	28	13	38	35	27
Cambridge (76/12)	63	24	13	42	31	26
$\bar{X}$ for Cambridge	60.3	26.5	13.5	37.8	36.3	25.7
Harris (75/4)	63	16	11	54	21	25
Harris (76/7)	70	19	11	52	25	23
$\bar{X}$ for Harris	66.5	17.5	11.0	53.0	23.0	24.0
$\bar{X}$ for type 3 question	61.9	24.3	12.9	41.4	33.0	25.3
<u>Type 4 question: Building</u> <u>more nuclear power plants</u> <u>to meet energy needs</u>						
Gallup (76/6)	75	18	7	67	18	15
Roper (75/6)	63	25	12	45	30	25
Roper (76/6)	57	27	16	38	35	27
$\bar{X}$ for Roper	60.0	26.0	14.0	41.5	32.5	26.0
$\bar{X}$ for type 4 question	65.0	23.3	11.7	50.0	27.6	22.3
$\bar{X}$ for all 14 samples	64.8	21.0	13.5	46.0	27.6	25.6

TABLE 3.17
FAVORABILITY TOWARD A NUCLEAR PLANT NEARBY BY SEX

Survey	Males			Females		
	Pro	Con	DK	Pro	Con	DK
Becker (73/6) ^a	64%	18%	18%	46%	24%	--
Becker (74/5) ^a	66	22	12	46	33	21%
Gallup (76/6) ^b	50	39	11	35	51	14
Harris (75/4) ^c	66	21	13	43	27	30
Harris (76/7) ^c	58	29	13	41	33	26
Sindlinger (60/6) ^d	70	15	15	48	25	27
$\bar{X}$ for above	62.3	24.0	13.7	43.2	32.2	24.5
Sindlinger (60/6) ^e	78	--	--	57	--	--

^aQuestion asked attitude toward a nuclear plant located "in this general area."

^bQuestion asked attitude toward a nuclear plant located "within 5 miles of here."

^cQuestion asked attitude toward nuclear power as main energy source for community.

^dQuestion asked attitude toward a nuclear plant "in your city."

^eQuestion asked attitude toward receiving household electricity from an atomic power plant.

nuclear power plants than they were of using nuclear power for electricity, and both sexes were more supportive of construction of nuclear power plants in general than of constructing them in their own communities.

Of the respondents who indicated uncertainty (DK), approximately two out of three were females. Similar sex differences in uncertainty have been noted by other researchers. For example, Kestenbaum and Hammersla (1976) found that females indicated significantly less certainty than did males about their perception of an assessment instrument, even though they were significantly more knowledgeable than the males. Therefore, the question arises whether the sex differences in proportion responding "don't know" simply reflect cultural norms regarding the expression of uncertainty, or whether they reflect sex differences specific to nuclear attitudes.

A comparison of proportions of males and females responding in the "don't know" category to the various options for meeting the energy shortage (Roper 75/6) indicates that for the questions regarding off-shore oil exploration, strip mining, taxes on large cars, and building enough power plants, as well as for the nuclear option, the female/male proportion varied little from a 2:1 ratio. On questions in which women may be expected to have as much knowledge and experience as males, such as turning off air conditioners and keeping home heat at 68°F, the percentage of women selecting a "don't know" response was similar to that of men.

The lesser support for nuclear power among females is more than an artifact of elevated "don't know" response rates for technologies with which women have had little experience, however. In order to compare the relative degree of support versus opposition for males and females, the ratios of those favoring versus those opposing nuclear power have been computed for both sexes. These ratios are given in Table 3.18.

It is clear that, among persons who do have opinions about nuclear power, the proportion of women supporting versus opposing nuclear power is much less than the male ratio of support versus opposition. Value

TABLE 3.18

RATIO OF PERCENTAGE ENDORISING TO PERCENTAGE OPPOSING
NUCLEAR POWER FOR MALES AND FEMALES

<u>Survey by Question Type</u>	<u>Males</u>	<u>Females</u>
<u>Type 1 question, nuclear feelings</u>		
Becker (73/6)	5.83	4.08
Becker (74/5)	4.87	2.70
<u>Type 2 question, nuclear use</u>		
Sindlinger (60/6)	14.80	9.00
<u>Type 3 question, building nuclear plants</u>		
Cambridge (75/5)	1.97	0.85
Cambridge (75/8)	2.63	1.15
Cambridge (76/4)	2.22	0.81
Cambridge (76/7)	2.14	1.11
Cambridge (76/10)	2.11	1.09
Cambridge (76/12)	2.63	1.35
Harris (75/4)	3.94	2.57
Harris (76/7)	3.68	2.08
<u>Type 4 question, nuclear plants and energy needs</u>		
Gallup (76/6)	4.17	3.72
Roper (75/6)	2.52	1.50
Roper (76/6)	2.11	1.09
<u>Nuclear plant nearby question</u>		
Becker (73/6)	3.55	1.92
Becker (74/5)	3.00	1.39
Gallup (76/6)	1.28	0.69
Harris (75/4)	3.14	1.59
Harris (76/7)	2.00	1.24
Sindlinger (60/6)	4.66	1.92

differences between men and women may explain much of this difference in nuclear power attitudes. Rokeach (1973) found very significant differences between males and females in the relative rank among other values given to "a comfortable life." This difference may be related to differences in willingness to conserve energy and in perceptions of energy needs discussed in Chapter 5. Sex differences in health and safety concerns, discussed in Chapter 4, may further contribute to differences in levels of support for nuclear power in general.

Unfortunately, the sort of data that would enable one to draw confident conclusions regarding factors contributing to male/female differences in nuclear power attitudes are not available. Specific comparisons of males and females across various age, income, and educational groups, for example, would be useful. Seldom have survey researchers supplied such information, even when it was collected. Often, the data collected represent household, rather than respondents' income (e.g., Harris, 75/4, 76/7), and occupation of the head of the household rather than the respondent.

The Fischhoff (Eugene 1976) study, which sampled the League of Women Voters--a group usually above average in education and socio-economic status and composed primarily of women--provides some relevant information. When respondents in this study assessed the risk of 30 different items, they perceived nuclear power as the most risky and also rated the perceived benefits of nuclear power as comparatively low. One may conjecture that the findings would be different for a group of similarly educated and knowledgeable males on the basis of generally higher level of support for nuclear power among men.

3.2.2 Analysis by Age

Thirteen reports of national probability samples provide responses to the general pro-con nuclear questions by various age groups. In addition, six of these include age breakdowns for the nuclear plant

nearby question. Percentages endorsing, opposing, or indicating uncertainty about nuclear power from the various age groups are shown in Table 3.19 for the general questions and in Table 3.20 for the nuclear plant nearby question. The various age groups do not appear to have responded differentially to the two questions. Data from most of the surveys indicate a curvilinear relationship between age and support for nuclear power, with the strongest support appearing among middle-aged respondents. Opposition to nuclear power varied more across age groups than did support, decreasing rather consistently from younger to older groups.

Data from the oldest and youngest respondent groups in the Cambridge surveys are graphically presented in Fig. 3.8. These data indicate that respondents in the 18-25 year age group exceeded the "over 65" group in opposition to nuclear power by 5% to 17% in these seven surveys. Differences between the oldest and youngest groups in support for nuclear power ranged from 1-9%, with the oldest group being slightly less supportive in four of the seven surveys. The graph in Fig. 3.9 shows mean levels of support, opposition, and DK responses for the Cambridge surveys across six different age groups. The greatest disparity between support and opposition occurs in the middle-aged groups. Much of the difference between older and younger respondents is attributable to the greater frequency with which older respondents indicated that they "don't know." Data from most of the other researchers show age patterns similar to those found in these Cambridge studies.

Clearly, age differences are less consistently related to nuclear support or opposition than sex differences. It may be that the age differences which do appear in these data are attributable to differences in attitudes toward economic growth, environmental issues, and technology, all of which will be discussed in Chapter 5. Support for nuclear power appears strong across all ages. In 16 of the 19 survey questions for which age data are available, support exceeded opposition in every age classification, usually by a wide margin. One of the three exceptions was the Gallup (76/6) nuclear plant nearby question--the sole national survey question in this entire compilation for which opposition exceeded

TABLE 3.19
FAVORABILITY TOWARD NUCLEAR POWER BY AGE

Survey	Age											
	18-29			30-44			45-64			Over 65		
General opinion of nuclear power	P ^a	C ^a	DK	P ^a	C ^a	DK	P ^a	C ^a	DK	P ^a	C ^a	DK
Becker (73/6)	66%	13%	21%	65%	11%	24%	62%	13%	25%	55%	12%	33%
Shall we build nuclear power plants?	18-25			26-35			36-45			46-55		
	P	C	DK	P	C	DK	P	C	DK	P	C	DK
Cambridge (75/1) ^b	52%	36%	12%	52%	35%	12%	53%	27%	20%	60%	22%	18%
Cambridge (75/5)	40	42	18	45	39	16	44	35	22	42	33	25
Cambridge (75/8)	47	39	14	51	30	19	56	27	16	52	25	23
Cambridge (76/4)	47	39	15	42	41	17	55	27	19	52	29	20
Cambridge (76/7)	40	41	19	46	31	24	47	33	20	54	35	11
Cambridge (76/10)	47	38	16	48	31	21	46	33	21	52	30	18
Cambridge (76/12)	48	39	13	45	31	24	58	23	19	61	24	15
	18-29			39-49			Over 50					
	P	C	DK	P	C	DK	P	C	DK			
Harris (75/4)	64%	22%	14%	64%	20%	16%	63%	15%	22%			
Harris (76/7)	57	27	16	60	24	16	63	17	20			
To meet energy needs, shall we build nuclear plants?	18-29			30-49			Over 50					
	P	C	DK	P	C	DK	P	C	DK			
Gallup (76/6)	70%	22%	8%	74%	16%	10%	68%	17%	15%			
	18-29			30-44			45-59			Over 60		
	P	C	DK	P	C	DK	P	C	DK	P	C	DK
Roper (75/6)	53%	30%	16%	54%	29%	17%	56%	25%	19%	50%	24%	25%
Roper (76/6)	45	36	19	48	32	20	52	24	25	44	31	25

^aCombined categories.

^bData reported in Cambridge (75/5).

TABLE 3.20

FAVORABILITY TOWARD A NUCLEAR PLANT NEARBY
BY AGE

Survey	Percent Favoring Plant							
	18-29		30-44		45-64		Over 65	
	P	C	P	C	P	C	P	C
Becker (73/6) ^a	55%	23%	55%	22%	60%	20%	49%	17%
Becker (74/5) ^a	55	31	60	25	55	27	52	27
	Under 30		30-49		Over 50			
	P	C	P	C	P	C		
Gallup (76/6) ^b	35	55	49	40	42	43		
Harris (75/4) ^c	54	26	59	22	50	24		
Harris (76/7) ^c	45	36	50	30	52	27		
	Under 45		Over 45					
	P	C	P	C				
Sindlinger (60/6) ^d	71	--	67	--				

^aQuestion asked attitude toward a nuclear plant located "in this general area."

^bQuestion asked attitude toward a nuclear plant located "within 5 miles of here."

^cQuestion asked attitude toward nuclear power as "main energy source for community."

^dQuestion asked attitude toward receiving household electricity from an atomic power plant.

FIGURE 3.8

SUPPORT AND OPPOSITION TO NUCLEAR POWER
AMONG OLDEST AND YOUNGEST AGE GROUPS

NOTE: "Do you generally favor or oppose the construction of more nuclear power plants?" Data from Cambridge (75/5).

FIGURE 3.9
MEAN DATA OVER SEVEN CAMBRIDGE SURVEYS
BY AGE

NOTE: "Do you generally favor or oppose the construction of more nuclear power plants?" Data from Cambridge (75/1, 75/5, 75/8, 76/4, 76/7, 76/10, 76/12).

support. (This question is discussed in Section 3.1.3.1). The other exceptions were Cambridge studies (75/5, 76/7) in which the youngest of six age groups were slightly more opposed than supportive (see Table 3.19).

3.2.3 Analysis by Educational Level

Among respondents of various educational levels, consistently more support for nuclear power (see Table 3.21) and for a nuclear plant nearby (see Table 3.22) occurred among those who are better educated. This has been true since the advent of nuclear energy in the 1940s, when respondents to the question, "Will atomic energy do more good than harm?" indicated support at 61% from college-educated persons, 47% among high school educated persons, and only 31% among those with a grade school education (Erskine, 1963). All data for educational differences from early nuclear power questions show the same pattern.

The mean percentages of seven educational groups indicating support, opposition, and indecision about nuclear power in the Cambridge studies are shown in Fig. 3.10. With increasing education, there were consistent, substantial increases in the percentages supporting nuclear power and consistent decreases in percentages indicating uncertainty (don't know). The levels of opposition to nuclear power show little change across educational levels. The same general pattern is apparent in the Roper, Gallup, and Becker data. However, the Harris data indicate more opposition to nuclear power among better-educated groups (see Table 3.21). The discrepant findings in the Harris studies regarding opposition among the better-educated groups are not easily explained. They are not attributable to question differences, since comparable questions are reported in Cambridge (Type 3 question) and in Roper (Type 4 question).

TABLE 3.21
FAVORABILITY TOWARD NUCLEAR POWER
BY EDUCATION

Survey	Educational Level														
	Grade School			High School			Graduated High School			College			College Grd or More		
	P ^a	C ^a	DK	P ^a	C ^a	DK	P ^a	C ^a	DK	P ^a	C ^a	DK	P ^a	C ^a	DK
<u>General opinion of nuclear power</u>															
Becker (73/6)				49%	13%	38%	65%	12%	23%	74%	12%	14%			
Becker (74/5)	42%	21%	37%	52	20	28	69	16	15	76	16	8	81%	13%	6%
<u>Shall we build nuclear power plants?</u>															
				High School						College			College Grd or More		
				P	C	DK				P	C	DK	P	C	DK
Harris (75/4)				57%	15%	28%				66%	20%	14%	68%	23%	9%
Harris (76/7)				57	18	25				64	21	15	57	31	12
	Grade School			High School			Graduated High School			Technical/Vocational			College		
	P	C	DK	P	C	DK	P	C	DK	P	C	DK	P	C	DK
Cambridge (75/1)	47%	31%	22%	46%	31%	22%	54%	30%	16%	58%	27%	15%	58%	30%	12%
Cambridge (75/5)	38	25	38	37	34	29	42	36	22	53	32	15	49	38	13
Cambridge (75/8)	47	20	33	43	28	29	51	29	20	60	26	14	54	32	14
Cambridge (76/4)	36	33	32	47	27	26	44	37	19	57	37	6	53	32	15
Cambridge (76/7)	43	26	31	41	32	27	50	33	17	52	38	10	53	32	15
Cambridge (76/10)	35	33	32	44	33	24	47	32	22	50	30	21	55	29	17
Cambridge (76/12)	42	24	34	52	21	27	48	30	22	51	29	20	56	34	10
<u>To meet energy needs shall we build nuclear plants?</u>															
	Grade School			High School						College					
	P	C	DK	P	C	DK				P	C	DK			
Gallup (76/6) ^b	59 ^a	20 ^a	21%	70 ^a	17 ^a	13%				78 ^a	19%	3%			
Harris (75/4) ^b	65	12	23	69	19	12				63	25	12			
Harris (76/7) ^b	60	14	26	64	21	15				59	30	11			
Roper (75/6)	38	29	32	52	28	20				63	26	11			
Roper (76/6)	39	23	38	47	32	21				51	33	16			

^a Combined categories.

^b Reported as "some high school or less," "high school graduate/some college," and "college graduate."

TABLE 3.22
FAVORABILITY TOWARD A NUCLEAR PLANT NEARBY
BY EDUCATION

Survey	Less than High School Graduate	High School Graduate	College
Becker (73/6) ^a	50%	55%	64%
Becker (74/5) ^a	48 ^b	58	61 ^b
Gallup (76/6) ^c	39	42	44
Harris (75/4) ^d	46	59	57
Harris (76/7) ^d	47	52	47
Sindlinger (60/6) ^e	41	53	71
Sindlinger (60/6) ^f	49	66	79

^aQuestion asked attitude toward a nuclear plant located
"in this general area."

^bEstimated by combining categories.

^cQuestion asked attitude toward a nuclear plant located
"within 5 miles of here."

^dQuestion asked attitude toward nuclear power as main
energy source for community.

^eQuestion asked attitude toward a nuclear plant located
"in your city."

^fQuestion asked attitude toward receiving household
electricity from an atomic power plant.

FIGURE 3.10

MEAN DATA OVER SEVEN CAMBRIDGE SURVEYS
BY EDUCATIONAL LEVEL

NOTE: "Do you generally favor or oppose the construction of more nuclear power plants?" Data from Cambridge (75/1, 75/5, 75/8, 76/4, 76/7, 76/10, 76/12).

Regarding changes in support from various educational levels over time, Harris (76/7) found an overall decline in nuclear power support from the preceding year, largely attributable to less support from the most highly educated group in the more recent study. Therefore, the data were examined to see whether similar decreases among better-educated respondents would be obtained by other researchers. Levels of support for the highest and lowest educational levels, in response to the various question types, are shown in Table 3.23. Comparisons may be made across two-year periods for Becker (73/6, 74/5), Harris (75/4, 76/7), Cambridge (averages of data collected in 1975 and 1976 respectively), and Roper (75/6, 76/6). For three Harris questions and one Roper question, there was less support among the best-educated group in the more recent data, and there was no parallel decline in support among the least-educated group. The Cambridge data for the same two-year period indicate no such differential changes among highly educated versus less-educated persons. Similarly, no such consistent pattern emerges from the Becker data for the 1973-74 time period. Therefore, conclusions about changes in support for nuclear power among specific educational levels cannot be drawn.

The differences between levels of support and opposition to nuclear power found by various researchers are quite evident in these educational tabulations. Some of this difference may be attributable to different educational categories used by the various researchers. For example, Roper recorded data from respondents in three categories; Harris recorded in six categories and then combined them into three. The three divisions used by Roper and Harris are not completely congruent. Thus, conclusions regarding variations among respondents at various educational levels must be in general terms (of more versus less education), rather than specific terms, regarding grade school versus high school or college education. Clearly, however, the data indicate greater favorability toward nuclear power among better educated persons.

TABLE 3.23

PERCENT FAVORING NUCLEAR POWER WITH HIGH AND LOW EDUCATION

Survey by Question Type	Total Population	Highest Educational Level	Lowest Educational Level
<u>Type 1, nuclear feeling question</u>			
Becker (73/6)	61%	74%	49%
Becker (74/5)	64	81	42
<u>Type 3, building nuclear plants question</u>			
Harris (75/4)	63	68	57
Harris (76/7)	61	57	57
Cambridge (75) ^a	48	58 ^b	43 ^b
Cambridge (76) ^c	49	56 ^b	43 ^b
<u>Type 4, nuclear plants and energy needs question</u>			
Harris (75/4)	67	63	65
Harris (76/7)	62	59	60
Roper (75/6)	53	63	38
Roper (76/6)	47	51	39
<u>Nuclear plant nearby question</u>			
Becker (73/6)	56	64	50
Becker (74/5)	55	61	48
Harris (75/4)	55	57	46
Harris (76/7)	51	47	47

^a Average of three surveys in 1975.

^b Combined groups so that categories are comparable to educational groups reported by other research organizations.

^c Average of three surveys in 1976.

TABLE 3.24

FAVORABILITY TOWARD NUCLEAR POWER
BY INCOME

Survey	Income Level (in thousands of dollars)																							
Shall we build nuclear power plants?	Under \$4			\$4-7			\$7-10			\$10-13			\$13-15			\$15-20			\$20-25			Over \$25		
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
Cambridge (75/1)	47%	34%	19%	48%	32%	20%	51%	30%	19%	53%	34%	13%	57%	32%	11%	59%	27%	14%	64%	25%	11%	65%	24%	11%
Cambridge (75/5)	35	31	35	37	38	25	38	38	24	48	32	20	50	30	20	50	35	15	52	38	10	53	34	14
Cambridge (75/8)	41	28	31	46	29	25	50	29	21	51	30	19	58	30	12	59	26	15	58	27	15	56	32	12
Cambridge (76/4)	37	30	34	42	34	24	41	37	21	52	35	13	45	35	20	53	35	11	50	35	15	63	26	11
Cambridge (76/7)	35	34	31	41	35	24	45	38	18	49	30	21	52	30	18	59	27	14	56	33	11	61	33	6
Cambridge (76/10)	28	37	36	42	36	23	45	35	20	49	30	21	54	23	23	50	32	18	62	26	12	58	31	11
Cambridge (76/12)	31	21	48	47	26	27	47	37	16	56	29	15	46	38	16	59	30	11	60	25	15	67	23	10
	Under \$5			\$5-10			\$10-15			Over \$15														
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK												
Harris (75/4)	52%	20%	28%	61%	17%	22%	64%	20%	16%	71%	19%	10%												
Harris (76/7)	53	22	25	57	25	18	63	24	13	68	19	13												
To meet energy needs, shall we build nuclear plants?	Under \$3			\$3-5			\$5-7			\$7-10			\$10-15			\$15-20			Over \$20					
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK			
Gallup (76/6)	49% ^a	20% ^a	31%	53% ^a	24% ^a	18%	64% ^a	21% ^a	15%	67% ^a	19% ^a	14%	73% ^a	15% ^a	12%	76% ^a	19% ^a	5%	81% ^a	15% ^a	4%			
	Under \$6			\$6-12			\$12-18			Over \$18														
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK												
Roper (75/6)	39%	32%	29%	52%	26%	22%	61%	25%	14%	59%	28%	13%												
Roper (76/6)	41	24	34	43	33	24	50	33	17	55	30	15												

^a Combined categories.

3.2.4 Analysis by Income

Because of the relationship between education, income, and occupation, it is not surprising that similar relationships should be found between these variables and support for nuclear power. Thirteen of the national probability samples provide data for respondents by income level for the general pro-con questions and three provide income data for responses to the nuclear plant nearby questions. These data are given in Tables 3.24 and 3.25 for general and nearby questions respectively. Without exception, the higher income groups were more favorable toward nuclear power. The differences in proportion of high and low income groups in favorability were considerable. Among the highest income groups, respondents favoring nuclear power ranged from 45% to 81%, with a median of 61%. Among the lowest income groups, the range of support was from 28% to 53%, with a median of 39%.

TABLE 3.25

FAVORABILITY TOWARD A NUCLEAR PLANT NEARBY BY INCOME

Survey	Income Level (in thousands of dollars)											
	Under \$5			\$5-10			\$10-15			Over \$15		
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
Gallup (76/6) ^a	36% ^b	37% ^b	27% ^b	41% ^b	45% ^b	14% ^b	47%	41%	12%	46% ^b	48% ^b	6% ^b
Harris (75/4) ^c	35	28	37	52	24	24	57	23	20	64	23	13
Harris (76/7) ^c	41	33	26	47	32	21	50	33	17	58	27	15

^a Question asked attitude toward a nuclear plant located "within 5 miles of here."

^b Estimated by combining categories.

^c Question asked attitude toward nuclear power as main energy source for community.

The differences are largely accounted for by a decrease in uncertainty from the lowest to the highest income groups, with median uncertainty at 31% for the lowest income category and at 12% for the highest income group. As in the data for educational levels, the opposition to nuclear power varied less over income levels than did the favorability and indecision (see Fig. 3.11). The range of opposition was from 20% to 37% for the lowest income group, with a median of 29%; the range for the highest income group was from 15% to 34%, with a median of 27%. All the data available are from the two-year period, 1975-76. Across this time period, there was no clear trend for either upper or lower income groups to become more or less favorable toward nuclear power.

One hypothesis, which may explain the difference in nuclear support between low and high income groups, is that there is a difference between concern about economic growth and concern about the energy needs to support such growth. In addition, there may be a greater belief in and commitment to advanced technologies among higher income groups. See Chapter 5 for evidence regarding these relationships.

3.2.5 Analysis by Occupation

Data for various occupational groups are available for three general nuclear questions (see Table 3.26). These data are similar to the data for education and income levels in that the more prestigious the occupation, the more support for nuclear power and the less uncertainty about it. This is probably also a function of the fact that education, occupation, and income are closely correlated. Variations in opposition across occupational levels are minimal. Data collected by Sindlinger (60/6) also note the same trend. The differences between occupational groups appear to be much less than those observed among income groups; a possible explanation is the fact that income level is a more precise index of differences in socioeconomic status than is a raw occupational category (Blau and Duncan, 1967).

FIGURE 3.11
MEAN DATA OVER SEVEN CAMBRIDGE SURVEYS
BY INCOME

NOTE: "Do you generally favor or oppose the construction of more nuclear power plants?" Data from Cambridge (75/1, 75/5, 75/8, 76/4, 76/7, 76/10, 76/12).

TABLE 3.26

FAVORABILITY TOWARD NUCLEAR POWER
BY OCCUPATION

Survey	Occupation											
	Prof/business			White collar			Blue collar			Non-labor force		
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
<u>To meet energy needs shall we build nuclear plants?</u>												
Gallup (76/6)	80% ^a	16% ^a	4%	76% ^a	13% ^a	11%	73% ^a	16% ^a	11%	63% ^a	20% ^a	17%
Roper (75/6)	63	26	11	62	24	15	54	27	20			
Roper (76/6)	58	29	14	49	33	18	50	29	21			

^aCombined categories.

3.2.6 Analysis by Size of Community

Responses according to community size for 11 national probability samples of general pro-con questions and for four samples of questions about a nuclear plant nearby are given in Table 3.27. Differences according to residence in an urban, suburban, or rural area are less consistent than other demographic differences. Less support and more opposition from least-populated areas were evident in both Roper studies (Type 4 question). For the Cambridge studies (Type 3 questions), support was less and opposition greater for urban residents than for the other groups. This was also true for the same question in the Harris (76/7) sample, and represents a decline in urban support and an increase in urban opposition among Harris respondents from the previous year. For the nuclear plant nearby question, support was much greater in the suburbs than in the other groups in Harris (75/4), but the following year (Harris, 76/7), the suburban group did not differ greatly from the town or rural samples. In this more recent study, support from the city residents showed a large decline from 1975, and that group was less supportive and more opposed than any of the other groups. This parallels

TABLE 3.27
FAVORABILITY TOWARD NUCLEAR POWER
BY SIZE OF COMMUNITY

Survey by Question Type	Size of Community														
<u>General opinion of nuclear power</u> (Type 1 question)	Metro Central			Metro Suburb			250,000- 999,000			Under 250,000			Non-metro		
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
Becker (73/6)	62%	13%	25%	63%	13%	24%	67%	8%	25%	70%	14%	16%	55%	15%	30%
<u>Shall we build nuclear power plants?</u> (Type 3 question)	Urban			Suburban			Town			Rural					
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK			
Cambridge (75/5)	43%	36%	22%	48%	36%	16%				43%	32%	25%			
Cambridge (76/4)	44	38	18	49	35	16				49	26	25			
Cambridge (76/7)	46	34	20	55	33	12				52	29	19			
Cambridge (76/10)	48	32	20	48	32	20				49	28	23			
Cambridge (76/12)	51	29	20	53	27	20				55	25	20			
Harris (76/4)	64	21	15	65	18	17	63%	19%	18%	62	16	22			
Harris (76/7)	55	29	16	61	22	17	62	18	20	67	16	17			
<u>To meet energy needs, shall we build nuclear plants?</u> (Type 4 question)	Over 1 million			500,000 to 1 million			50,000 to 500,000			2,500 to 50,000			Under 2,500		
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
Gallup (76/6)	69%	19%	12%	69%	23%	8%	77%	14%	9%	70%	22%	8%	67%	17%	16%
	Large metropolitan			Over 150,000			35,000 to 150,000			Under 35,000					
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK			
Roper (75/6)	54%	28%	19%	56%	26%	18%	52%	24%	23%	43%	43%	14%			
Roper (76/6)	50	28	22	47	34	19	44	31	25	45	32	23			
<u>Do you approve a nuclear plant nearby?</u>	Metro Central			Metro Suburb			250,000- 999,000			Under 250,000			Non-metro		
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
Becker (73/6)	45%	26%	29%	49%	21%	30%	64%	15%	21%	66%	21%	13%	57%	21%	22%
Becker (74/5)							Metro-under 1 million								
	46	41	13	58	27	15	Pro	Con	DK	62	24	14	55	23	22
	Urban			Suburban			Town			Rural					
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK			
Harris (75/4)	53%	26%	21%	60%	24%	16%	51%	26%	23%	50%	22%	28%			
Harris (76/7)	45	35	20	51	28	21	54	31	15	51	27	22			

the change in urban support found in this same survey sample for the Type 3 question. These data lead to the conclusion that the size of the community in which respondents live is not an important or primary determinant of their nuclear power attitudes.

3.2.7 Analysis by Region

Responses to nuclear questions by regions are shown in Table 3.28 for general questions and in Table 3.29 for questions regarding the location of a nuclear plant nearby. Regional responses are available for 17 samples asking the general questions and for seven samples asking questions about a nuclear plant nearby. The different geographic divisions used by the various research organizations make interpretation difficult. Gallup, Harris, Roper, and Sindlinger used four regional divisions which are approximately the same. Becker used five regional divisions; Cambridge used six. (Three maps are presented in Fig. 3.12 to indicate the areas designated in these studies.) Of special interest is the fact that all of the region designated by Cambridge as Pacific, as well as most of the region designated by Cambridge as Central, is included in the West designation used by the other research organizations.

When regional variations in support, opposition, and uncertainty regarding nuclear power are examined, it becomes apparent that the variation from region to region is not great. In the Harris (76/7) study for the Type 4 question, there is only a 3% difference in the percentage supporting nuclear power between the least versus the most supportive areas. The maximum difference among regions in support levels is observed for the Sindlinger (60/6) question about receiving household electricity from atomic power. Regional differences in opposition to nuclear power range from 3% to 20%, with a median difference of 9.5%. Somewhat greater differences in uncertainty are apparent, with a range of 3% to 26% differences in the DK categories, and a median difference in uncertainty of 11.8% among regions.

TABLE 3.28
FAVORABILITY TOWARD NUCLEAR POWER
BY REGION

Survey	Region														
	Northeast			Southeast			North Central			Southwest			West		
General opinion of nuclear power	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
Becker (73/6)	58%	14%	28%	52%	14%	34%	65%	12%	23%	55%	9%	36%	80%	10%	10%
Becker (74/5)	62	19	19	60	11	29	63	20	17	66	19	15	69	18	13
Shall we use nuclear power for electricity?	East			Midwest			South			West					
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK			
Sindlinger (60/6)	61%	5%	37% ^a				63%	7%	30% ^a	57%	7%	37% ^a	76%	4%	21% ^a
Shall we build nuclear power plants?	East			Midwest			South			West					
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK			
Harris (75/4)	58%	23%	19%				65%	18%	17%	64%	15%	21%	68%	18%	14%
Harris (76/7)	54	29	17				62	19	19	65	14	21	65	25	10
	Northeast			Industrial			Midlands			South			Central		
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK
Cambridge (75/1)	51%	28%	21%	56%	29%	15%	52%	33%	15%	51%	31%	18%	63%	24%	13%
Cambridge (75/5)	39	40	21	48	30	22	32	48	20	45	27	28	53	33	15
Cambridge (75/8)	46	33	21	53	29	18	48	30	22	49	29	22	59	28	13
Cambridge (76/4)	42	42	17	43	40	18	50	34	16	49	22	29	52	29	18
Cambridge (76/7)	50	38	12	43	32	25	47	36	17	51	29	20	57	27	16
Cambridge (76/10)	42	30	28	45	33	22	47	38	16	51	26	23	56	24	20
Cambridge (76/12)	54	27	20	46	30	24	51	34	15	53	23	25	57	25	18
To meet energy needs, shall we build nuclear plants?	East			Midwest			South			West					
	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK	Pro	Con	DK			
Gallup (76/6)	70%	19%	11%				75%	17%	8%	70%	15%	15%	68%	23%	9%
Harris (75/4)	65	21	14				66	17	17	70	11	19	64	22	14
Harris (76/7)	60	24	16				63	20	17	62	15	23	62	27	11
Roper (75/6)	53	26	27				53	32	15	51	25	24	60	26	13
Roper (76/6)	41	34	25				49	29	22	47	28	25	53	37	10

^a Combined categories.

TABLE 3.29
FAVORABILITY TOWARD A NUCLEAR PLANT NEARBY
BY REGIONS

Survey	Region									
	Northeast		Southeast		North Central		Southwest		West	
	Pro	Con	Pro	Con	Pro	Con	Pro	Con	Pro	Con
Becker (73/6) ^a	50%	22%	56%	18%	54%	21%	55%	16%	66%	24%
Becker (74/5) ^a	52	29	59	20	52	32	61	25	61	26
	East		Midwest		South		West			
	Pro	Con	Pro	Con	Pro	Con	Pro	Con		
Gallup (76/6) ^b	36	52	45	44	45	37	42	51		
Harris (75/4) ^c	49	30	57	25	53	19	56	23		
Harris (76/7) ^c	45	35	50	29	48	27	56	31		
Sindlinger (60/6) ^d	56	22	64	17	51	21	65	18		
Sindlinger (60/6) ^e	66	10	71	8	58	14	80	4		

^a Question asked attitude toward a nuclear plant located "in this general area."

^b Question asked attitude toward a nuclear plant located "within 5 miles of here."

^c Question asked attitude toward nuclear power as main energy source for community.

^d Question asked attitude toward a nuclear plant located "in your city."

^e Question asked attitude toward receiving household electricity from an atomic power plant.

FIGURE 3.12

REGIONAL DIVISIONS FOR THREE SURVEY ORGANIZATIONS

Despite the small regional variations, the findings quite consistently identify the West as the most supportive region of the country (taking into consideration that the Cambridge Central is the same as the West in other areas). Also, there is a clear tendency for the East and/or the Northeast to be least supportive. The most opposition often comes from the East and/or the Southeast or South, and, somewhat surprisingly, from the West. Because of the especially low levels of DK responses in the West, that area sometimes shows both the most support and the most opposition, especially regarding the Type 4 question on which Westerners have apparently become more polarized than have residents in other portions of the country. An examination of responses to other nonnuclear related questions indicates that the tendency for Westerners to be less unsure is not limited to nuclear power attitudes. This is partially explained by the higher educational levels attained by residents in the Pacific and Mountain states (1970 census data). It is also possible that social norms in the West are more conducive to attitudinal involvement as opposed to a tendency for those in other areas to give noncommittal or unconcerned responses, though we have no specific data relevant to this suggestion. Early data from the Sindlinger (60/6) study indicate that Westerners were more knowledgeable about nuclear power installations and about companies doing nuclear energy research than were those in any other section of the country. These differences held for both males and females in the West.

It is possible that the degree of opposition or support for nuclear power may be related to the amount of experience with energy from nuclear power. At present, the concentration of operating and proposed nuclear power plants is in the East/Northeast/North Central regions of the country. The West (or Central Cambridge region) has very few plants on-line or under development. Perhaps the low support and higher opposition levels found in the East/Northeast have resulted from crystallization of opposition accompanying nuclear plant experience. This, however, is not consistent with findings reported earlier in this analysis that persons in the vicinity of nuclear power plants tend to be more supportive and less opposed to nuclear power. This apparent inconsistency of research findings may be accounted for, however, if one considers that

the benefits of a nuclear plant in the vicinity (e.g., tax contributions to the local government, increased influx of industry, and the attendant job opportunities) are limited to those in very close proximity to the plant, whereas other aspects of the plant operation (e.g., attendant publicity, reallocation of land usage, increased highway crowding) may be more widely felt and more heavily publicized throughout the areas. In the assessment of nuclear plant neighbors, only those in the immediate vicinity were usually included.

So far, experience with nuclear power plants has been quite limited. Over 60 nuclear power plants are currently in commercial operation; however, only nine of these were on-line in the 1960s. Of those nine, three were located in the West (two in California and one in Washington), two in Midwestern states (Illinois and Michigan), and four in the East (one each in Connecticut, Massachusetts, New Jersey, and New York). Therefore, no region of the country has had extensive long-term experience with nuclear power plants, and attitudinal changes attendant thereto are yet to be observed.

There may be other explanations for the apparently higher acceptance of nuclear power in the West versus the apparently higher opposition in the East. For example, the population density and industrial activity in the East, which have fostered the concentration of planned installations in that area, may also contribute to greater negative impacts accompanying such installations. Conversely, the acceptance of nuclear power in the West may be in some ways dependent upon the availability of open land for such installations. These suggestions are speculative. The survey data provide no evidence with which to evaluate such speculations.

Comparisons of responses across question types must be very tentative because of variations in quantity and quality of the data on the various questions, (e.g., the data for Type 1 and Type 2 questions are from 1960, 1973, and 1974, whereas data for Type 3 and Type 4 questions are from 1975 and 1976). Nevertheless, it is noteworthy that regional differences appear more clearly for some questions than for others. The

West, for example, is most supportive, relative to other areas, for question Types 1, 2, and 3, and for the nuclear plant nearby questions. Western response patterns for the Type 4 question, in which nuclear plant construction is tied to energy needs, are less clearcut. This suggests the possibility that the support for nuclear energy in the West is related more to knowledge about nuclear power or to other factors than to perception of energy needs and primacy of importance of energy needs. Also, it appears that the East is clearly the least supportive area for the Type 3 question, but the South and Southeast appear to be least supportive of the Type 1 and Type 2 questions. Regional differences in attitudes toward energy needs, alternative power sources, and related topics are discussed in Chapter 5.

Since regional differences are not great, and since nuclear power plants are becoming more widely dispersed throughout the country, these survey findings tend to support an expectation that major regional differences in acceptance or rejection of nuclear power in the future are unlikely.

3.3 Interpretation of Responses

3.3.1 Interpretation of Unsure (DK) Responses

Throughout this discussion, attention has been drawn to the often sizable percentages falling into the DK category, variously labeled by researchers as "don't know," "no opinion," "uncertain," "it makes no difference," or a combination of these. Since the percentages in this category are often as large as the percentage opposed, and may represent from one-third to one-half of the sample, it is of considerable interest to know who comprises the category and what a "DK" response indicates.

Several hypotheses about such responses will be considered. First, these respondents may be apathetic, uncommunicative, and/or

uncooperative with interviewers. Perhaps they shrug off questions with a "can't answer" or "don't know" response rather than giving serious consideration. If this accounted for most of the DK category, one would expect the DK percentages to be relatively stable from one nuclear question to another and from one topic to another. This hypothesis is not supported by the DK data in the surveys. Percentages of DK responses to nuclear questions vary across survey samples from a low of 2% (Bardsley, OR 76/12) to a high of 41% (Navarro MO 75). These percentages are even higher for the studies with a "makes no difference" option. When the DK response to various questions in any one survey are examined, one also finds considerable variation. For example, DK responses to the nine options for solving the energy shortage presented to respondents in Harris (76/7) ranged from 9% to 27%, with a median of 15%. Thus, the evidence indicates that DK responses are not simply alienation/won't answer responses.

Otis Dudley Duncan (1977) in a discussion of the Harris data, suggested that a DK response may represent a reluctance to endorse the pro-nuclear position or latent opposition to nuclear power. Wheeler's analysis of election polls (1976) would support this conclusion. Wheeler cited numerous instances in which a minority candidate received a significantly higher percentage of votes than was indicated in preelection polls. He suggested that, whenever a high percentage of undecided opinions is recorded, a significant percentage of these may be from persons leaning toward the less-popular candidate who are reluctant to openly support him/her. Since the pronuclear position is clearly more popular than an antinuclear stance, perhaps the undecided respondents include many leaning in an anti-nuclear direction.

In our survey data, the groups contributing most to the DK responses are females, those with lower levels of education, those over 60, those with lower incomes, blue collar workers, and persons living in the South or Northeast. It is noteworthy that some of these groups--especially females and persons in the Northeast--are from demographic groups that tend to be more opposed to nuclear power.

Contrary to Duncan's conjecture that DK respondents tend to be anti-nuclear, this analysis of survey data shows some evidence that DK responses are more likely to represent latent pronuclear attitudes. For example, Fig. 3.10, showing pro, con, and DK responses from various educational levels, indicates little change in opposition, but a consistent increase in support accompanying a decrease in DK from one educational level to another. Similarly, variations across income levels (see Fig. 3.11) and regions (see Table 3.28) show a tendency for DK and pronuclear responses to vary inversely; a similar inverse relationship between DK and opposition is observed less frequently and to a lesser degree. However, this would be expected from the relative proportions of the population that hold pronuclear and antinuclear attitudes. That is, with the general population divided two to one in favor of nuclear power (a rough generalization from the survey findings), as those without opinions decide one way or the other, it is to be expected that they would do so in approximately the same proportion, i.e., two to one becoming pronuclear. This interpretation is consistent with the overall relationship between a decrease in DK and an increase in pro-con categories observed in the surveys.

A final hypothesis about respondents in the DK category is that they are truly without nuclear opinions. Considerable evidence suggests that much of the public knows little about nuclear power, and that many do not care one way or another. When a "makes no difference" option is offered to respondents, about 30% select it, and an additional 15% to 22% indicate no opinion.

In two national samples, Becker (73/6, 74/5) asked "How much have you heard, read, or seen about the use of nuclear power for electricity?" In 1973, 16% of respondents said they had heard nothing at all and another 48% claimed to have heard "only a little." Only 10% said they had heard a great deal. In 1976, 60% said they had heard "only a little" or "nothing." In ORC (76/4), respondents were asked, "Are there any existing nuclear power plants in the state where you live?" Of those who live in states with nuclear plants, 23% said there was no plant, and 28% did not know. Becker (73/6) asked a similar question and found that

32% did not know. Of respondents who said there was a nuclear plant within 100 miles, 73% either could not identify the plant or incorrectly identified it.

Area studies confirm these results. Forty-five percent of respondents in Louisiana and Texas (Central LA, TX 73/4) said they could recall hearing nothing about the use of atomic energy for electricity. During a nuclear initiative campaign in Washington, 48% of respondents to the same question said they had seen or heard only a little or nothing at all about nuclear power generating plants (Bardsley, WA 76/8). Residents of Tulsa were asked about the planned nuclear plant (Black Fox) to be built 25 miles east of the city. Although 59% knew of the plans to build the plant, 49% could not name even one advantage of nuclear power and 29% could name no disadvantages. Not surprisingly, in response to a question about approval/disapproval of the construction of the plant, 44% said that "it makes no difference," and another 9% had no opinion.

Disinterest and lack of information about nuclear power has apparently been prevalent from the beginning. Based on a 1950-51 survey no longer available, Douvan and Withey (1954) reported that one-half of the sample felt indifferent when coming across references to nuclear power in reading; these respondents reported themselves "disinterested in further data about atomic energy." Douvan and Withey also noted a paucity of accurate information about atomic power, and reported that persons living near atomic installations were neither more knowledgeable nor more interested than a comparative group of citizens away from nuclear power plants.

All of the above leads to the conclusion that, for a sizable proportion of the population, the topic of nuclear power has not received serious consideration. These persons remain, therefore, truly without nuclear power opinions.

A further analysis of DK respondents is presented in Chapter 6, based on secondary analyses of data from the Harris (75/4, 76/7) studies.

3.3.2 Interpretation of Pro and Con Responses

Just as a DK response may indicate a truly neutral or undecided position, a reluctance to express one's true attitude, or weak leanings in either direction, so pro or con responses may represent various attitudinal positions. Such responses may express genuine relatively stable pro or con attitudes, they may express very temporary, weakly held pro or con attitudes, or they may be responses from undecided persons who feel constrained by the demand characteristics of the interview situation to give some response.

Since most questions provide only pro or con options (e.g., "Do you agree or disagree?" "Would it be all right with you or would you oppose?"), a DK response is a volunteered response and may be underused in relation to the true percentage of DK respondents in the sample. To the degree that this occurs, pro and/or con percentages are elevated by the responses of undecided respondents.

In studies of public attitudes toward school segregation and water fluoridation, Abelson (1976) observed that many respondents hopped "wildly back and forth on the attitude scales from one time to the next while reporting no exposure to any conversations or persuasive appeals on the issue. It is as if their interview responses are given randomly." Abelson suggested that such random responses occur most frequently for topics on which voters lack information, and that such topics represent "nonsense" issues for an uninformed portion of the public. LaPorte and Metlay (1975), in an extensive survey of attitudes toward science and technological advances, found that the attitudes of the majority of the public were not internally coherent. They labeled responses from this group as "relatively random" and suggested that the issue area of the survey held little salience for them.

Data from the nuclear surveys indicate very low levels of nuclear information and of exposure to nuclear power discussions, suggesting that survey respondents may engage in random responding of the type observed by Abelson (1976) and LaPorte and Metlay (1975). In two of the

nuclear studies, responses of the same persons were sampled at different time intervals, yielding data regarding the degree of stability of individuals' nuclear attitudes. Mazur (Syracuse 77/3) contacted 106 respondents four months after an initial attitudinal assessment and found consistency of attitudinal responses among males. The ORNL (Hartsville 75/8) study also reported consistency of attitudes toward a nuclear plant over the six months between surveys. These data do not concur with Abelson's (1976) findings of individual attitudinal fluctuation. However, both of these were local studies at the sites of proposed nuclear installations; sample sizes were small (101 and 288), and the degree of attitudinal consistency observed may differ from that among other populations.

Considering group rather than individual variation, the available survey samples indicate considerable fluctuation in levels of support and opposition. Among the national samples, support levels ranged from 35% to 80%. In Section 3.1.2.4 on the Type 4 question, the difficulty in explaining widely divergent support levels from two national studies taken the same month (76/6) was noted. Cambridge indicated that nuclear attitudes were extremely volatile in comparison with other topics assessed, and attributed this to the fact that much of the public knows very little about nuclear power. One interpretation of such fluctuation is that levels of support for both pro and con attitudes are inflated with "random" responses of undecided respondents.

If undecided respondents contribute to both pro and con categories, it is likely that the former is more affected than the latter. This follows from the fact that pro is the more popular position, and hence may be endorsed more frequently by those without any real opinions. An additional contributing factor is the tendency of survey researchers to posit all questions so that pro responses are more culturally acceptable; i.e., it is more desirable in our culture to say yes, to favor, to agree, or to indicate it is all right than it is to say no, to disagree, or to oppose. Thus, the influence of both so-called acquiescent response style and the connotations of specific words used in the response options (e.g., "all right" versus "oppose") tends to elicit more pro than con

responses from respondents without firm opinions. [See O'Neil (1967) for a discussion of this problem in survey research.]

Direct evidence that the pro respondents are less likely to be strongly committed than the con respondents is available from a question posed to the Cambridge (75/5) sample. After responding to the question about construction of nuclear power plants, respondents were asked to place themselves on a seven-point scale regarding the construction of such plants. The end-points of the scale were labeled "strongly support" and "strongly oppose." Proportions placing themselves at the various scale points are:

Strongly Support							Strongly Oppose
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	
23%	12%	9%	16%	6%	8%	27%	

A striking feature of these responses is the large proportion indicating the extreme positions; i.e., 23% and 27% choosing "strongly support" and "strongly oppose," respectively. Customarily, respondents to a bipolar scale prefer the midpoints. Apparently, a higher proportion of these respondents are strongly committed to their positions than is customary in attitudinal research.

A second surprising occurrence in these data is the relative strength of the proponents and opponents of nuclear power. In this same survey (Cambridge, 75/5), the general question about construction of nuclear power plants elicited response levels of 45% in favor versus 35% opposed. Although this margin of support is smaller than in most samples, there is still a respectable plurality favorable to nuclear power. However, in response to the question in which respondents were asked to indicate their positions between "strongly support" and "strongly oppose," those strongly opposed exceeded by four percentage points those strongly in favor. This finding is consistent with the hypothesis that levels of support for nuclear power are elevated by uncommitted or uncertain respondents.

The exact wording of both questions and the percentage of each demographic group responding favorably and unfavorably to the first question and indicating strong support or strong opposition in response to the second question are shown in Table 3.30. The ratios of the proportion indicating strong support versus the proportion supporting nuclear plants, and the ratios of those strongly opposing versus opposing nuclear plant construction are shown in Table 3.31. From these ratios it is clear that commitment among those indicating opposition is much stronger than commitment among those indicating support for nuclear power. Unfortunately, the strength of commitment question occurred in only one of the Cambridge studies and no similar question was presented by other researchers. Thus, comparative data concerning the commitment of other respondents regarding construction of nuclear power plants are not available.

The Type 1 question about feelings toward nuclear power (discussed at length in Section 3.1.2.1; see data presented in Table 3.1) provided response options of "strongly favorable," "somewhat favorable," "somewhat unfavorable," and "strongly unfavorable." The percentages responding "strongly favorable," and "strongly unfavorable," are shown in Table 3.32. In only one sample was the percentage strongly unfavorable greater than the percentage strongly favorable. In most of the 10 other samples, the percentage strongly favorable was substantially greater than the percentage strongly unfavorable. The questions posed to these samples differed from the Cambridge strength of commitment question not only in content (feelings about nuclear power versus construction of more power plants) but also in format and focus. Therefore, it is difficult to interpret the apparently contrasting evidence regarding the degree to which pro versus con respondents are committed to their respective views.

TABLE 3.30

STRENGTH OF COMMITMENT OF NUCLEAR PROPONENTS AND OPPONENTS

Respondent Category	Cambridge (75/5)			
	Favor Nuclear Plants ^a	Oppose Nuclear Plants ^a	Strongly Support ^b	Strongly Oppose ^b
<u>Total</u>	45%	35%	23%	27%
<u>Income</u>				
\$0-3,999	35	31	22	31
\$4-6,999	37	38	25	32
\$7-9,999	38	38	18	25
\$10-12,999	48	32	30	20
\$13-14,999	50	30	23	21
\$15-19,999	50	35	23	25
\$20-24,999	52	38	19	28
Over \$25,000	53	34	31	26
<u>Age</u>				
18-25	40	42	22	29
26-35	45	39	22	26
36-45	44	35	21	28
46-55	42	33	23	27
56-65	49	25	22	26
Over 65	49	25	32	23
<u>Sex</u>				
Male	57	29	33	23
Female	34	40	15	30
<u>Education</u>				
Some grade school	38	25	23	25
Some high school	37	34	23	30
Graduated high school	42	36	24	27
Technical/vocational	53	32	25	18
Some college	49	38	23	26
Graduate college	54	37	25	27
Graduate/professional	52	38	22	26
<u>Urban/Rural</u>				
Urban	43	36	24	27
Suburban	38	36	23	28
Rural	43	32	24	23

^a"Do you favor or oppose building more nuclear power plants?"

^b"Where would you place yourself for construction of more nuclear power plants?" Respondents chose one of seven points on a scale from "Strongly support" to "Strongly oppose." Percentages given are those choosing point 1 and 7.

TABLE 3.31

RELATIONSHIP OF PROPORTIONS STRONGLY FAVORING/FAVORING
AND STRONGLY OPPOSING/OPPOSING NUCLEAR
PLANT CONSTRUCTION

<u>Respondent Category</u>	Ratio of % Strongly Favoring to % Favoring	Ratio of % Strongly Opposing to % Opposing
<u>Total</u>	.51	.77
<u>Income</u>		
\$0-3,999	.63	1.00
\$4-6,999	.68	.84
\$7-9,999	.47	.66
\$10-12,999	.63	.63
\$13-14,999	.46	.70
\$15-19,999	.46	.71
\$20-24,999	.37	.74
Over \$25,000	.58	.76
<u>Age</u>		
18-25	.55	.69
26-35	.49	.67
36-45	.48	.80
46-55	.55	.82
56-65	.45	1.04
Over 65	.65	.92
<u>Sex</u>		
Male	.58	.79
Female	.44	.75
<u>Education</u>		
Some grade school	.61	1.00
Some high school	.62	.88
Graduated high school	.57	.75
Technical/vocational	.47	.56
Some college	.47	.68
Graduate college	.46	.73
Graduate/professional	.42	.68
<u>Urban/Rural</u>		
Urban	.56	.75
Suburban	.48	.78
Rural	.56	.72

NOTE: Ratios are computed from data from Cambridge (75/5) survey.

TABLE 3.32

PERCENTAGES STRONGLY FAVORABLE AND STRONGLY UNFAVORABLE
TO NUCLEAR POWER

(Type 1 Question)

Survey	Strongly Favorable	Strongly Unfavorable
<u>National probability samples</u>		
Becker (73/6) ^a	28%	4%
Becker (74/6) ^a	26	5
ORC (74/11) ^b	29	9
ORC (75/2) ^b	31	14
ORC (75/4) ^b	26	11
<u>State or area probability samples</u>		
West (AZ 75/11) ^c	34	11
Central (Marble Hill 76/11) ^d		
Indiana	20	13
Kentucky	14	15
Bardsley (OR 76/8) ^d	14	12
Bardsley (OR 76/12) ^e	26	13
Bardsley (WA 76/8) ^d	21	12

^a"What is your general opinion of nuclear power?"

^b"Taking into account all you have heard or read, how do you feel toward nuclear power plants in general?"

^c"What is your general opinion toward nuclear generating plants?"

^d"Overall, would you say your opinion of nuclear power is...?"

^e"Apart from Measure #9, is your overall opinion of nuclear power plants...?"

Additional evidence, which should be considered in interpreting the strength of commitment, is provided by the Harris samples of leadership groups and by the nuclear safeguards referenda conducted in six states in 1976. Harris (75/4, 76/7) sampled business leaders, political leaders, nuclear power regulators, and environmentalists as well as the general population. These special groups were asked to respond to the questions as they thought the public would respond. According to Harris (75/4), these leadership groups, particularly the political leaders, "seriously underestimated the public support for the building of more nuclear power plants." Such underestimation would be expected if the proportion of respondents strongly committed to an antinuclear position were as large, or nearly as large, as the proportion committed to a strongly pronuclear position.

Votes on nuclear safeguards initiatives, presented in seven states in 1976, constitute public responses toward nuclear power, and may also be considered a "strength of commitment" measure. These votes have not been presented along with survey data (although responses to nuclear attitude questions obtained in surveys during initiative campaigns have been analyzed) because they are data of a very different sort. In contrast with attitudinal survey responses, votes are generally preceded by intensive, overt attempts to influence voters; they require a form of effort expenditure very different from that required of survey respondents; and they represent a deliberate intentional contribution toward a specific decision or sociopolitical outcome. In addition, votes represent a nonrandom sampling of opinion. (Among Harris survey respondents, only 75% were registered voters.) In the case of the nuclear safeguard initiatives, these factors, plus the wording of the initiatives themselves, make interpretations of initiative votes in terms of attitudes toward nuclear power exceedingly difficult. Nevertheless, the initiative votes represent an important expression from the public, and should not be ignored. The results of these initiatives, together with percentages registered and voting in the initiative states, are presented in Table 3.33. The initiatives were defeated by wide margins in all seven states.

TABLE 3.33

RESULTS OF NUCLEAR SAFEGUARDS INITIATIVE VOTES, 1976

State	Voting Age Population Estimate ^a	Registered Voters ^b	Ballots Cast ^c	Voted For Initiative ^d	Voted Against Initiative ^d	Voted, But Did Not Vote On Initiative ^d
Arizona Proposition 200 Nov. 1976	1,555,000	979,654 63%	764,886 78%	207,639 27%	487,795 64%	69,452 9%
California Proposition 15 June 1976	15,294,317	8,710,756 58%	6,323,651 73%	1,950,430 31%	4,048,355 64%	324,866 5%
Colorado Amendment #3 Nov. 1976	1,773,000	1,361,570 77%	1,111,599 82%	305,142 27%	734,843 66%	71,614 6%
Montana Measure 71 Nov. 1976	518,000	454,924 88%	339,346 75%	120,557 35%	175,925 52%	42,864 13%
Ohio Issue #6 Nov. 1976	7,459,000	4,693,338 63%	4,194,557 --	1,150,360 27%	2,462,000 59%	582,197 14%
Oregon Measure 9 Nov. 1976	1,653,000	1,420,146 86%	1,048,561 74%	423,008 40%	584,845 56%	40,708 4%
Washington Initiative 325 Nov. 1976	2,536,000	2,065,378 81%	1,584,590 77%	482,756 30%	963,756 61%	138,078 9%

^aFrom U.S. Bureau of the Census, Statistical Abstract of the United States: 1976. (97th Edition) Washington, D.C., 1976. All other numbers from the individual states' elections division.

^bPercentages in this column indicate percentage of voting age population registered to vote.

^cPercentages in this column indicate percentage of registered voters casting ballots in this election.

^dPercentages in this column indicate percentage of ballots cast.

^eTwenty-two counties do not require voter registration.

The broad range of data discussed above do not lead to any clear conclusion about the degree to which opponents and proponents of nuclear power are strongly committed to their positions. They do suggest the possibility that proportions indicating support or opposition to general nuclear questions may not always reflect the degree or strength of such support or opposition among the population.

3.3.3 Relationship of Nuclear Knowledge and Nuclear Attitudes

If the survey findings indicate that much of the public lacks knowledge about nuclear power, what do they suggest about the effect of the acquisition of nuclear information? ORC (75/4) claims that knowledge increases favorability toward nuclear power and supports this with evidence that those who knew of nuclear power plants in their states were more favorable toward nuclear plants in general by 72% versus 55%. Knowledge questions similar to the ORC (74/5) question about the presence of a nuclear plant in the state or area were asked in a number of national and area surveys. However, unlike the ORC study, most researchers did not report whether or not these responses were accurate. When accuracy is unknown, calculation of a relationship between reporting a nuclear plant in one's area and attitudes toward nuclear plants yields no useful information regarding the effect of knowledge on attitudes or the reverse.

Equally uninformative are data showing that those who claim to have heard a great deal about nuclear power, or to have followed nuclear discussions carefully, are more pronuclear than are those who say they have heard little or nothing about nuclear power. For example, Becker (73/6) indicates that 86% of those hearing a great deal about nuclear power versus 21% of those hearing nothing express favorable attitudes. Similar results were obtained by Becker (74/5). Since favorable attitudes could be responsible for the involvement in nuclear power reading or discussion, and since knowledge was not actually assessed, these data also fail to answer the question: Do those who have acquired knowledge about nuclear power hold more favorable nuclear attitudes than those who are lacking in knowledge?

Although such data are not available from national samples, a number of special studies provide useful data on the relationship between nuclear knowledge and nuclear attitudes. Mazur (Syracuse 77/3) examined the relationship between responses to specific nuclear knowledge questions and responses to attitudinal questions relative to nuclear power in general and to the proposed siting of a nuclear waste repository in the Syracuse area. He found no relationship between knowledge and attitudes toward either of the issues. The only factor correlated with nuclear knowledge was sex; males were significantly more knowledgeable than were females. Within each sex, however, no relationship between knowledge and nuclear power/nuclear waste attitudes was found.

Summers (WA 76) administered five nuclear knowledge questions along with several attitudinal questions to respondents. On the basis of the latter, respondents were classed as high versus low in nuclear support. The two attitudinal groups showed no significant differences in nuclear knowledge. Similarly, no relationship between knowledge about a nuclear plant under construction and attitude toward the plant was found in ORNL (Hartsville 75/8). Nor was any relationship between knowledge about nuclear power and favorability toward its development found by Kasperson (76/7).

When the information held by various leadership groups was assessed at length by IES (WI 1973), the environmental leaders were no less knowledgeable than were other groups, but their attitudes toward nuclear power were less favorable. In an analysis of opposition to various technologies, Mazur (1975) found leaders of opposition to nuclear power very well informed. Although opposition to both nuclear energy and fluoridation is often attributed to ignorance of the technologies involved, Mazur reported four fluoridation studies that did not support the assumption about an uninformed opposition for that topic area. Furthermore, an attitudinal-knowledge assessment of residents of Syracuse conducted by Mazur in 1972 found only a slight but "not pronounced" tendency for more nuclear knowledge to be related to less opposition among males. These data are all from relatively small samples, none of which is representative of the United States' total population. Whether

similar results would occur from careful national probability samples is unknown. Without supporting data, however, there should be no assumption that, as nuclear knowledge increases, parallel increases in pronuclear attitudes will follow.

3.4 Conclusions regarding General Nuclear Power Attitudes

From this large body of general nuclear attitude data, what conclusions may be presented with confidence? Clearly, support for nuclear power is widespread. Those favoring nuclear power far exceed those opposed, by roughly a two-to-one margin across the surveys. The plurality favoring versus opposing nuclear energy holds in almost every question of every survey across every total sample or subsample of the population. However, in the one survey in which strength of commitment to a pro-nuclear or antinuclear position was assessed, those strongly committed to a pro or con stance were more evenly divided than were the respondents generally.

Those found to be the most favorable toward nuclear power are respondents who are better-educated, higher-paid, or middle-aged. Among groups more opposed to nuclear power are women, young people, and those with less education and lower incomes. In general, residents of Western states are more supportive of nuclear power than are those from other regions of the country, while those in the Northeast are less supportive. Regional differences are not great, however. The most reliable differences in nuclear attitudes among demographic groups were found to be related to sex. Across all survey samples, males were more favorable and less opposed than were females.

When responses were analyzed across time, no clear trends were apparent, although considerable fluctuation was found. Support for nuclear power has not increased; evidence regarding a decrease in support is inconclusive. The demographic groups showing stronger support and

stronger opposition today seem to be the same as those who were supportive and opposed in early studies.

An often-expressed expectation that with increased nuclear knowledge and nuclear experience would come an increase in nuclear acceptance, has not been demonstrated. The data do indicate that residents near a nuclear installation are slightly more supportive and less opposed to having a nuclear plant nearby than is the general public. To the degree that the survey responses have assessed nuclear knowledge, the evidence indicates that a majority of the public is still quite uninformed. Furthermore, in a few studies (none of them national in scope) in which nuclear knowledge and nuclear attitudes were compared, no relationship between knowledge and attitudes was found. The general lack of nuclear information among the public and the uncertain strength of commitment among pro and con respondents indicate that future attitudes about nuclear power are not easily predictable.

4 ATTITUDES ABOUT SPECIFIC NUCLEAR POWER ISSUES

4.1 Introduction

The preceding section discussed survey findings regarding general attitudes toward nuclear power and the demographic characteristics of those who favor, oppose, or are ambivalent about it. This section of the review will discuss the reasons why respondents hold these attitudes about nuclear power in relation to reasons for support of or opposition to nuclear power and in relation to attitudes about specific nuclear power issues.

The discussion of the nuclear power issues begins with a comparative assessment of reasons for support of nuclear power or opposition to nuclear power. Many of these reasons come as a response to a question asking a respondent why he/she is for or against nuclear power. Responses to questions asking about worries or advantages and disadvantages of nuclear power are also included. Most of the questions required respondents to volunteer answers, although a few questions had structured response categories that were read to respondents. The open-ended responses are especially important, because they indicate what is at the forefront of public thinking about nuclear power.

After examining the reasons for support of or opposition to nuclear power, attitudes about specific nuclear power issues are presented. These specific issues include safety, health effects of nuclear power, radioactive waste disposal, economics of nuclear power, nuclear fuel supply, nuclear power and pollution, safeguards and terrorism, and proliferation. These issue areas were delineated partly as a function of the types of open-ended responses in support of or opposition to nuclear power and partly as a function of the types of questions asked by survey organizations.

Most of the discussion will focus on the national survey data. The state and area findings will be included (1) if needed to add breadth to some of the issue areas not thoroughly covered by national findings, or (2) if they are quite discrepant from national findings.

4.2 Arguments for and against Nuclear Power

4.2.1 Question Types

Arguments for and against nuclear power have been elicited by a wide variety of question types. The most typical approach taken by survey organizations was to ask a question to determine whether a respondent is for or against nuclear power (as discussed in Section 3) and then to ask the respondent to give reasons for his/her position. NORC (74/5) used structured response alternatives, whereas Sindlinger (60/6), Becker (73/6), Harris (75/4, 76/7), and the Cambridge surveys asked for volunteered responses. Cambridge (75/5) also asked all respondents to give their "biggest worry" about nuclear power, and Harris (75/4, 76/7) asked all respondents to name two or three of the main advantages and disadvantages of using nuclear power plants to produce electric power. ORC (74/11, 75/2) listed four problems of nuclear power and asked respondents which, if any, were serious problems. Cambridge (75/5, 76/4) collected data permitting a comparison of respondents' concerns over radioactive wastes and explosions.

The final type of data to be analyzed in this section is provided by two types of structured questions asked by Harris (75/4, 76/7). Harris presented respondents with a list of nine purported problems of nuclear power and asked respondents to indicate whether they felt that the problem was a major problem, a minor problem, or hardly a problem at all. Harris also presented respondents with a list of nine purported advantages of nuclear power and asked whether the advantage was a major

advantage, a minor advantage, or no advantage at all. The way that these questions were worded may have biased the responses somewhat. First, the respondent was told that some people say that these are problems or advantages, thereby suggesting that such a perception was socially supported. This can cause biasing, especially in face-to-face interviews. Second, two of the three response categories indicated a problem or an advantage, while only one indicated that no problem or advantage existed. Thus, the response categories also indicated that a problem or advantage existed. Because of these factors, the responses to the purported problems and advantages are best analyzed in a relative, rather than an absolute, fashion.

The remainder of section 4.2 discusses the arguments for and against nuclear power and attempts to identify the consistencies across time, respondent groups, and question types. Although there are major consistencies among the various survey findings, there are also "inconsistencies" that reflect either true attitudinal differences or are due to such factors as: (a) the exact question wording; (b) whether responses were structured or open-ended; (c) how many responses a respondent could make according to the question format; and (d) who answered the question, that is, all respondents or just those who favor or oppose nuclear power.

4.2.2 Arguments against Nuclear Power

4.2.2.1 Reasons for opposing nuclear power. As discussed in Section 3, most of the surveys asked respondents whether they were for or against nuclear power and then asked why they held that position. The reasons for opposing nuclear power were consistent across national, state, and area samples, so only data from national samples will be examined. In general, reasons for opposition centered around safety concerns, nuclear wastes, economic considerations, pollution, satisfaction with other energy sources, and lack of perceived need for nuclear energy.

The major reason for opposing nuclear power involves considerations of danger or risk (see Table 4.1). In the earliest national survey, Sindlinger (60/6) found that 54% of those who opposed nuclear power did so because of danger. The next most cited reason for opposition was satisfaction with present methods (18%). Becker (73/6) found almost the same pattern--56% of those who opposed nuclear power gave concern over safety as a reason, while only 19% cited pollution damage as the second major concern. NORC (74/5) presented structured response alternatives to respondents and allowed more than one response to be chosen. Here, 70% opposed nuclear power because it was dangerous to health or the environment, while the second most common response (41%) indicated satisfaction with present methods of energy generation.

The Harris (75/4, 76/7) survey data were from open-ended, multiple responses, and several response categories pertinent to danger were allowed. Averaging across both surveys, about 59% of those who opposed nuclear power gave as a reason that nuclear power was dangerous, unsafe, or posed a health hazard; 17% opposed nuclear power because of possible accidents or because they felt that proper precautions regarding safety were not being taken; and 15% were opposed because of danger from radiation leakage, fallout, or contamination. The three next most cited reasons for opposition--problems regarding nuclear wastes, preference for other sources, and perceived lack of technical knowledge--also averaged 15%.

The Cambridge data in Table 4.1 also coded multiple "danger" responses. Averaging the six surveys from 1975 and 1976, reasons for opposition involving concerns over danger were again cited most often. Here, 39% opposed nuclear power because they felt that nuclear power was dangerous, unsafe, or posed a high risk of accidents; 4.5% were opposed because of dangers from radiation leakage, fallout, or contamination; 4% were opposed because of possible explosions; and 10% were opposed because they felt that nuclear power wasn't yet safe enough, that there weren't enough safeguards, or that there were just too many problems. The next most cited reason for opposition was lack of need (about 7%).

TABLE 4.1

REASONS FOR OPPOSING NUCLEAR POWER

		Sindlinger ^a (60/6)	Becker ^b (73/6)	NORC ^c (74/5)	Harris ^d (75/4) (76/7)		Cambridge ^e (75/5) (75/8) (76/4) (76/7) (76/10) (76/12)					
Response	Percent of Total Opposed	6%	20%	20%	19%	22%	35%	29%	34%	33%	31%	28%
<u>Danger</u>												
1. Danger; concern over safety		54	56									
2. Dangerous; unsafe, high risk of accidents							44	42	38	38	35	39
3. Dangerous, unsafe; health hazard					53	64						
4. Dangerous to health and environment				70								
5. Danger of accident; don't take proper precautions					16	18						
6. Dangers from radiation leakage, fallout, or contamination					16	14	8	4	2	5	7	1
7. Danger of explosion							8	5	5		3	3
8. Not safe yet, not safe enough, not enough safe-guards; too many problems							11	11	14	10	5	11
<u>Nuclear Wastes</u>												
9. Waste is dangerous, poisonous, or deadly							4	5	3	4	4	5
10. Problems with radioactive wastes; no way to dispose					16	14						
<u>Economics</u>												
11. Too costly or expensive		13	5	26	11	5	6	8*		8	7	8
12. Results in unemployment		5		17								
<u>Pollution</u>												
13. Air pollution damage					11	5						
14. Water pollution damage					5	5	6					
15. Pollution damage (air, water, and/or environment)			19					7	3	4	8	4
<u>Other</u>												
16. Satisfaction with present methods		18		41	5	5						
17. No need, have enough							4	6*	10	6	7	7
18. Should develop solar instead							2		3	4	2	1
19. Should develop other sources instead					16	14						
20. Scientists don't know enough about it					16	14				2	7	3
21. Need for safeguards; sabotage, terrorism					2	5			2	3	4	2
22. General disapproval			12									
23. Other		10	13	7	16	14			14	10	6	11
24. Don't know			3						5	5	5	5
25. Other/Don't know							7	12*				

TABLE 4.1 (Continued)

^a"Atomic power should be used to produce electricity." (Agree or Disagree) Followed by: "Why do you say that?"

^b"Suppose your electric company announced that it planned to build a nuclear power generating plants in this general area producing electric power by means of atomic energy. Would building this kind of plant be all right with you or would you oppose it?" Followed by: "Why do you say that it would be all right?" or "Why do you say that you would oppose it?"

^c"Do you agree or disagree with this statement: Nuclear power should be used to produce electricity. Followed by: "IF AGREE: Listed below are some reasons people often give for believing that nuclear power should be used to produce electricity. Please tell me which of the reasons listed describe well why you believe that nuclear power should be used to produce electricity." "IF DISAGREE: Listed below are some reasons people often give for believing that nuclear power should not be used to produce electricity. Please tell me which of the reasons listed describe well why you believe that nuclear power should not be used to produce electricity."

^d"In general, do you favor or oppose the building of more nuclear power plants in the United States?" Followed by: "Why do you feel that way? Any other reason?"

^e"Do you generally favor or oppose the construction of more nuclear power plants?" Followed by: "Why do you favor (oppose) nuclear power?"

4.2.2.2 Worries about and disadvantages of nuclear power. Concerns over safety are not only expressed by nuclear opponents. Cambridge (75/5) found that the biggest worry about nuclear power volunteered by the total public involved danger (see Table 4.2): danger over accidents, explosions, or chain reactions (19%); death, disaster, or danger in general (15%); health danger (3%). Actually, the two remaining responses also involve danger--waste radioactivity (7%) and terrorism, misuse, or sabotage (8%). It is very interesting to note that when respondents could name only their single biggest worry, all of the responses involved danger and none involved economic or pollution considerations. Also, 16% of the respondents said that they had no worries at all about nuclear power.

Harris (75/4, 76/7) asked the total public and nuclear plant neighbors to give two or three disadvantages of nuclear power (see Table 4.2). Again, the most frequently volunteered disadvantages centered around some sort of danger. This was true for the total public and for nuclear plant neighbors. Averaging across both surveys, about 24% of the total public and 19% of the nuclear plant neighbors cited "unsafe, dangerous, or health hazard"; 21% of the total public and 23% of the neighbors cited "danger of radiation contamination or leaks and cracks in the reactor"; and 15% of the public and 22% of the neighbors cited "danger of accidents, explosions, earthquakes, or chain reactions." The next most frequently volunteered response involved two types of pollution considerations (volunteered by 20% of the total public and 30% of the nuclear plant neighbors) and economic considerations (16% of the total public and 13% of nuclear plant neighbors). Only 12% of the total public and 13% of the neighbors cited problems with waste disposal as a disadvantage. Also, 9% of the total public and 12% of the nuclear plant neighbors felt that there were no disadvantages associated with nuclear power.

4.2.2.3 Major problems of nuclear power. Harris (75/4, 76/7) used a structured set of questions to determine how the total public and nuclear plant neighbors perceived the severity of certain purported problems (see Table 4.3 for exact question wording). Note that all of

TABLE 4.2

BIGGEST WORRY ABOUT AND DISADVANTAGES OF NUCLEAR POWER

Response	Cambridge ^a	Harris ^b			
	Total Public (75/5)	Total Public (75/4)	Public (76/7)	Nuclear Plant (75/4)	Neighbors (76/7)
<u>Danger</u>					
1. Death, disaster, danger in general	15%				
2. Unsafe, dangerous, health hazard		23%	25%	18%	19%
3. Health danger	3				
4. Danger of radiation contamination, leaks, cracks in reactor	15	20	21	23	23
5. Danger of accidents, explosions, earthquakes, or chain reactions	19	14	16	21	23
6. Public reaction over safety; objections of environmental groups		4	4	10	6
7. Danger to workers in nuclear plant		1	1	1	--
<u>Nuclear Wastes</u>					
8. Waste radioactivity	7				
9. Problems with radioactive waste disposal		10	13	9	17
<u>Economics</u>					
10. Initial expense is high; financing problems		7	8	7	7
11. Expensive, high cost		7	7	6	4
12. Puts people out of work		1	1	1	1
<u>Pollution</u>					
13. Pollution, damage to environment, wildlife		9	10	14	9
14. Thermal pollution, kills marine life		12	8	23	14
<u>Other</u>					
15. Lack of technical knowledge; uncertainty of consequences		6	7	6	5
16. Need stringent controls, safeguards		5	7	7	3
17. Danger of sabotage		2	5	3	5
18. Terrorism, misuse, sabotage	8				
19. Shortage, lack of plutonium		1	2	2	2
20. Sites not available		2	1	6	3
21. Inefficient, breaks down		1	1	1	--
22. I have no worries at all	16				
23. None, no disadvantages		9	8	12	12
24. Other/don't know	17				
25. All other answers		5	8	10	10
26. Don't know		27	20	14	13

^a"What is your biggest worry about nuclear power?"

^b"What do you feel are the two or three main disadvantages of nuclear power plants to produce electricity? Any others?"

TABLE 4.3
MAJOR PROBLEMS CONNECTED WITH NUCLEAR POWER PLANTS

Response	Total Public			Harris Nuclear Plant Neighbors		
	75/4	76/7	Change	75/4	76/7	Change
<u>Danger</u>						
1. The chance of an explosion in the case of an accident	47%	54%	+7%	45%	41%	- 4%
2. The escape of radioactivity into the atomsphere	49	57	+8	47	40	- 7
3. The chance that the escape of radioactive materials can affect human life, causing deformed babies and other physical abnormalities		56			45	
4. The chance that a nuclear power plant could melt down and release radioactive clouds that could contaminate hundreds of square miles		46			31	
<u>Waste disposal</u>						
5. The disposal of radioactive waste materials which remain radioactive for many centuries to come	63	67	+4	66	55	-11
<u>Pollution</u>						
6. The discharge of warm water into lakes and rivers that could endanger fish and other water life	47	50	+3	47	40	- 7
7. Giving off fumes that can pollute the air	36	43	+7	34	34	0
<u>Sabotage and terrorism</u>						
8. The threat of attempts to sabotage nuclear power plants	39	45	+6	41	31	-10
9. The possibility that plutonium, which is made in a nuclear power plant, could be stolen by radical revolutionaries	34	41	+7	34	26	- 8

NOTE: Figures represent percentages of the total public or nuclear plant neighbors who felt that the listed problem was a major problem as compared to a minor problem, hardly a problem at all, or were not sure. The problems listed above were prefaced with "Now let me ask you about some things that some people have said are problems associated with nuclear power being used as a source of energy for electric power."

these problems involve some sort of danger, and not, for example, economic considerations. Using this format, the disposal of radioactive wastes was seen as a major problem by both the total public and by nuclear plant neighbors more often than any of the other problems. On the average, 65% of the total public and 61% of nuclear plant neighbors believed that nuclear waste disposal is a major problem.

In general, the four problems concerning health and safety dangers were perceived as the next most serious problems by both groups. On the average, from 46% to 56% of the total public and from 31% to 45% of nuclear plant neighbors perceived these dangers as major problems. The health and safety dangers were followed by pollution problems as the third most important set of nuclear problems. Thermal pollution was seen as more of a problem than was air pollution. On the average, 49% of the total public and 44% of nuclear plant neighbors felt that thermal pollution was a major problem, while 40% of the total public and 34% of nuclear plant neighbors felt that air pollution was a major problem.

Slightly less concern was expressed regarding sabotage and terrorism. On the average, 42% of the general public and 36% of nuclear plant neighbors saw the threat of attempts to sabotage nuclear power plants as a major problem; 38% of the public and 30% of nuclear plant neighbors saw as a major problem the possibility that plutonium could be stolen by radical revolutionaries.

It has been pointed out that one should not interpret in an absolute fashion the percentages of those who felt that the purported problem was a major problem because of the possibility of a biasing effect due to the question format. Relative interpretations do not suffer in this fashion, since the same amount of bias would theoretically exist for each question. Interpreting these data in a relative fashion provides a little different picture than the data provided by volunteered responses and discussed in 4.2.2.1 and 4.2.2.2. When structured responses were given to a set of structured problems, waste disposal was seen as more of a problem than other specific dangers associated with health and safety.

Data provided by ORC (74/11, 75/2) parallel the Harris "major problems" question findings (see Table 4.4). The respondents in this survey (about 50%) considered disposal of wastes to be a significantly more serious problem than radiation discharge (about 23%), nuclear accident (about 21%), or thermal pollution (about 13%). The percentage of respondents that considered radiation discharge or nuclear accident as a serious problem did not differ statistically.

TABLE 4.4
SERIOUS PROBLEMS ASSOCIATED WITH NUCLEAR POWER PLANTS

Response	ORC	
	(74/11)	(75/2)
Disposal of wastes	52%	48%
Radiation discharge	20	25
Nuclear accident	19	23
Thermal pollution	9	17
Other	2	2
None of these	4	4
Don't know	13	omitted

NOTE: "Which of these, if any, do you consider to be serious problems associated with nuclear power plants--thermal pollution, radiation discharge, nuclear accident, or disposal of radioactive wastes?"

Final data, regarding the relative importance of nuclear wastes and power plant explosions, are provided by Cambridge (75/5, 76/4) (see Table 4.5). Significantly more people ($p < .001$) are very concerned about wastes escaping than are very concerned about nuclear explosions.

It appears that, when respondents who oppose nuclear power are asked why, about 40% to 60% are likely to respond with a general "danger" response, and less than 20% volunteer specific dangers, such as dangers from accidents or explosions, radiation contamination, and nuclear wastes. When all respondents are asked to list two or three (specific)

disadvantages of nuclear power, only about 24% give a general danger response, while about 21% cite radiation contamination from leaks and cracks in the reactor, about 15% cite accidents or explosions, and about 12% cite radioactive wastes. However, when all respondents are asked to respond to a set of structured problems, nuclear waste is considered to be much more of a problem than other specific dangers. Thus, it appears that in 1975 and 1976, at least, dangers related to both reactor operation and nuclear wastes are of considerable concern to the American public.

TABLE 4.5
COMPARATIVE CONCERN BETWEEN RADIOACTIVE WASTES AND EXPLOSIONS

Response	Cambridge (75/5)		Cambridge (76/4)	
	Wastes ^a	Explosions ^b	Wastes ^a	Explosions ^b
Very concerned	46%	33%	47%	36%
Somewhat concerned	33	32	30	33
Not really concerned at all	18	30	17	26
Don't know	4	5	5	5

^a"How concerned are you about radioactive wastes escaping to harm people and the environment?"

^b"How concerned are you about a nuclear explosion of a power plant?"

4.2.2.4 Trends over time. The dangers or perceived dangers associated with nuclear power have been the primary concern of the public from 1960 through 1976. Data collected by some survey organizations indicate that these concerns increased from 1975 to 1976, whereas other researchers found decreased concern from 1975 to 1976. The Harris reasons for opposing the building of more nuclear power plants (see Table 4.1) indicate an increase in reasons related to danger. In 1975, 53% opposed nuclear power because it was dangerous, unsafe, or a health hazard; in 1976, 64% opposed nuclear power for these reasons. This difference is statistically significant ($p < .001$). The Harris "disadvantages" relating to danger (see Table 4.2) and the Harris "major problems" relating to danger (see Table 4.3) also showed an increase in danger arguments against nuclear power from 1975 to 1976.

The Cambridge data (see Table 4.1), however, show a significant ($p < .001$) decrease in concern over danger. Here, an average of 43% of those who opposed nuclear power in 1975 did so because they felt that nuclear power was dangerous, unsafe, or posed a high risk of accidents; in 1976 an average of 37.5% opposed nuclear power for those reasons. Cambridge also found a decline from an average of 6.5% in 1975 to an average of 4% in 1976 in those who opposed nuclear power because of the danger of an explosion. Given these opposing findings, the conclusion drawn is that concern over dangers fluctuates over time but has remained generally stable since 1960 as the main reason for opposing nuclear power.

Concern over nuclear wastes was not mentioned as a reason for opposing nuclear power (see Table 4.1) in the Sindlinger (60/6) or the Becker (73/6) study, nor was it enough of an issue to be included as a structured response by NORC (74/5). From 1975 on, however, nuclear waste problems have been used as arguments against nuclear power. Although the percentage of the Harris respondents who opposed nuclear power because of waste disposal problems decreased from 16% in 1975 to 14% in 1976 (see Table 4.1), 3% more of the total public and 8% more of nuclear plant neighbors listed waste disposal problems as a main disadvantage of nuclear power in 1976 than in 1975 (see Table 4.2); and 4% more of the total public saw waste disposal as a major problem in 1976 than in 1975 (see Table 4.3) (although such was not the case for nuclear plant neighbors). The Cambridge data (see Table 4.1), however, show a stable percentage of those who oppose nuclear power for waste disposal reasons since 1975.

Economic arguments against nuclear power have been offered since the earliest survey (Sindlinger, 60/6). Economic arguments against nuclear power have remained fairly stable in both a relative and an absolute sense from 1960 through 1976 (see Tables 4.1 and 4.2). About 5% to 18% of those who oppose nuclear power do so for economic reasons, and about 15% of the public cite nuclear economics as a disadvantage of nuclear power. Economic considerations are volunteered much less often

than danger and about the same as, or a little more than, nuclear waste considerations.

Pollution arguments against nuclear power were not mentioned by any of the Sindlinger (60/6) respondents (see Table 4.1). By 1973, however, Becker (73/6) found that 19% of those who opposed nuclear power did so because of concerns over pollution damage. The Harris data (see Tables 4.1 and 4.2) indicate a slight (3% to 6%) decline in concern over nuclear power pollution from 1975 to 1976, while the Harris "major problems" findings show a 3% increase in concern over thermal pollution and a 7% increase in concern over air pollution (see Table 4.3). The Cambridge data (see Table 4.1) are interpreted as showing no differences from 1975 to 1976. The largest changes in perceptions regarding pollution were from nuclear plant neighbors (see Tables 4.2 and 4.3). Nuclear plant neighbors seem less concerned about pollution, especially thermal pollution, in 1976 than in 1975.

Satisfaction with present energy production methods has remained a reason for opposing nuclear power since 1960. Other reasons for opposing nuclear power appeared in 1975 and have remained fairly stable through 1976. These include the feeling that other methods should be developed instead; the belief that scientists don't know enough about nuclear power; and worries about safeguards, sabotage, or terrorism.

The Harris (75/4, 76/7) "major problems" questions showed an interesting pattern of change from 1975 to 1976 (see Table 4.3). Seven purported problems were presented in both the 1975 and the 1976 surveys. Each of these issues was considered to be a major problem by a larger percentage of the public in 1976 than in 1975. In contrast, six out of the seven issues were perceived to be major problems by a smaller percentage of nuclear plant neighbors in 1976 than in 1975.

4.2.2.5 Demographic relationships. Cambridge (76/4) provided data on demographic differences in response patterns of reasons for opposing nuclear power. Very few differences were found with regard to sex, although, among those who oppose nuclear power, a higher percentage of

males than females (19% versus 11%) say that nuclear plants are not safe yet. Only one age difference is apparent--43% of those over 65 are more likely to respond with "dangerous, unsafe, or risky," while approximately 30% of all other age groups give this reason. Two major differences are seen with regard to education. First, "not safe enough yet" responses are positively associated with education--only 3% of those having had some grade school give this response while 41% of those with graduate school education who oppose nuclear power give this response. Second, those with technical/vocational training that oppose nuclear power are most likely (49%) to cite "danger, unsafe, or risky" as a reason for opposition; those with graduate school education are least likely (17%) to cite this reason; and all other educational groups are in between (about 30% $\pm$ 5%).

4.2.3 Arguments for Nuclear Power

4.2.3.1 Reasons for favoring nuclear power. The reasons usually given for favoring nuclear power center around nuclear power as a good and needed energy source, the economics of nuclear power, the belief that nuclear power conserves other resources, and the belief that nuclear power produces clean energy or is less polluting than other energy sources (see Table 4.6). None of these reasons has been consistently cited as the main reason for favoring nuclear power.

A majority (51%) of Sindlinger's (60/6) respondents who favored nuclear power believed that atomic power should be used to provide electricity because it would provide cheaper electricity. The next most cited reason was given by the 19% who felt that nuclear power enabled the United States to develop atomic energy for peaceful purposes. The other three reasons mentioned were that nuclear power conserves other resources (15%), that it represents progress (11%), and that it is available where other sources are not (10%).

In 1973, however, after environmental awareness had begun to grow and before the Arab oil embargo, Becker (73/6) found that the main

TABLE 4.6

REASONS FOR FAVORING NUCLEAR POWER

Response	Sindlinger (60/6)	Becker (73/6)	NORC (74/5)	Harris		Cambridge						
Percent of Total Favoring	64%	56%	80%	(75/4) 63%	(76/7) 61%	(75/5) 45%	(75/8) 53%	(75/12) 46%	(76/4) 47%	(76/7) 49%	(76/10) 48%	(76/12) 52%
<u>Energy source</u>												
1. Available where others aren't	10		64									
2. Conserves other resources	15	4	75				9	5	4	4	6	1
3. Other sources depleted						13			7	5	2	4
4. Helps to solve energy crisis; need more power				33	30	16	21	25	23	22	29	33
5. Better or good source; source of future				21	15	20	15	8	7	9	7	5
6. Energy independence				14	11	5	4	4	4	6	3	2
7. Unlimited, abundant fuel supply				13	10							
8. Inevitable, no alternative					7							
9. Necessary until other sources developed												
10. Good until solar is ready					2	3	1	1	1	1	1	
<u>Economics</u>												
11. Cheap(er) electricity	51	11	50	29	24	19	21	22	20	16	15	14
12. Provides jobs		4		3	3				4	3		3
13. Promotes industry		1										
<u>Other</u>												
14. It's safe; safe system		16		5	7	7	4	4	9	4	6	8
15. Clean energy, less pollution		21		17	13		8	14	6	7	5	3
16. Atomic energy for peace	19		42									
17. Greater efficiency, more power		19		8	10							
18. Represents scientific progress	11	8	36								4	2
19. Favor, if safe and controlled				6	10					4	4	3
20. Already have some; inevitable									6	4	5	8
21. General approval		18										
22. Other		12		5	8				6	10	11	9
23. Don't know	7	4							2	4	2	4
24. Other/Don't know						17	17	17				

NOTE: See Table 4.1 for exact question wording.

reason given for supporting nuclear power "in the area" was that it was a cleaner system that controls pollution (21%). This reason was closely followed by several others: 19% cited the belief that nuclear power was more efficient and more powerful, 18% gave general approval, 16% felt that nuclear power was a safe system, and 16% cited economic reasons (11% favored because of cheaper electricity, 4% believed that more jobs would result, and 1% felt that nuclear power promoted industry).

Since the Arab oil embargo, the main volunteered reason for favoring nuclear power has centered around the perception that nuclear power is a good source of needed energy (see Table 4.6). NORC (74/5), using structured response categories, found that most respondents favored nuclear power because it conserves other resources (75%) and is available where others are not (64%). These responses appear to reflect salient concerns of an American public that had recently experienced an oil embargo. Concerns less important at that time were the beliefs that nuclear power is cheaper (50%), that nuclear power allows the United States a chance to develop atomic energy for peace (42%), and that nuclear power represents progress (36%).

The Harris and Cambridge surveys conducted in 1975 and 1976 (see Table 4.6) found the same general trend. The majority of responses regarded the use of nuclear power for needed energy. The reason volunteered most often for favoring nuclear power was that we need more power (to help solve the energy crisis): on the average for 1975 and 1976, 32% of the Harris respondents and 24% of the Cambridge respondents gave this reason. Other reasons volunteered somewhat frequently by respondents were that nuclear power is a good source of energy or is a good source for the future, nuclear power helps to achieve energy independence, and that there is an abundant source of nuclear fuel.

As with NORC (74/5), both Harris and Cambridge found that the second major set of reasons for supporting nuclear power involved economic considerations. Averaging across the 1975 and 1976 surveys, Harris found that 27% favored nuclear power because it provided cheaper electricity; 18% of the Cambridge respondents gave this reason.

Harris and Cambridge found that the reasons volunteered next most often for favoring nuclear power involved pollution considerations. Averaging across the 1975 and 1976 surveys, Harris found that 15% favored nuclear power because it is perceived to be less polluting, and 6% of the Cambridge respondents gave this reason.

4.2.3.2 Advantages of nuclear power. Harris (75/4, 76/7) asked the total public and nuclear plant neighbors to name two or three main advantages of nuclear power (see Table 4.7). For the total public, on the average, the greatest perceived advantage was that nuclear power would be cheap (32%); the second most cited advantage was that nuclear power was clean or less polluting (25%); and the third main reason was the belief that there is an unlimited or abundant source of nuclear fuel (20%). If the energy source considerations (see Table 4.7) were combined and the economic considerations were combined, however, more of the public gave reasons for support involving energy source considerations.

The pattern of advantages given by nuclear plant neighbors was consistent with the public--an economic consideration was seen as the main advantage (41%), a clean energy reason closely followed (39%), and the unlimited or abundant source reason was third (16%). In general, though, nuclear plant neighbors placed about equal consideration on economic considerations and energy source considerations. Compared to the public, more nuclear plant neighbors volunteered as advantages the belief that nuclear power is less polluting than many of its alternatives and the belief that nuclear power is cheap.

4.2.3.3 Major advantages of nuclear power. Harris (75/4, 76/7) also presented to all respondents a set of structured questions to determine how advantageous 10 purported advantages of nuclear power were perceived to be (see Table 4.8). Since these findings confirm the findings discussed in 4.2.3.2, they will just be mentioned briefly. Relatively speaking, economic considerations and energy source considerations were seen as the main advantages of nuclear power. Nuclear

TABLE 4.7

ADVANTAGES OF NUCLEAR POWER

Response	Total Public		Harris	
	(75/4)	(76/7)	Nuclear Plant	Neighbors
	(75/4)	(76/7)	(75/4)	(76/7)
<u>Energy source</u>				
1. Unlimited supply, abundant source, reusable	21%	19%	15%	17%
2. Energy independence	11	10	16	11
3. Alternative to gas, oil, coal	8	8	5	7
4. We need energy; good source of energy	7	11	13	9
5. Helps save natural resources	5	4	4	8
<u>Economics</u>				
6. Cheap, produced more cheaply, less expensive to use	31	32	37	45
7. Cheaper in the long run	7	7	13	3
8. Would create jobs	4	3	7	3
<u>Other</u>				
9. Clean energy, less pollution than gas, oil, coal	25	24	36	42
10. More powerful, efficient; high output of energy	12	13	8	14
11. More reliable, dependable	2	4	4	9
12. Compact, self-contained; less storage space necessary	2	1	2	2
13. Could be built anywhere	*	*	1	1
14. It's available immediately	2	3	1	2
15. It's safer, not dangerous	1	2	4	5
16. Favor, if safe, properly controlled	2	3	3	2
17. Favor, if built away from populated areas	*	1	1	1
18. They will solve waste disposal problems	*	--	--	*
19. Progress; modern, advanced technology	2	2	2	4
20. None, no advantages	5	7	5	5
21. All other answers	4	5	6	3
22. Don't know	21	15	13	10

NOTE: "What do you feel are the two or three main advantages of nuclear power plants to produce electric power? Any others?"

*Less than 0.5%.

TABLE 4.8
MAJOR ADVANTAGES OF NUCLEAR POWER

Question	Harris					
	Total Public			Nuclear Plant Neighbors		
	75/4	76/7	Change	75/4	76/7	Change
<u>Energy source</u>						
1. Eventually, nuclear power plants using the same energy over and over again, eliminating any future shortage of energy to produce electric power	74%	71%	-3%	74%	73%	- 1%
2. Building more nuclear power plants to avoid a serious shortage of electric power in the country		71			74	
<u>Economics</u>						
3. Having nuclear power plants which produce cheaper electric power	79	77	-2	82	79	- 4
4. Once constructed, nuclear power plants producing less expensive electricity	75	71	-4	75	73	- 2
5. Building nuclear power plants away from heavily residential areas and still bringing cheaper power to people where they live	72	68	-4	77	67	-10
6. A nuclear power plant attracting new industry to an area and creating more jobs	66	60	-6	69	62	- 7
7. Locating nuclear power plants in under-developed areas of the country where new industry can be built and new cities built	56	54	-2	62	56	- 4
<u>Other</u>						
8. Nuclear power plants operating more efficiently than other types of electric power plants	68	64	-4	72	72	0
9. Nuclear power plants being a major peaceful benefit from all the money this country has spent on atomic energy	65	59	-6	52	58	- 4
10. Nuclear power plants creating no pollution of the air and water, such as that created by electric power plants using oil or coal	63	62	-1	70	63	- 7

NOTE: Figures represent percentages of the total public or nuclear plant neighbors who felt that the listed advantage was a major advantage as compared to a minor advantage, no advantage at all, or were not sure. The advantages listed above were prefaced with "Now let me read you some other things that people have said are advantages to nuclear power."

power's advantage as a nonpolluting energy source followed. This was true both for the public and for nuclear plant neighbors; again, nuclear plant neighbors saw economic considerations as more of an advantage than did the public.

4.2.3.4 Trends over time. There were several trends over time in reasons for supporting nuclear power noted in 4.2.3.1. Here, we noted that the main reason for support in 1960 was the belief that nuclear power was cheap; the main reason for support in 1973 (after the rise in environmental awareness and before the Arab oil embargo) was the belief that nuclear power produced little pollution; and the main reason for supporting nuclear power since the oil embargo has been the belief that nuclear power is a good source of needed energy. In 1975 and 1976, however, when all respondents (not just nuclear supporters) were asked to consider the advantages of nuclear power, economic advantages were given more often than the belief that nuclear energy is a good source of needed energy.

There are also a few trends in 1975 and 1976 provided by Harris and Cambridge that are worth noting (see Table 4.6). With regard to the response category "helps to solve energy crisis; need more power," Harris found a decline from 33% to 30% ($p < .05$) in respondents volunteering those reasons for supporting nuclear power. Cambridge, however, found the opposite results (comparing averaged data for 1975 and 1976): the average number of respondents volunteering that reason for supporting nuclear power increased from 21% in 1975 to 27% in 1976 ($p < .001$). Harris found a significant decline ($p < .001$) in the volunteered response "better or good source; source of future" which was corroborated by Cambridge. The Harris decline ($p < .05$) in "energy independence" was not supported by Cambridge. Both Harris and Cambridge also gave evidence ($p < .05$) for a decline in those who favor nuclear power because it pollutes less than alternative sources.

However, when viewing the total public who listed advantages of nuclear power (see Table 4.7) rather than just those who favor nuclear power, these changes are not found. None of the volunteered main

advantages of nuclear power changed from 1975 to 1976, except for the significant ($p < .001$) increase from 7% in 1975 to 11% in 1976 in those listing "we need energy; good source of energy" as an advantage of nuclear power.

The structured "major advantage" questions of Harris (see Table 4.8) provide data that suggest a small overall decline in the perceived advantages of nuclear power. For all of the questions save one, fewer of both the total public and nuclear plant neighbors rated the purported advantages as a "major" advantage in 1976 compared to 1975. Also, 7% of the total public in 1976, compared to 5% in 1975, said that there were no advantages to nuclear power. Although substantively small, this change is significant ($p < .001$). These changes are partially supported by the structured "major problem" findings presented in 4.2.2.3. As discussed earlier, more of the total public rated the purported problems as "major" problems in 1976 than in 1975, although the opposite held for nuclear plant neighbors.

In summary, the main reasons for favoring nuclear power have involved the low perceived cost of nuclear power, the comparatively nonpolluting effect of nuclear power, and the need for nuclear power as an energy source. The single most important reason for supporting nuclear power has changed from 1960 to 1976. In 1960, the reason volunteered most often in support of nuclear power was that it was seen as a cheap source of energy. In 1973, the reason volunteered most often in support of nuclear power was that it was seen as a clean source of energy. Since the oil embargo, the reason volunteered most often in support of nuclear power has involved the perceived need for energy. Even though the major reason for supporting nuclear power has changed, in 1975 and 1976 the main advantage of nuclear power as perceived by the total public was that nuclear power was cheaper.

4.2.3.5 Demographic relationships. Cambridge (76/4) provided demographic breakdowns on volunteered reasons for supporting nuclear power. The only major difference between the sexes on cited reasons for supporting nuclear power is on the need for power--29% of the women give

this reason, whereas only 20% of the men make this response. There appears to be no association between age and the percentage of those citing a specific reason for support. Income breakdowns show one interesting difference. Here, about 25% of those earning less than \$10,000 and 23% of those earning more than \$15,000 cite cheap electricity as a reason for support, whereas only about 10% of those between these income levels give this reason for support. On this same variable, 12% of those in the Pacific states cite cheap electricity as a reason for support, while 17% in the Central states, 17% in the Industrial states, 20% in the Midlands, and 28% in the South and in the Northeast cite this reason for nuclear support. A somewhat opposite relationship for areas of the country is seen with regard to citing a need for power: the Pacific states perceive the greatest need for power (34%); the Midland states perceive the least need for power (14%), and the other four areas fall in the middle (22% to 24%). With regard to education, those with the most and those with the least education cite cheap electricity as a reason for support (approximately 22% to 24%), whereas approximately 15% of those with a high school or technical/vocational education give this reason. Finally, 4% of those with a graduate school education cite the need for power as a reason for support, while at least 20% of all other educational groups cite this reason.

4.2.4 Comparison of Arguments for and against Nuclear Power

In this section, a few interesting comparisons regarding arguments for and against nuclear power will be discussed. Of particular interest is the fact that many of the arguments for and against nuclear power reflect opposite human perceptions of a specific nuclear power issue. Perceptions of nuclear power economic considerations provide an example of an issue area where opposite beliefs about nuclear power have been held from the earliest survey to the present.

In 1960, Sindlinger (60/6) found that 51% of those who favored nuclear power did so because they believed that nuclear power was

cheaper, while 13% of those who opposed nuclear power did so because they believed that nuclear power was too expensive. Five percent of those who opposed did so because they believed that unemployment would result. The percentages of those who favored and those who opposed nuclear power and cited economic reasons (i.e., both cost and employment factors) are, respectively: Becker (73/6), 16% and 5%; NORC (74/5), 50% and 43%; Harris (75/4), 32% and 11%; Harris (76/7), 27% and 5%; Cambridge (the average for the 1975 surveys), 21% and 7%; and Cambridge (the average for the 1976 surveys), 19% and 6%. Also, 42% of the total public in 1975 and 42% in 1976 listed economic advantages of nuclear power, while 15% in 1975 and 16% in 1976 listed economic disadvantages (Harris, 75/4, 76/7). Thus, although more people felt that nuclear power provides an economic advantage, there was a small but important segment of the public that felt that nuclear power is uneconomical.

Pollution provides another important example of opposing perceptions on the same issue. In Becker (73/6), 21% of those who favored nuclear power did so because of the belief that it is clean energy, while 19% of those who opposed did so because of worries about pollution damage. Much the same pattern of responses holds for the reasons volunteered in the Harris and Cambridge surveys for support or opposition (see Tables 4.1 and 4.6) and for the advantages and disadvantages volunteered in the Harris surveys (see Tables 4.2 and 4.7). On the average, 25% of the Harris respondents volunteered the belief that nuclear power is a clean form of energy, while 20% of the respondents volunteered the belief that nuclear power causes pollution damage.

To a lesser degree, these types of opposing perceptions are also found with regard to other issue areas. Whereas some sort of danger was most often cited as a disadvantage or reason for opposing nuclear power, from 4% to 16% of the respondents believed that the safety of nuclear plants was a reason for supporting nuclear power (see Table 4.6) from 1973 through 1976, although only 1.5% of the total public (Harris, 75/4, 76/7) volunteered as a main advantage of nuclear power that "it is safer" or "it is not dangerous." We also note that waste disposal has become an important issue when a few (less than 0.5%) of the Harris respondents

volunteered "they will solve waste disposal problems: as a main advantage of nuclear power. Similarly, Harris (75/4, 76/7) found that about 16% of the respondents believed that nuclear power is more efficient and reliable than other sources, while 1% felt that nuclear power is inefficient or breaks down; about 7% felt that we lack technical knowledge to build nuclear power plants, while about 3% volunteered that nuclear power is available immediately; and finally, about 6% volunteered that nuclear power has no advantages, while about 9% volunteered that nuclear power has no disadvantages.

4.2.5 Summary

To help summarize this section, it is interesting first to note Becker's (73/6, 74/5) findings, presented in Section 3.3.1, which showed that 60% of the respondents said that they knew "only a little" or "nothing" about nuclear power, while only about 10% said that they had heard "a great deal." Despite this seeming lack of knowledge about nuclear power, Harris (75/4, 76/7) found that only about 24% of the respondents could not volunteer any disadvantage of nuclear power and only about 18% of the respondents could not volunteer any advantage of nuclear power. For those that had a pro or con attitude toward nuclear power, the Harris surveys found that all of the respondents were able to offer a reason. These findings suggest two conclusions. First, the respondents who do not have a pro or con attitude about nuclear power appear to be able to list fewer advantages or disadvantages of nuclear power than those who have a pro or con attitude. Second, although many of the respondents with a pro or con attitude profess to know very little about nuclear power, they are capable of giving at least one reason for their position. This implies that the little information that they have received about nuclear power is in terms of advantages and disadvantages rather than layperson-oriented technical information.

The major disadvantages of nuclear power and reasons for opposing nuclear power include safety and health concerns, waste disposal problems, and lack of perceived need for the power. Opposition is also

voiced because of pollution damage and economic problems. The main advantages of, or reasons for supporting, nuclear power center around economic arguments (provides cheap electricity; provides employment) and the beliefs that nuclear power pollutes less than other energy sources and that it is a needed source of energy.

4.3 Safety

As discussed in Section 4.2, the major concern of the public with regard to nuclear power relates to safety and health dangers. The distinction between safety concerns and health concerns is often hard to make, although some questions specifically use the words safety or health. In general, questions are classified as safety-related if they use the term safety or if the questions refer to acute, unanticipated problems such as an accident or an explosion. Questions are classified as health-related if the term health is used or if the danger is long-term, such as the danger from long-term releases of small amounts of radioactivity. Safety is discussed first because, given this distinction, most of the survey questions relate to safety.

4.3.1 General Safety Questions

4.3.1.1 Safety of a nuclear power plant. Harris (75/4, 76/7) asked a structured general safety question and found that over 60% of the respondents felt that nuclear power plants are safe, and about 20% felt that they are not safe (see Table 4.9). The safety of nuclear plants was trusted significantly more ($p < .001$) by nuclear plant neighbors than by the general public, with about 75% of the nuclear neighbors believing in the safety of nuclear power plants. The responses were biased in favor of nuclear safety, since two of the three response categories referred to nuclear power as safe. In fact, 5% to 7% of the total public volunteered the answer "dangerous" to this question.

TABLE 4.9
NUCLEAR POWER PLANT SAFETY

Response	Total Public		Harris ^a Nuclear Plant Neighbors		Bardsley ^b		
	(75/4)	(76/7)	(75/4)	(76/7)	(WA 76/8)	(OR 76/8)	(OR 76/12)
Very safe (not dangerous)	26%	25%	35%	42%	38%	37%	44%
Somewhat safe	38	38	38	34			
Not so safe	13	16	12	13			
Dangerous ^c	5	7	7	3	47	51	47
Not sure (undecided)	18	14	8	8	15	12	9

^a"All in all, from what you have heard or read, how safe do you think nuclear power plants that produce electric power are--very safe, somewhat safe, or not so safe?"

^b"Nuclear power plants are dangerous." Responses: agree, disagree, undecided.

^cHarris respondents volunteered this response, while it was structured for the Bardsley respondents.

Perhaps using balanced response categories (e.g., very safe, somewhat safe, somewhat unsafe, and very unsafe) would eliminate the need for voluntary answers and provide a more accurate measure of how the public perceives nuclear power safety.

There were three demographic findings with regard to this safety question that were consistent between Harris (75/4) and Harris (76/7). First, men were significantly more likely than women ($p < .001$) to say that nuclear power plants are safe (approximately 72% versus 56%). Second, there was a positive linear relationship between education and percentage of respondents feeling that nuclear power plants are safe. Third, the West was significantly more likely to feel that nuclear power is safe ($p < .05$) than was the East. The Midwestern and the Southern safety attitudes fall in between these two extremes. The demographic patterns are consistent with the findings reported in Section 3.2 indicating that those groups which support nuclear power also believe in the safety of nuclear power.

After determining whether a respondent felt that nuclear power plants were safe or unsafe, Harris (75/4, 76/7) asked respondents why they felt that way (see Tables 4.10 and 4.11). The main reason for believing that nuclear power plants are safe, offered on the average by 14% of the total public and 24% of the nuclear plant neighbors, was that a respondent had not heard of any accidents (the safety record is good). Belief in precautions and safety efforts, confidence in people associated with nuclear power, the belief that they would not be built if they were not safe, lack of worry, and the fact that some respondents had heard or read that they are safe follow closely as reasons for believing in the safety of nuclear power.

TABLE 4.10

REASONS WHY NUCLEAR PLANTS ARE FELT TO BE SAFE

Why Nuclear Plants Are Safe	Harris			
	Total Public		Nuclear Plant Neighbors	
	(75/4)	(76/7)	(75/4)	(76/7)
1. Haven't heard of any accidents; record of plants is good	12%	15%	24%	24%
2. There are many precautions, efforts to keep them safe	8	7	15	13
3. I have confidence in people, scientists who work on them	8	6	6	10
4. They wouldn't be built if not safe; they must be safe	7	4	5	4
5. I just feel they be safe; not worried	6	4	2	4
6. I've read, heard they are safe	6	6	3	5
7. They're safe as long as handled properly; as long as constant precautions are taken	4	4	5	2
8. No fumes; don't pollute	1	1	4	3
9. I, relative, friend work(ed) in nuclear plant	1	1	3	2
10. The only problem is waste disposal; fish kill	1	1	1	1
11. They must conform to government (AEC) regulations and controls	--	3	--	5
12. They are improving, getting safer all the time	--	3	--	1
13. I live near one	*	1	7	7
14. I don't believe arguments/groups against the safety of nuclear power plants	--	1	--	*
15. All other reasons why safe	2	5	4	5

NOTE: Asked only of respondents who felt that nuclear power plants were very safe or somewhat safe.

*Less than 0.5%.

TABLE 4.11

REASONS WHY NUCLEAR PLANTS ARE FELT TO BE UNSAFE

Why Nuclear Plants Are Unsafe	Harris			
	Total Public		Nuclear Plant Neighbors	
	(75/4)	(76/7)	(75/4)	(76/7)
1. Don't know all of the consequences, how safe or dangerous it is; need more research	11%	9%	4%	3%
2. Danger of radiation, leakage	10	7	8	9
3. Danger of explosions, accidents, breakdowns	8	7	12	8
4. It's dangerous, unsafe	6	7	2	2
5. Nothing is foolproof; always chance of human error	6	5	3	8
6. Bad for environment; causes pollution	4	3	4	4
7. Have read, heard about problems, dangers, etc.	4	5	3	4
8. Problems with radioactive wastes	3	4	5	4
9. Thermal pollution	3	1	4	2
10. Danger of sabotage	2	2	3	1
11. They don't take proper precautions	2	--	1	--
12. It's like an atomic bomb	1	1	2	1
13. They won't tell us if something goes wrong	1	1	1	*
14. Have had problems in plants around here	*	*	2	*
15. They are built in wrong places/San Andreas fault danger of earthquakes	--	1	--	1
16. All other reasons why unsafe	2	4	*	4

NOTE: Asked only of respondents who felt that nuclear power plants were not so safe or dangerous.

The reason volunteered most often as to why the public felt that nuclear power plants are unsafe was, interestingly enough, related to uncertainty about danger rather than to a specific danger. On the average, 10% of the respondents felt that nuclear plants were unsafe because all of the consequences are not known; 8.5% of the responses related to danger of radiation and radiation leaks; 7.5% related to danger from explosions, accidents, and breakdowns; and 6.5% of the respondents believed that nothing involving humans is foolproof (thus, something will go wrong). On the other hand, nuclear plant neighbors were most concerned about safety regarding the danger from explosions, accidents, or breakdowns (10%) and less concerned about uncertainty of consequences (3.5%).

As expected, opposite perceptions on the same issue were held by individuals who differed on their safety evaluation of nuclear power. While the major reason for believing in the safety of nuclear power was a perceived good safety record, 4.5% of those who felt that nuclear power was unsafe felt that way because they had read or heard about safety problems, 3.5% cited problems with radioactive wastes, and less than 0.5% refer to problems that have occurred in nearby plants.

Cambridge (76/4) asked respondents to agree or disagree with the statement "No one would be foolish enough to build nuclear power plants if they were really that dangerous." Fifty-two percent of the total public agreed with this statement, while 12% disagreed and 36% didn't know. This question appears to be biased toward a "safe" response. To believe that a nuclear power plant was "that" dangerous and to express that belief, a respondent was required to agree that certain people, who were normally perceived to be responsible individuals, were acting foolishly in building nuclear power plants. The 36% "don't know" category, much higher than that reported by Harris (75/4, 76/7), reinforces this interpretation.

As with the Harris data discussed above, Cambridge (76/4) found that men were significantly ($p < .05$) more likely to agree with this statement than women. However, no relationships between perceived

safety and education or between perceived safety and area of the country were found. Also, 72% of those who favor the construction of more nuclear power plants agree with the above statement, 28% of those who oppose construction agree with the statement, and 43% of those who don't know about more construction agree.

Bardsley (WA 76/8, OR 76/8, OR 76/12) found responses somewhat discrepant with Harris (75/4, 76/7) and Cambridge (76/4) (see Table 4.7). In the three Pacific Northwest surveys, from 47% to 51% of the respondents agreed and from 37% to 44% disagreed with the statement, "Nuclear power plants are dangerous." An interesting pre- and postinitiative difference should be noted. Before the Oregon initiative vote, 51% believed "dangerous" and 37% believed "not dangerous"; after the initiative, 47% believed "dangerous" (a significant decrease, $p < .05$) and 44% believed "not dangerous" (a significant increase, $p < .001$).

Iowa (IA 76/4) asked, "There are about 60 nuclear power generating plants in the United States today. How confident are you of the safety of nuclear power plants?" Of the 600 respondents, 22% were very confident (33% of the men, 13% of the women), 37% were somewhat confident (33% of the men, 41% of the women), 19% were not confident at all (16% of the men, 21% of the women), and 22% did not know (18% of the men, 25% of the women). Men were significantly ($p < .001$) more confident than were women in the safety of nuclear power plants. Again, the response categories are biased in favor of a "confident" response.

What can be said about the beliefs of the American public on the general safety of nuclear power plants? Unfortunately, the Harris, Cambridge, and Iowa questions or response formats seem to be biased toward a favorable safety response--all of these studies show a majority of the public believing in the safety of nuclear power plants. Response to Bardsley's "Nuclear power plants are dangerous" showed a plurality or majority of agreement. If there is response bias in favor of agreement to an item, this question may slightly underestimate perceived plant safety. These data are only from two states, also, and generalizations

are limited. Our conclusion is that the public at this time may be fairly evenly split with regard to the reactor safety issue.

4.3.1.2 Safety and power plant proximity. The earliest question asked in this category was by ORC (Indian Point 60/6), which posed a safety question about the proposed Indian Point plant, "Do you feel there might be any danger to the community or to you personally from this plant?" Twelve percent said "yes," 57% said "no," and 31% were undecided. College-educated males were the most likely demographic group to perceive no danger. The percentage of those who felt that there might be danger is much lower than for more recent surveys.

For example, Roper (73/10, 74/10, 75/10, 76/10) asked respondents whether a plant nearby would be (completely) safe or whether it would present (some) danger (see Table 4.12 for exact question wording). More respondents felt that some danger would exist (averaging 43%) than felt that nuclear power was (completely) safe (averaging 37%). The question wording probably biases a "danger" response, since some respondents may consider that some danger may exist, but that the amount of danger (risk) is acceptable. This acceptable risk consideration is supported by the Harris (75/4, 76/7) finding that approximately 10% more of the general public felt that building more nuclear power plants was a risk worth taking, if the government is satisfied on inspection that an accidental explosion is unlikely to happen, than simply favored the construction of more nuclear power plants.

Bardsley (OR 68/1, OR 69/6, OR 75/7) collected some interesting data on safety and plant proximity that clearly emphasize the large impact that subtle wording differences can have on response patterns (see Table 4.13). When Bardsley asked respondents in 1968, 1969, and 1970 how concerned they would be over their own safety if a plant were built nearby, from 9% to 15% indicated that they would be "very concerned." The question in Bardsley (OR 75/7), however, asked about concern over safety (which would include the safety of others). Here, 44% indicated that they would be "very concerned." Although some of this difference may be due

to the increased salience of nuclear safety as a public issue from 1970 to 1975, much of the difference is probably due to the wording change. One interpretation is that some people, at least, worry more about the safety of others than worry about their own safety. A Battelle (76) study lends some support to this conclusion. Here, long-term safety regarding waste disposal was perceived to be a more important criterion for waste planning than was short-term safety. Thus, the safety of future generations was judged to be more important than the safety of present generations. Also, concern is sometimes expressed over the safety of those who work in nuclear power plants (see Table 4.2 and Section 4.3.4), which lends a little more support to the interpretation.

TABLE 4.12
PERCEIVED ATOMIC POWER PLANT SAFETY
AS A FUNCTION OF THE OBJECT OF CONCERN

Response	Bardsley			
	(OR 68/1) ^a	(OR 69/6) ^a	(OR 70) ^{a,b}	(OR 75/7) ^c
Very concerned	9%	15%	14%	44%
Quite concerned	18	18	16	19
Not too concerned	35	25	32	24
Not concerned at all	33	34	33	12
Undecided	5	8	5	1

^a"If an atomic power plant were built in your general area, how concerned would you be over your safety?"

^bReported in Bardsley (OR 75/7).

^c"If an atomic power plant were built in your general area, how concerned would you be over safety?"

A second interpretation, however, is less altruistic. Worry over one's own safety must be compared to worry about the safety of all the others. It is much more probable that "someone" may be injured than it is probable that the respondent himself (herself) would be injured. Therefore, the high expressed concern for others' safety may simply reflect the higher perceived probability that "someone," rather than just "I," could get hurt.

TABLE 4.13
POWER PLANT SAFETY AND PLANT PROXIMITY

Response	Roper			
	(73/10)	74/10)	75/10)	76/10)
Safe	36%	37%	42%	33%
Would present dangers	41	41	43	46
Don't know	23	22	15	21

NOTE: "There are differences of opinion about how safe atomic energy plants are. Some people say that they are completely safe, while others say that they present dangers and hazards. How do you feel--that it would be safe to have an atomic energy plant someplace near here, or that it would present dangers?"

More support for this hypothesis was provided by Roper (see Table 4.13) who asked, "How do you feel--that it would be safe to have an atomic energy plant someplace near here, or that it would present dangers?" In each of the four surveys, from 1% to 13% more respondents felt that the plant would present dangers than felt that the plant would be safe. The danger does not refer specifically to the respondent, and the response pattern is more like the Bardsley "general safety" responses than the "own safety" responses.

4.3.1.3 Miscellaneous safety questions. IGA (Sacramento 76/6) posed this attitude item to their sample of Sacramento voters, "Nuclear power is dangerous and a serious threat to life and the environment." Of the sample of 597 voters, 12% strongly agreed, 21% agreed, 23% neither agreed nor disagreed, 31% disagreed, and 12% strongly disagreed. The response pattern here appeared to show less worry about safety than the Bardsley (OR 75/5) or the Roper questions. This appears to be a function of the word "serious" in the IGA question.

A safety question regarding power plant insurance was asked by PubResp (AZ 76/9) two months before the Arizona nuclear initiative vote. They found that 36% of their 885 Arizona respondents agreed with the statement, "If nuclear power plants were entirely safe, insurance companies would be willing to completely insure them against nuclear accident."

Just after the California nuclear initiatives vote, IGA (Sacramento 76/6) asked Sacramento voters to agree or disagree with, "Nuclear power plants are safe enough with present regulations." Three percent strongly agreed, 29% agreed, 29% neither agreed nor disagreed, 24% disagreed, and 15% strongly disagreed.

4.3.2 Accidents and Explosions

4.3.2.1 Accidents. As discussed in 4.2, nuclear plant accidents were the volunteered concern of many respondents. Specific questions regarding the danger of accidents were asked of the general public by Harris (75/4) and Cambridge (75/5, 76/4, 76/10) (see Table 4.14). Cambridge consistently found that about 40% of the public felt that there was a great danger of accidents, while about 40% felt that there was not a great danger of accidents. A special subsample of California residents in the Cambridge (76/4) study showed that, two months before the California nuclear initiative vote, California residents felt that nuclear power was safer than did the total U.S. population: 32% saw a great danger of accidents, 52% did not, and 16% did not know.

TABLE 4.14
SAFETY REGARDING ACCIDENTS

Response	Harris ^a	Cambridge ^b		
	(75/4)	(75/5)	(76/4)	(76/10)
Completely true (Safe)	26%	39%	37%	40%
Partly true	24			
Partly untrue	11			
Completely untrue (Unsafe)	8	42	41	42
Don't know	31	19	23	18

^a"The probability of a nuclear power plant accident is less likely than being hit by a bolt of lightning. Responses: completely true, partly true, partly untrue, completely untrue, and don't know."

^b"Nuclear power is unsafe with great danger of accidents. Responses: agree, disagree, and don't know."

Certain demographic differences are consistent in the Cambridge (75/5, 76/4, 76/10) data. Combining the three surveys, about 46% of the women and 36% of the men agreed with the statement "Nuclear power is unsafe with great danger of accidents." Agreement with this statement decreased as a function of increasing income. Collapsing across surveys and combining some income groups, we find that 48% of those earning less than \$10,000 agreed with the statement, 41% of those earning between \$10,000 and \$15,000 agreed with the statement, and 35% of those earning over \$15,000 agreed with the statement. A similar pattern was found for educational level: 46% of those with less than a high school education agreed, 40% of those with a high school or technical/vocational education agreed, and 36% of those with at least some college agreed. Interestingly enough, however, there was no difference in agreement with this question when nuclear plant proximity was considered: about 42% each of those not living near a nuclear plant, of those living near a nuclear plant, and of those living near the site of a potential plant agreed with this statement.

Although the American public believed that accidents could occur, they evidently believed such accidents are quite unlikely. Harris (75/4) found that exactly 50% of the adult public (see Table 4.12) believed that a power plant accident is less likely than being hit by a bolt of lightning, while 19% believed that an accident is more likely than being hit by a bolt of lightning. However, 31% of the public was not able to make a judgment on the probability.

4.3.2.2 Nuclear power plant explosions. Questions have also been asked to determine the public's feeling about the probability of nuclear power plant explosions (see Table 4.15). The earliest structured question about explosions was asked by Becker (73/6). Here, 37% of the respondents felt that there was some danger from a possible "atomic explosion" from a nuclear power plant, while 37% felt that there was no danger. Harris (75/4) found that 39% of the respondents felt that a nuclear plant could be subject to a "massive nuclear explosion," while 24% did not think that the plant could explode.

TABLE 4.15
SAFETY REGARDING EXPLOSIONS

Response	Becker ^a	Harris ^b	Cambridge ^c		
	(73/6)	(75/4)	(75/5)	(76/4)	(76/10)
Strongly agree (Agree)	13%	17%	14%	12%	12%
Agree but not strongly	24	22			
Disagree but not strongly	19	9			
Strongly disagree (Disagree)	18	15	67	64	67
No opinion (Don't know)	26	37	19	25	21

^a"Nuclear plants are safe. There is no danger from an atomic explosion. Responses: strongly agree through strongly disagree, don't know."

^b"A nuclear power plant can fail and the nuclear materials can come together to cause a massive nuclear explosion. Responses: completely true (recoded above as strongly agree) through completely untrue (recoded above as strongly disagree), don't know."

^c"There is absolutely no danger that a nuclear power plant would blow up. Responses: agree, disagree, don't know."

Cambridge (75/4, 76/4, 76/10), using a more strongly worded question, found that an average of 66% of the respondents felt that there was at least some danger of a power plant blowing up, while 13% felt that there was "absolutely no danger" that a plant could explode (see Table 4.15). The same question, posed by Cambridge (76/4) to California residents two months before their vote on the nuclear initiative, found essentially the same results: 63% believed an explosion could occur and 14% did not believe an explosion could occur.

Since the Harris (75/4) and Cambridge (75/5) data were collected only one month apart, the difference in the number of respondents who believed that an explosion could occur is most likely due to differences in wording. Nevertheless, a large number of individuals, from about 40% to 70%, believed that a nuclear power plant could explode. What kind of explosion was the public thinking about? The Becker (73/6) and Harris (75/4) question strongly suggested an "atomic bomb" type of explosion--

the type of explosion that is acknowledged by nuclear scientists to be technically impossible. The Cambridge question, however, was more general about the type of explosion. A steam explosion following a major loss-of-coolant accident can occur and could be included by the Cambridge question.

It is likely, however, that many respondents still believed that a nuclear power plant can explode like an atomic bomb. This interpretation is supported by state survey data provided by Nordhaus (MI 73/5). Here, 34% of the sample responded that it was "very, somewhat, or probably likely" to the question, "Do you personally think a nuclear power plant could explode like a bomb?"

The Cambridge (75/5, 76/4, 76/10) data, when averaged, reinforced some of the demographic differences discussed on the safety question in 4.3.3.1. About 68% of the women and 64% of the men felt that a nuclear power plant could blow up. Although not large, this difference is statistically significant ($p < .01$). There was no difference among income groups. Educational groups showed some response differences: 61% of those with less than a high school education, 67% of those with a high school or technical/vocational education, and 69% of those with at least some college felt that a nuclear power plant could blow up. The differences between the lowest educational level and the other two levels is statistically significant ($p < .05$). Younger individuals were more likely to believe that a nuclear power plant could blow up: 70% of those between 18 and 35 held this belief, 64% of those between 35 and 55 held this belief, and 61% of those over 55 believed that a plant could explode.

4.3.3 Worker Safety

About 1% of the Harris (75/4, 76/7) respondents volunteered power plant worker safety as a disadvantage of nuclear power. In a structured question designed to assess this exact concern, Sindlinger (60/6) found

that 49% of the respondents agreed and 31% disagreed that "Working in an atomic plant is as safe as working in any other plant." NORC (74/5), 14 years later, found that 60% of the respondents agreed and 40% disagreed with the statement, "Working in an electric plant fueled by nuclear energy is as safe as working in any other plant."

There does not appear to be any major change over time in the perception of this issue. If the 20% who didn't have an opinion on the Sindlinger (60/6) question were forced to agree or disagree with the statement as NORC (74/5) required, and if those 20% split somewhat evenly, then the results would be very close to the NORC (74/5) findings.

4.3.4 Effects of the Safety Issues

The public's perception of power plant safety can have several effects. These effects have been probed by survey organizations using structured questions regarding respondents' willingness to live near a nuclear power plant, to build more plants, and to continue full operation of present plants.

4.3.4.1 Safety and willingness to live near a nuclear power plant.

Cambridge (75/5, 76/4) asked respondents to agree or disagree with the statement, "Nuclear power is safe enough; I would be willing to live near a nuclear power plant." In 1975, 39% of the respondents agreed with the statement, 47% disagreed, and 13% didn't know; in 1976, 41% of the respondents agreed with the statement, 40% disagreed, and 18% didn't know.

These data are very interesting in several respects. First, the 7% decrease in unwillingness to live near a plant was statistically significant ($p < .001$) and consistent with the decrease in "danger" reasons for opposing nuclear power reported by Cambridge for this same time period (see Table 4.1). Second, the 1975 Cambridge findings show that more people were unwilling to live near a nuclear plant than were willing to live near a nuclear plant. This is inconsistent with most of the other national findings from the regular "nuclear nearby" questions

discussed in Section 3.1, which found that more people were willing than unwilling to live near a nuclear plant [Gallup (76/6) was the only exception]. This seeming inconsistency was most likely due to the reference to safety in the Cambridge question, and it should be kept in mind that the Cambridge surveys consistently found less support for nuclear power than most other national surveys. Third, it is interesting to note how a special California subsample responded to this same question in Cambridge (76/4): 54% thought that nuclear plants are safe enough to live near and 35% didn't feel that way. In this comparison, at least, California residents were much more pronuclear than were United States respondents as a whole.

The demographic differences reported by Cambridge (75/5, 76/4) also followed the pattern of differences found for other safety questions. An average of 30% of the women and 52% of the men felt that nuclear plants were safe enough to live near, while 53% of the women and 36% of the men did not feel that way. With regard to income, 32% of those earning less than \$10,000 agreed that nuclear power plants are safe enough to live near, 44% earning between \$10,000 and \$15,000 agreed, and 49% of those earning over \$15,000 agreed. Older individuals were slightly more willing to agree with the statement than were younger individuals, but the finding was not consistent between the two surveys. Although there was no difference as to who was not willing to live near a plant, as a function of educational level, 34% of those with less than a high school education felt that nuclear plants are safe enough to live near, 42% of those with a high school or vocational/technical education agreed, and 48% of those with at least some college agreed. Those living close to a nuclear plant responded no differently to this question than those who did not live near a nuclear plant.

4.3.4.2 Construction of more nuclear power plants. Becker (73/6) and Cambridge (75/12) asked the only national survey questions regarding safety and the building of more nuclear power plants (see Table 4.16). Becker (73/6) found that 44% of the public did not believe that the possibility of a serious accident should halt power plant construction, while 38% of the public felt that the possibility of a serious accident

was enough to halt construction. Cambridge (75/12) found that 58% of the public felt that if there is even the slightest danger that nuclear power is unsafe, the U.S. should delay building nuclear power plants even if the delay means power shortages in 10 years. This difference in the concern for safety may be due to the fact that the question of nuclear safety became much more of a public issue from the middle of 1973 through the end of 1975. It could also be due to the difference in question wording--the Cambridge (75/12) question referred to "delay" whereas the Becker (73/6) question implied the complete end to power plant construction.

Very few differences among demographic groups were found in the Cambridge (75/12) data on delaying the building of nuclear power plants. The only clearly significant finding was with regard to those who favor or oppose the construction of more nuclear power plants. If there is even the slightest chance that nuclear power is unsafe, 82% of those who opposed the construction of more plants felt that the building of plants should be delayed even if it means power shortages in 10 years, 47% of those who favored the construction of more nuclear plants held this opinion, and 56% of those who didn't know about construction of more plants held this opinion.

The state surveys showed great response variability on this type of question (see Table 4.16). Oklahoma residents seemed hesitant to endorse forever halting construction of nuclear plants because of safety considerations: 46% felt that nuclear plants have a good enough safety record to warrant building more, while only 16% felt that "no more should be built in the future." However, a majority of Iowa respondents favored a temporary halt to construction: 57% felt that construction should stop until more research on plant safety is conducted (46% men and 67% women), while only 26% felt that construction should continue without delay (41% men and 13% women).

The Field (CA 76/5, CA 76/6) question also asked about delaying construction for further safety research, and respondents again showed a tendency to favor a delay. Here, 41% in May 1976 and 37% in June 1976

TABLE 4.16
EFFECTS OF SAFETY
ON NUCLEAR POWER PLANT CONSTRUCTION

Response	National Samples		State Samples			
	<u>Becker^a</u>	<u>Cambridge^b</u>	<u>Central^c</u>	<u>Iowa^d</u>	<u>Field^e</u>	
	(73/6)	(75/12)	(OK 76/3)	(IA 76/4)	(CA 76/5)	(CA 76/6)
Don't build	38%	58%	16%	57%	41%	46%
Build	44	21	46	26	41	37
Don't know	18	22	38	17	18	17

^a"Nuclear plants should not be built because of the possibility that a serious accident could result in death or injury to thousands of people within a hundred miles of here."

^b"If there is even the slightest danger that nuclear power is unsafe we should delay building the plants even if it means power shortages in 10 years."

^c"Some people say there is not enough proof that nuclear power plants are safe, and that no more should be built in the future. Others disagree, saying nuclear plants have an excellent safety record and that more should be built. Which way do you feel?"

^d"Which of these two statements best describes your feeling on nuclear power plant construction in Iowa? Construction of plants should stop while more research on plant safety is conducted."

^e"Do you think construction of more nuclear power plants should be continued under present federal and state safety regulations, or do you think new construction of nuclear power plants should stop until more research on nuclear safeguards is conducted?"

(preinitiative vote), felt that present federal and state safety regulations were good enough to continue construction; while 41% in May 1976 and 46% in June 1976, felt that construction should stop until more research on nuclear safeguards is conducted. We should note, however, that the Iowa (IA 76/4) survey found more respondents opposing rather than favoring the construction of nuclear power--a finding discrepant from most other surveys.

Two final questions were posed by PubResp (AZ 76/9), whose findings show that 60% of the Arizona respondents agreed with the statement, "We should go slow on building a nuclear power plant until all of the safety evidence is in." Only 41% of the respondents agreed with the statement, "Even if the energy crisis continues, I'm against the building of nuclear power plants as long as there is any serious question of their safety."

In all cases, the addition of a safety consideration with what would have otherwise been treated as a general pro/con nuclear attitude question decreased the support and increased the opposition to nuclear power. This is most clearly seen by examining the Cambridge (75/12) data. Cambridge (75/12) found that 46% of the sample generally favored the construction of more nuclear power plants while 23% generally opposed such construction. For the same respondents, however, if there was the slightest danger, 58% favored building delays even if it meant power shortages in 10 years, while only 21% did not favor the building delays.

The other main finding of interest is that, while a minority of respondents felt that nuclear power plants should never be built because of safety considerations, from a plurality to a majority of the respondents would endorse a slowing down or a delay in nuclear power plant construction because of safety considerations. Several of the questions specified that more safety research be conducted at that time.

4.3.4.3 Continued nuclear power plant operation. Safety considerations also affect perceptions about the operation of nuclear power plants that have already been built. While only 19% of the Becker

(73/6) respondents (see Table 4.17) said that they agree with Ralph Nader's position that nuclear power plants are unsafe and should be shut down immediately, 40% of the Gallup (76/6) respondents (a plurality) believed that present operations should be cut back until more stringent safety regulations are put into practice. The difference between answers is most likely due to the difference in completely shutting down plants compared to cutting back operations.

California respondents seem to favor nuclear power more than the general U.S. public. According to Field (CA 76/5, CA 76/6) and IGA (Sacramento 76/6), from 31% to 36% of California respondents believed that operations should be cut back, compared to Gallup's (76/6) 40% for the total public. Also, from 42% to 48% of California respondents believed that present safety regulations are strict enough to allow full nuclear power plant operation, compared to Gallup's (76/6) 34% for the total public.

In summary, a majority (57%) of the U.S. public in 1973 did not endorse the complete shutting down of operating plants. However, much like the willingness to delay construction, a plurality (40%) of the U.S. public was willing to cut back operations until more strict safety regulations could be put into practice. Unlike the U.S. public, however, a plurality of Californians in 1976 felt that present regulations were safe enough.

4.3.5 Past Safety Record

Structured questions have also been asked to determine how the American public perceives the past nuclear safety record. Becker (73/6) asked respondents to agree or disagree with "On the whole, the electric companies have done an excellent job of building and operating nuclear power plants and protecting the safety of the public." They found that 34% of the respondents strongly agreed, 33% agreed but not strongly, 6% disagreed but not strongly, 3% strongly disagreed, and 24% had no

TABLE 4.17

EFFECTS OF SAFETY ON THE OPERATION OF NUCLEAR POWER PLANTS

Response	National Surveys		State and Area Surveys		
	Becker ^a	Gallup ^b	Field ^c		IGA ^d
	(73/6)	(76/6)	(CA 76/5)	(CA 76/6)	(Sacramento 76/6)
Strongly agree (should cut back)	8%	40%	36%	31%	13%
Agree but not strongly	11				23
Neither agree nor disagree					23
Disagree but not strongly	26				33
Strongly disagree (safe enough)	31	34	42	48	9
No opinion	24	26	22	21	

^a"Ralph Nader is right when he says that nuclear plants are unsafe and that all of them should be shut down immediately."

^b"Do you feel that nuclear power plants operating today are safe enough with the present safety regulations, or do you feel that their operations should be cut back until more strict regulations can be put into practice?"

^c"Do you feel that nuclear power plants operating today are safe enough with the present safety regulations, or do you feel that their operations should be cut back until more strict safety regulations can be put into practice?"

^d"Nuclear power plant operation should be cut back until more strict safety regulations exist."

opinion. Thus, in 1973, a majority of the American public perceived the nuclear safety record as good to excellent.

Although this type of question was not asked in subsequent national surveys, Bardsley (WA 76/8, OR 76/8, OR 76/12), in three state surveys, asked respondents to agree or disagree with "Nuclear plants have an outstanding safety record." For Bardsley (WA 76/8), 52% of the respondents agreed, 27% disagreed, and 21% were undecided. The Oregon surveys found much the same results, although an interesting pre- and post-initiative change was found. Before the initiative, Bardsley (OR 76/8) found that 51% agreed, 30% disagreed, and 19% were uncertain about the above statement; after the initiative, Bardsley (OR 76/12) found that 52% agreed (a nonsignificant increase), 36% disagreed (a change significant at $p < .001$), and 12% were undecided (the increase probably, but not necessarily, came from this group). It is interesting to note that this 12% "undecided" group is significantly smaller than the 24%, 21%, and 19% figures cited for the other three studies.

4.3.6 Solving the Safety Issues

Who can solve the safety problems? Although no data pertinent to this question were gathered before the nuclear initiative votes in 1976, two postinitiative findings indicate that, after the safety issue was publicly aired over the media, the Californians--as well as the total American public--look to nuclear safety experts and technology to handle the safety issue.

IGA (Sacramento 76/6), in a mail-in survey of Sacramento-area residents who had voted on the ballot on which the nuclear initiative was placed, asked respondents to agree or disagree with "[The] public ought to be guided by experts on nuclear safety." Of the 595 respondents who answered the question, 16% strongly agreed, 52% agreed, 23% neither agreed nor disagreed, 7% disagreed, and 2% strongly disagreed. Cambridge (76/12) asked respondents to agree or disagree with "American technology can solve the problem of nuclear safety." Sixty-four percent

of the respondents agreed with this statement, 13% disagreed, and 23% didn't know.

4.3.7 Summary

Nuclear power plant safety is the major nuclear power concern of many Americans and is a major reason for opposing nuclear power. This concern over safety decreases public willingness to live near a nuclear plant, decreases public willingness to allow the building of more nuclear plants, and increases public willingness to cut back the present operating capacity of nuclear plants. The public is not willing either to halt completely the construction of more plants or to completely cut back power production, but a plurality is willing to delay construction or cut back operations until certain conditions about regulations or research can be met. However, a majority of the public perceives the past safety record of nuclear power as very good and believes that American technology can solve the problems of safety.

4.4 Health

4.4.1 Introduction

Questions regarding health have not received nearly the prominence of safety-related questions. For instance, specific health concerns were not often volunteered as reasons for opposing nuclear power. This is undoubtedly due to the fact that health and safety concerns are very hard for the general public to separate. Using the definition of health-related questions as those questions either referring to health or to long-term, chronic radioactivity effects, survey organizations themselves have only asked a few specific health-related questions.

4.4.2 Specific Health Questions

NORC (74/5) used the following question: "Now I'm going to read a list of things that are said to affect people's health. I'd like you to tell me to what extent you believe people's health is affected by radiation from electric plants fueled by nuclear energy." Here, 19% chose the structured response "a lot," 13% chose "some, but not much," 12% chose "only a little," 25% chose "none at all," and 31% were not sure. This is a very small percentage relative to the other items listed by NORC (74/5). The percentage of respondents answering "a lot" to other items was: 49% for untreated sewage, 43% for untreated liquid waste from factories, 40% for automobile exhaust, 36% for smoke and gases from coal-burning electric plants, 20% for burning of trash, and 13% for private septic tanks. Thus, in mid-1974 at least, many other common societal problems were perceived to be greater health hazards than radiation from nuclear power plants.

Harris (75/4) asked respondents to assess the truthfulness of: "Some communities have had nuclear power plants for as long as 14 years and have had cheaper electric power and no health problems." Twenty-three percent of the respondents said that this statement was completely true, 18% said it was partly true, 3% said it was partly untrue, 3% said it was completely untrue, and 53% said that they didn't know. Although these findings are hard to interpret because the respondents were evaluating the truthfulness of three different propositions in one statement, the findings do seem to indicate that more of the public see nuclear power as producing no health problems than the converse.

Bardsley (OR 68/1) asked, "How much danger, if any, do you think there would be from radiation from an atomic power plant?" Three percent said "a lot," 6% said "quite a bit," 33% said "a little," 39% said "none," and 19% were undecided. Nuclear neighbor responses did not differ from this response pattern. This question, with responses biased toward "danger," showed a general lack of worry about health dangers from radiation. An ambiguous statement by Bardsley (OR 71/4) received an ambiguous response. With regard to "Nuclear power plants will not produce harmful amounts of radiation," 36% agreed, 20% disagreed, and

44% were undecided. PubResp (AZ 76/9) found 52% agreement with "Nuclear power is probably safe, since the government would not permit use of an energy source dangerous to people's health." This statement is somewhat ambiguous, since it is hard to tell which clause the respondent was agreeing with.

Questions specifically about the health effects of nuclear power are rarely asked, despite concern over the carcinogenic effects of substances found in the environment. The data that exist suggest that health issues involving planned releases of radioactivity are not perceived to be as serious as what we have identified as safety issues, which often involve unplanned releases of radioactivity. This is a tentative conclusion, however, since respondents might simply perceive all dangers as related to the safety questions posed by the survey organizations.

4.5 Waste Disposal

4.5.1 Specific Questions about Waste Disposal

The earliest question about nuclear wastes was asked by ORC (Indian Point 60/6) in a siting study. With regard to the statement, ". . . the Atomic Energy Commission sets safety rules for the disposal of atomic waste. Do you feel confident that their methods are safe, or is there some question in your mind about how safe they are?" Fifty-seven percent felt confident, 13% had some question, and 30% didn't know. Education breakdowns were provided that showed a significant decrease in "don't know" responses with increasing education.

The next question asked about nuclear wastes was provided by Nordhaus (MI 73/5). In response to "Do you personally think a nuclear power plant's radioactive waste could become a disposal problem?" 60%

felt that the disposal problem was either very likely, somewhat likely, or were not sure but felt that it was probably likely.

Harris (75/4) asked respondents to comment on the truthfulness of the statement: "Waste from nuclear power plants can cause radioactivity exposure to too many people." On this question, 25% of the total public felt that the statement was completely true; 29%, partly true; 11%, partly untrue; 9%, completely untrue; and 26% were not sure. Thus, a majority of the public believes that wastes could cause radioactivity exposure to too many people.

This concern could certainly influence attitudes about nuclear power plant construction. In a question designed to ascertain this influence, Harris (75/4, 76/7) asked respondents if building more nuclear power plants was a risk worth taking if the plants met tough government standards for nuclear waste disposal. In 1975, 79% felt that it was worth the risk, 11% felt that it was not worth the risk, and 10% were not sure; in 1976, the respective figures were 72%, 16%, and 12%. Thus, a substantial majority of the American public felt that the risk was worth taking if tough government standards were met. However, the 7% decrease in this response from 1975 to 1976 was statistically significant ($p < .001$). This finding shows general agreement with the other Harris findings that indicate a growing concern over the nuclear waste issue.

An interesting comparison here is with the percentage that generally favored the construction of more nuclear power plants. Averaging across both Harris (75/4, 76/7) surveys, 76% felt that building more plants was worth the risk if tough waste disposal standards were met, whereas only 62% generally favored the building of more nuclear power plants. Conversely, only 14% didn't feel it was worth the risk, while 21% generally opposed the building of more nuclear power plants. Evidently, the guarantee of tough waste disposal standards places nuclear power in a more favorable light for some individuals.

Two other waste disposal questions were asked by PubResp (AZ 76/9). First, 31% of the respondents agreed with the statement "Nuclear waste

will be with us for 250,000 years since there is no known way to permanently deactivate it." Second, 28% agreed with the statement, "Nuclear power plants have a plutonium waste by-product which could pollute the atmosphere and cause cancer." These findings are especially interesting because of the truth of both statements. Thus, it appears that only about 25% to 30% of Arizona residents, at least, are aware that plutonium is a reactor by-product and that some radioactive materials will remain radioactive for 250,000 years.

The structured questions discussed in this section seem to indicate that a majority of the public expresses some concern over nuclear wastes. This is in agreement with the open-ended and structured responses discussed in Section 4.2, which indicate that the concern over nuclear wastes was a major public concern over nuclear power. As with the issue of nuclear safety, however, survey findings indicate that the American public has confidence in the ability of modern technology to solve the waste disposal problem.

Cambridge (75/5, 75/12, 76/4) found that approximately 51% of the respondents believed that modern technology can find a safe method for radioactive waste storage so that there will never be a problem, about 23% believed that wastes are so dangerous that we cannot afford to risk producing them, and about 26% were not sure (see Table 4.18). These findings also suggest a close relationship between perception of the waste problem and favorability toward building more nuclear power plants. Note that about 46% of the respondents in the three Cambridge surveys favored the construction of nuclear power plants and about 50% of the respondents in the same surveys believed that modern technology can find a safe method for waste storage; about 31% opposed the construction of more nuclear power plants and about 23% believed that wastes are too dangerous to produce; about 24% were not sure about the construction of more nuclear power plants and about 26% were not sure about whether the waste problem can be solved through technology. Cambridge (76/4) also asked this question of a special California subsample two months before the vote on the California nuclear initiative. California responses were almost exactly the same as for the total public: 24% thought that

wastes were too dangerous to produce, 56% thought that modern technology could solve the waste disposal process, and 20% were not sure.

TABLE 4.18
NUCLEAR WASTES, PLANT CONSTRUCTION, AND TECHNOLOGY

Response	Cambridge		
	(75/5)	(75/12)	(76/4)
The radioactive wastes from nuclear power plants are so dangerous that we cannot afford to risk producing them, since we cannot insure that in 100 or 1,000 years from now that there won't be a leak	26% (35) ^a	22% (23)	22% (34)
With modern technology we can find safe, scientific ways to store nuclear wastes so there will never be a problem	51 (45)	45 (46)	56 (47)
Not sure	23 (20)	33 (31)	22 (19)

NOTE: "As you know, radioactive waste from nuclear reactors remain for hundreds of years after they are produced. Which of these statements is closest to your opinion?"

^aFigures in parentheses represent percentages of those who in the same survey indicated that they favored the construction of more nuclear power plants (second row), opposed the construction of more nuclear power plants (fourth row), and those who didn't know (sixth row).

Cambridge also presented demographic breakdowns for the national sample respondents. The results are quite similar to the results for the general nuclear power attitude breakdowns. Averaging across the three surveys, more men (about 59%) than women (about 42%) believed that technology could solve the problem, and women (about 32%) more than men (about 21%) did not state an opinion on the matter. Respondents with higher income and more education felt that technology would solve the waste problem. About 40% of those earning less than \$10,000, about 54% of those earning from \$10,000 to \$15,000, and about 63% of those earning \$15,000 or more believed that technology can find safe waste disposal methods. Also, about 38% of those with less than a high school education,

about 51% of those with a high school education, about 57% of those with a technical/vocational training, and about 57% of those with at least some college believed that technology can find safe waste disposal methods. There were few differences related to education and income on the "wastes are too dangerous" response, but considerable differences were found in the "not sure" category, with the low income and less educated respondents selecting "unsure" to a greater extent than did those with higher income and more education.

There were also some interesting age differences. About 27% of those 35 years of age or less, about 21% of those from 36 through 55, and about 20% of those over 55 felt that the wastes are too dangerous to produce. About 55% of the middle-aged respondents felt that technology can solve the problem, whereas about 48% of those in the other two age categories held that belief. With regard to regional differences, respondents from the Northeast generally showed the least optimism about a technical solution and the most support for producing no more wastes, while respondents from the Central states showed the most optimism about finding a technical solution and worried least about producing more wastes. The major difference between respondents who differed with regard to proximity to a nuclear power plant, is that about 53% of nuclear neighbors and potential nuclear neighbors believed that a technical solution would be found, whereas 46% of those in areas with no nuclear plant existing or anticipated held this belief.

We should point out that the Cambridge findings are slightly discrepant from the Harris data, which indicate increasing concern about nuclear wastes from 1975 to 1976 (see Tables 4.1, 4.3, and above). The Cambridge "concern about radioactive wastes" question (see Table 4.5) indicated stability in the amount of concern from 1975 to 1976. The Cambridge question about the technical ability to handle wastes showed an increased amount of optimism with regard to belief in technical solutions (see Table 4.18). The increase of those who believe that a technical solution will be forthcoming from 48% (averaged) in 1975 to 56% in 1976 is statistically significant ($p < .001$).

Thus, in general, the Harris data indicate growing public concern with regard to nuclear wastes, and the Cambridge survey data either indicate no change or an increase in public optimism regarding technical solutions to the waste problem. Several explanations are possible.

First, it is important to note that the last Cambridge survey of interest here was conducted in April, 1976--about six to eight weeks prior to the vote on the California nuclear initiative and at least six months before the nuclear initiative votes in the other five initiative states. The second Harris survey was conducted in July 1976, after the California vote. It is quite possible, since the initiatives contained a waste-related clause, that the publicity about the waste question affected public opinions fairly rapidly after April to produce the difference that Harris found in July.

A different interpretation is also plausible. It may be, as Harris shows, that the public is becoming more concerned about the waste issue. It is possible, however, that public confidence in the ability of technical experts to solve technical problems has remained constant or has even increased as the Cambridge data indicate. To support this, Harris (75/4, 76/7) found that 58% of the total public in both surveys had a "great deal of confidence" in scientists' ability to deal with the nuclear waste problem--this finding was 20% higher than the confidence placed in the second highest category of individuals.

There are also several "waste disposal and technology" questions that have been asked in the state and area surveys that uphold the general findings of the national studies. IGA (Sacramento 76/6), immediately after the vote on the California nuclear initiative, asked Sacramento area voters to agree or disagree with "We have the technology to cope with waste disposal from nuclear power plants." Of the total respondents, 5% strongly agreed, 31% agreed, 26% neither agreed nor disagreed, 22% disagreed, and 15% strongly disagreed. Breakdowns on this question were given as a function of how one voted on the nuclear initiative. As expected, very large differences in response patterns were found between supporters and opposers of the initiative. For those

who supported the initiative (i.e., were antinuclear), 0% strongly agreed with the above statement, 15% agreed, 19% neither agreed nor disagreed, 35% disagreed, and 31% strongly disagreed; for those who opposed the initiative (i.e., were pronuclear), 7% strongly agreed, 41% agreed, 32% neither agreed nor disagreed, 16% disagreed, and 4% strongly disagreed.

A comparable question was asked by PubResp (AZ 76/9) two months before the Arizona initiative. Here, 42% strongly agreed or somewhat agreed with "The waste problem is not a real one since science has devised acceptable ways of storing waste." Although the IGA (Sacramento 76/6) and PubResp (AZ 76/9) results show less optimism with regard to technical solutions than the Cambridge data, question wording seems to be responsible. Cambridge asked whether technology could solve the waste disposal problem, while IGA and PubResp asked whether technology had already solved the problem.

A question very comparable to the Cambridge question was asked three different times by Bardsley (WA 76/8, OR 76/8, OR 76/12). Bardsley (WA 76/8) found that 57% agreed and 24% disagreed with the statement, "Modern technology is capable of developing safe methods of storing nuclear waste." The first Oregon survey was conducted three months before the Oregon nuclear initiative and the second was conducted one month after the vote. Before the vote, 51% agreed and 31% disagreed with the statement; after the vote, 55% agreed and 32% disagreed with the statement. Neither of the changes were statistically significant. Men and women did not respond to this question differently. Demographic groups most likely to agree that technology could solve the problem were those 30-60 years old, the highly educated, those in the upper income bracket, and white collar workers.

4.5.2 Summary

Nuclear waste appears to be a nuclear power issue that has only recently captured widespread public attention. None of the respondents

in Sindlinger (60/6) or in Becker (73/6) offered "nuclear wastes" as a reason for opposing nuclear power. Thus, up through 1973, nuclear wastes did not seem to be an important enough issue to freely come to the mind of respondents. By late 1974, however, ORC (74/11, 75/2) determined through a structured question that nuclear wastes were considered to be more serious a problem than radiation discharge, nuclear accidents, or thermal pollution. In 1975 and 1976, Harris and Cambridge surveys found that nuclear wastes were an important enough issue to be volunteered by respondents in an open-ended fashion. In fact, nuclear wastes were enough of an issue that at least a few of the Harris (76/7) respondents said that "they will solve waste problems" when asked to name an advantage of nuclear power. Harris (75/4, 76/7) also found in a structured question that the disposal of radioactive wastes was considered a "major problem" by about 65% of the respondents; and Cambridge (75/5, 76/4), in a structured question, found that about 47% of their respondents were "very concerned" about radioactive wastes escaping.

These data certainly indicate growing public concern over the nuclear waste issue. Harris (75/4, 76/7), however, found that about 76% of the respondents--despite the large percentage that saw nuclear waste as a major problem--felt that allowing nuclear power plants to be built is a risk worth taking, if the plants meet tough government standards for nuclear waste disposal. This risk acceptance may be partially explained by the fact that about 50% of the public in 1975 and 1976 believed that modern technology could solve the waste problem.

4.6 Economic Issues

4.6.1 Introduction

Whereas safety, health, and nuclear waste have been mainly perceived as major arguments against nuclear power, economic considerations

(e.g., cheap electricity, more jobs, more industry) have often been seen as the major benefits of nuclear power. As already noted in Section 4.2.2, however, there are also respondents who believe that nuclear power is more costly than nonnuclear alternatives.

4.6.2 Specific Questions about Economic Issues

Sindlinger (60/6) and NORC (74/5) both asked respondents to agree or disagree as to whether they thought that nuclear power would make electric bills lower. Sindlinger (60/6) found that 52% of the respondents thought that electric bills would be lower, and NORC (74/5), 14 years later, found about the same percentage (55%) of respondents taking this position. However, 45% of the NORC (74/5) respondents did not think that the electric bills would be lower, while Sindlinger found 15% who thought that the bills would not be lower, 19% who were undecided, and 15% who had no opinion. Trends in time cannot be ascertained from these data because of major differences in response categories.

Harris (74/5, 76/7) asked respondents to assess the likelihood of a number of specific economic consequences of a nuclear power plant being built in their own community (see Table 4.19). About 60% of all respondents in both surveys felt that if a nuclear power plant were built in their own community, then it would be more likely that (a) electric power would be a better buy for the money, (b) more business would come to the community and create more jobs, and (c) the community would be a better place to find a job.

It is also very important, however, to note that only a little over 40% of nuclear plant neighbors felt that the three positive economic consequences listed above would be more likely. Evidently, the nuclear plant neighbors' perception of these consequences has been changed through contact with a nearby nuclear power plant. This finding is not in full agreement with different Harris (75/4, 76/7) data (see Table 4.8) showing that the nuclear plant neighbors perceive four economic advantages as major advantages to a slightly, although not significantly, greater degree than does the general public.

TABLE 4.19

LIKELIHOOD OF ECONOMIC CONSEQUENCES
OF BUILDING A NUCLEAR POWER PLANT
IN OWN COMMUNITY

Question and Response	Harris			
	Total Public		Nuclear Plant	
	(75/4)	(76/7)	(75/4)	(76/7)
<u>Electric power would be a better</u>				
<u>buy for the money</u>				
More likely	61%	60%	42%	44%
Less likely	12	13	16	14
No real change (volunteered)	10	13	25	28
Not sure	17	14	17	14
<u>More new business would come to</u>				
<u>the community and create more</u>				
<u>jobs</u>				
More likely	67	64	43	47
Less likely	11	10	14	14
No real change (volunteered)	12	15	25	25
Not sure	10	11	18	14
<u>The community would be a better</u>				
<u>place to find a job</u>				
More likely	58	55	37	42
Less likely	11	13	16	12
No real change (volunteered)	17	20	30	35
Not sure	14	12	17	11

NOTE: "Do you feel that the building of a nuclear power plant in your community would result in these things being more or less likely to happen?"

Harris (75/4, 76/7) also asked respondents if it would be worthwhile having a nuclear plant in their own community if it meant that the electric power rates would be some percentage higher or lower (see Table 4.20). It appears that, in general, the public favors nuclear power when it costs about the same as other types of power or when it is cheaper. In 1975, 55% of the public thought that nuclear power is worthwhile when it costs the same, although this declined significantly ($p < .01$) in 1976, when 47% (still a plurality) thought that it is worthwhile when it costs about the same. Given any cost advantage, nuclear power is perceived to be worthwhile by a majority of the total public and by a majority of the nuclear neighbors. It is important to note, however, that even if nuclear power provided electricity 50% cheaper, about 20% of the total public and about 18% of the nuclear neighbors do not feel that it would be (is) worthwhile to have a nuclear power plant in their own community.

TABLE 4.20
PERCENT SAYING THAT IT IS WORTHWHILE
TO HAVE A NUCLEAR POWER PLANT IN OWN COMMUNITY
IF IT MEANT THAT POWER RATES WOULD BE...

Response	Harris			
	Total Public		Nuclear Plant Neighbors	
	(75/4)	(76/7)	(75/4)	(76/7)
20% more than other types of power	24%	17%	20%	29%
10% more than other types of power	31	25	26	37
About the same as other types of power	55	47	54	63
10% less than other types of power	70	60	69	74
15% less than other types of power	75	65	73	77
25% less than other types of power	80	74	80	80
50% less than other types of power	83	78	84	81

NOTE: The percent saying "not sure" was from 9%-11% in all cases for the total public.

It is also interesting to note that, for the general public, nuclear power had to become more cost advantageous between 1975 and 1976 for the public to perceive it as worthwhile, whereas for nuclear neighbors in the same period, nuclear power was seen as worthwhile at less of a cost advantage. In general, the East sees nuclear power in own community as less worthwhile regardless of rates, and the young (18-29) and those with incomes of \$5,000 and over see nuclear power in own community as more worthwhile regardless of rates.

4.6.3 Summary

From the earliest surveys to the present, economic considerations have been perceived as a major benefit of nuclear power. For example, economic benefits of nuclear power were volunteered by 42% of the total public (Harris, 75/4, 76/7) as advantages of nuclear power. Analysis of the structured questions in this section also shows that a majority of respondents see nuclear power as providing economic benefits. A smaller, stable percentage of respondents, however, perceive nuclear power to be uneconomical.

Economic considerations that directly affect an individual seem to be quite important. As discussed in Section 3.1.2.6, from 42% to 67% of the public would favor having a nuclear plant nearby or in their own community. More specifically, in Harris (75/4), 55% favored a plant in the community; and in Harris (76/7), 51% favored a plant in the community. But, for the same Harris respondents, 83% in 1975 and 78% in 1976 would favor a nuclear plant in their own community if it meant that their electric bills would be 50% lower. Thus, over 50% of those who would not otherwise favor a nuclear power plant in their community would do so if nuclear power could save them 50% on their electric bills.

4.7 Nuclear Fuel Supply

A large supply of nuclear fuel within the U.S. has often been cited as an advantage of nuclear power. For example, Harris (75/4, 76/6) found that approximately 20% of the American public volunteered that an unlimited supply of fuel was an advantage of nuclear power (see Table 4.2). In the same surveys, only 1% to 2% of the public volunteered that the nuclear fuel supply was so limited as to be a disadvantage of nuclear power. In the Harris (75/4, 76/7) structured "major advantage" questions (Table 4.8), about 73% of the respondents felt that a major advantage of nuclear power was that it would eventually use the same energy over and over again, eliminating any future shortages of energy.

Harris (75/4, 76/7) also asked three other structured questions about the nuclear power supply (see Table 4.21). Averaging across the two surveys, about 64% of the respondents think that nuclear power can be produced in almost unlimited quantities, about 73% think that nuclear fuel could be obtained almost entirely within the United States (presumably enough to produce the unlimited quantities of power), and about 52% think that we will not run out of our nuclear fuel supply any time soon in the future.

Harris (75/4) also asked respondents to assess the truthfulness of the following statement about the breeder reactor: "Through the use of breeder plants, plutonium, which is used to produce nuclear power, can be reused over and over again, doing away with any possible raw material shortage." The responses were: completely true, 25%; partly true, 20%; partly untrue, 3%; completely untrue, 3%; and not sure, 49%. Thus, 45% of the public believes that the breeder reactor has great potential, while 49% of the public evidently had not heard enough about the breeder reactor to be able to make a judgment on the statement.

In summary, the nuclear power fuel supply is seen by most people as an advantage of nuclear power. A majority of adult Americans feel that there is a sufficiently large supply of nuclear fuel in the U.S. to

produce almost unlimited quantities of electricity with nuclear power without running out in the near future.

TABLE 4.21
NUCLEAR POWER SUPPLY

Question and Response	Harris	
	(75/4)	(76/7)
Can be produced in almost unlimited quantities		
Think so	65%	63%
Don't think so	10	> 37
Not sure	25	
Could be obtained almost entirely within the United States		
Think so	73	73
Don't think so	7	> 27
Not sure	20	
Would not run out of supply any time soon in the future		
Think so	53	51
Don't think so	22	> 49
Not sure	25	

NOTE: Prefaced with "Now let me ask you about three different sources of energy. Do you think nuclear power... or not?"

4.8 Pollution

Two types of pollution are asked about with regard to nuclear power--thermal pollution and air pollution. Direct questioning by Harris (75/4) regarding thermal pollution reveals that 66% of the respondents believed that "hot water from nuclear power plants endangers fish and other water life in lakes and streams": 33% responded completely true, 33% said partly true, 5% said partly untrue, 5% said completely untrue, and 24% were not sure.

Harris (75/4, 76/7) also asked two other structured questions about the polluting effects of nuclear power (see Table 4.22). These questions were asked in a comparative sense (doesn't pollute . . . so much), and the same questions were asked of oil and coal (see Chapter 5). It is interesting that about 45% of the total population thought that nuclear power "doesn't pollute the water so much" and only 25% disagreed with this. It appears that the public believes that thermal pollution from any source is a problem but that nuclear power presents less of a problem than other sources. With regard to air pollution, about 59% of the public believed that nuclear power "doesn't pollute the air so much," while about 14% did not believe this to be the case. As with the open-ended responses discussed in Section 4.2, thermal pollution from nuclear power was seen as a bigger problem than air pollution from nuclear power.

TABLE 4.22
NUCLEAR POWER AND POLLUTION

Question and Response	Harris	
	(75/4)	(76/7)
Nuclear power is a clean source of energy and doesn't pollute the water so much		
Think so	44%	46%
Don't think so	25	} 54
Not sure	31	
Nuclear power is a clean source of energy and doesn't pollute the air so much		
Think so	57	60
Don't think so	14	} 40
Not sure	29	

The issue of pollution has two sides with regard to nuclear power. Some individuals believe that thermal pollution effects, especially, are a good reason not to build nuclear power plants. Others feel that thermal and air pollution is a problem, but less of a problem than for other electrical generation sources. In general, more of the public has

a positive attitude toward nuclear power regarding pollution than a negative attitude toward nuclear power regarding pollution. This is especially true in a comparison of all generation sources. A more complete comparison of the polluting effects of alternative electrical energy sources is given in Chapter 5.

4.9 Safeguards and Terrorism

Safeguards and terrorism issues have not had as large an impact on the general public as have most of the other nuclear power issues. Cambridge (75/5) found that 8% of the public volunteered safeguards or terrorism as their biggest worry about nuclear power (see Table 4.2). Harris (75/4) found that 7% of the public volunteered safeguards and terrorism as a disadvantage of nuclear power; this figure rose significantly to 12% ($p < .001$) in Harris (76/7). Cambridge (see Table 4.1) found that about 3% of those who opposed nuclear power in 1976 listed safeguards or sabotage as a reason, while nobody who opposed nuclear power in 1975 listed safeguards or sabotage as a reason for opposition.

The Harris (75/4, 76/7) structured "major problem" questions also provide data in this same vein (see Table 4.3). Fewer respondents perceived sabotage and terrorism as a major problem relative to other problems. The proportion of respondents seeing sabotage and terrorism a major problem, however, increased significantly ($p < .001$) in the same period of time.

There was only one other structured sabotage and terrorism question asked in a national survey. Harris (75/4, 76/7) found that about 70% of the respondents believed that it is worth taking the risk of building nuclear power plants "if the plants have proper security to prevent the stealing of plutonium or the sabotage of the plants by revolutionaries. . . ." This should be compared to the 62% of the respondents who, in general, favored the construction of more nuclear power plants.

There were two sabotage/terrorism questions asked in state surveys. Nordhaus (MI 73/5) found that 39% of the respondents did not think that "enough control is exercised to keep criminals from hijacking shipments to or from nuclear power plants." Those most likely to feel that more control is necessary were women, those 50 years old or older, those with a high school education or less, and those with incomes below \$12,500. PubResp (AZ 76/9) found that 18% of 885 respondents strongly agreed or somewhat agreed with the statement, "The threat of sabotage to nuclear power plants is a major reason not to build any more nuclear power plants."

In summary, the public perceives safeguards and terrorism as problems associated with nuclear power, but does not feel that these problems are as great as safety and health issues, waste disposal, economic considerations, and pollution. The concern over safeguards and terrorism increased significantly from 1975 to 1976.

4.10 Proliferation

As an issue related to nuclear power, proliferation does not appear to be at the forefront of the public's mind. No respondent volunteered proliferation as a worry, a disadvantage of nuclear power, or a reason for opposing nuclear power (see Tables 4.1 and 4.2). However, these findings may be due to the fact that proliferation may be perceived in regard to reactor sales abroad rather than in regard to a U.S. nuclear power program.

For example, data from Roper (75/8, 76/11) indicate that the U.S. public worries about proliferation in regard to a worldwide nuclear power program (see Table 4.23). In 1975, 45% of the public felt that the U.S. should not sell reactors abroad because of proliferation problems, and this decreased (nonsignificantly) to 42% in late 1976. In 1975, 36% of the public felt that we should sell nuclear power plants

abroad, and this decreased significantly ($p < .001$) to 31% in 1976. Much of the decrease was picked up by those who felt that reactor sales abroad depend upon to whom the U.S. sells (a volunteered answer). Combining those who favor the sale of reactors abroad with those who qualify the sale, we find that about equal numbers favor and oppose the sale of reactors abroad.

TABLE 4.23
SALE OF POWER PLANTS AND PROLIFERATION

Response	Roper	
	(75/8)	(76/11)
U.S. should sell nuclear power plants	36%	31%
U.S. should not sell nuclear power plants	45	42
It depends on to whom sold (volunteered)	10	15
Don't know	9	11

NOTE: "The U.S. has been selling nuclear power plants for peaceful purposes to other countries. Some people say this is a mistake because it could give other nations a nuclear capability for warfare. Others say these nations can and will buy nuclear power plants from someone else if we don't sell them, and if we sell them we have more control over what they get and how they are used. How do you feel--that as a general policy the U.S. should or should not sell nuclear power plants to other countries?"

4.11 Conclusion

In summary, it is important to point out that responses to two major types of questions regarding public attitudes about specific nuclear power issues were analyzed: (1) answers to open-ended questions that required a volunteered response on the part of the respondent, and (2) questions that had structured response categories, i.e., respondents were asked to select from a list of given responses to a question. Volunteered responses to open-ended questions were considered to be

important measures of the most salient issues of concern to respondents regarding nuclear power.

Some of the most important findings regarding attitudes about nuclear power were collected by asking respondents to volunteer reasons why they favored or opposed nuclear power. The main reason volunteered for supporting nuclear power has changed over time. In 1960, the main reason for supporting nuclear power was the belief that it provided cheaper electricity. In 1973, however, after the beginning of the environmental awareness movement and before the Arab oil embargo, the main reason volunteered for supporting nuclear power was the belief that nuclear power plants are less polluting than other electrical generating sources. Since the Arab oil embargo, the main reason offered for supporting nuclear power has been that nuclear power is a good or needed energy source.

When all respondents volunteered two or three main advantages of nuclear power in 1975 and 1976, however, the advantage volunteered most often was the belief that nuclear power produces cheap electricity. This was followed by the belief that nuclear power is clean energy or pollutes less than other sources, which in turn was followed by the belief that nuclear power is an abundant or unlimited energy source. As classes of responses, however, advantages of nuclear power relating to the need for nuclear power were offered most often, followed by advantages relating to economic benefits.

Since 1960, when the open-ended format has been used, the main reason for opposing nuclear power has remained stable; and this reason has always involved responses relating to danger. When survey organizations reported the specific dangers that respondents volunteered in this open-ended format, the most frequently cited dangers included a general danger response followed by dangers relating to nuclear power plant accidents or explosion, dangers relating to radiation contamination from nuclear power plants, and dangers relating to nuclear waste disposal. Other frequently cited reasons for opposing nuclear power

included beliefs that nuclear power is too expensive or too polluting, satisfaction with present methods, and no perceived need for more energy.

When all respondents were asked to list two or three disadvantages of nuclear power, a very similar pattern of responses was obtained. Furthermore, it is interesting to note that, when all respondents were limited to volunteering their single biggest worry about nuclear power, all of the responses involved some sort of danger and none of the responses involved economic or pollution considerations.

A different response pattern was found, however, when respondents were asked to give comparative assessments of different specific nuclear power plant issues by using questions with structured response categories. In these types of questions, when no general "danger" response category was included, the disposal of radioactive wastes was perceived as the greatest specific problem with nuclear energy; it was perceived to be more of a problem than radiation discharge, power plant accidents or explosions, and thermal pollution. In a comparative assessment of the health effects of nuclear power, problems with untreated sewage, untreated liquid factory waste, automobile exhaust, and smoke and gases from coal-burning electric plants were perceived to be significantly greater health hazards than radiation from nuclear power plants.

With regard to the general safety of nuclear power plants, respondents were somewhat evenly split between those who believed that nuclear power plants are safe and those who believed that they are somewhat dangerous. This same general response pattern was found for beliefs in the danger of a nuclear power plant accident or explosion. A majority of the public believed that an accident or explosion could occur, that the probability of an accident is very small, that the past safety record of nuclear power plants has been very good, and that technology can solve the safety problems associated with nuclear power, including problems of waste disposal.

Concern over power plant safety appeared to decrease public willingness to live near a nuclear power plant and public willingness to endorse the building of more nuclear power plants, and it appeared to increase public willingness to cut back the present operating capacity of nuclear power plants. While much of the public was willing to delay continued expansion of nuclear power to allow time for further research, there was neither general support for halting power plant construction forever nor for a large cutback in the present generation of electrical power.

From the earliest survey in 1960 to the present, opposing perceptions of nuclear power economic considerations have been held by the public. In general, however, a majority of respondents perceived nuclear power as providing economic benefits. Nuclear power was also evaluated positively regarding the supply of nuclear fuel. A majority of the public believed that there is a sufficiently large supply of nuclear fuel in the United States to produce almost unlimited quantities of electricity without running out in the near future.

Thermal pollution from nuclear power plants was perceived to be more of a problem than air pollution from nuclear power plants. However, more people evaluated nuclear power positively than negatively with regard to pollution considerations.

Safeguards and terrorism issues have been volunteered as problems or disadvantages of nuclear power by about 10% of the public since 1975. Public concern regarding the adequacy of safeguards to prevent terrorism increased from 1975 to 1976. This issue, however, was not perceived to be as important as those issues already discussed. Possibly, the least salient concern of the public is proliferation. Proliferation was neither volunteered as a problem or disadvantage of nuclear power, nor was it volunteered as a reason for opposing nuclear power. Very few structured questions regarding proliferation have been asked, however, so this conclusion must be considered tentative.

5 GENERAL ENERGY ATTITUDES

5.1 Introduction

The purpose of evaluating public opinion toward energy issues broader than the development of nuclear power is to place the discussion of nuclear attitudes, detailed in the previous two chapters, in the context of the larger energy picture as perceived by the public.

Three approaches will be used in this chapter to analyze the relationship of nuclear attitudes to general energy attitudes. First, the differences between people with antinuclear and pronuclear attitudes will be examined for a broad range of energy issues. Comparison of these two groups should indicate the degree to which a particular perspective on larger energy issues is associated with a specific set of attitudes toward nuclear energy. Second, public attitudes toward energy needs (5.3), energy alternatives (5.4), and energy conservation (5.5) will be discussed to provide an overview of public perceptions, preferences, and concerns in these areas. These data will provide a comparative base for the evaluation of public attitudes toward nuclear energy, e.g., the percentage in favor of and opposed to nuclear energy may be more meaningful relative to the percentage in favor of and opposed to specific alternatives. Third, demographic characteristics will be examined throughout this chapter to detect any distinct clusters of general energy and nuclear attitudes among demographic groups. This analysis should help determine the degree to which attitudes toward nuclear energy can be explained by attitudes toward general energy issues and by demographic characteristics such as sex, education, and income.

We hypothesize that one's evaluation of nuclear energy is influenced by an evaluation of energy needs and the degree to which one

focuses on the supply side versus the demand side of the energy equation. Thus, we expect that one's attitude toward nuclear energy will be related to one's assessment of:

1. the existence and severity of an energy shortage;
2. the preference for increasing the energy supply compared to the preference for limiting energy consumption to meet an energy shortage (if one is perceived to exist);
3. the characteristics of alternative energy sources with respect to availability, our technical capacity to utilize them, and economic, health, safety, and environmental impacts; and
4. the perceived efficacy of limiting energy consumption and the expected economic consequences of conservation.

We hypothesize then, that attitudes toward energy issues involve a complex set of both beliefs about objective relationships (e.g., whether or not conservation prevents economic growth), and value positions (e.g., whether or not it is good to limit energy consumption).

5.2 Comparison of Pronuclear and Antinuclear Groups

The comparison of the attitudes of pronuclear and antinuclear individuals concerning other energy issues is a useful way of determining some of the parameters that distinguish pronuclear and antinuclear groups. The positions of pronuclear and antinuclear groups on a wide range of energy issues are presented in Table 5.1. [Pro and con individuals are defined by their response to a general nuclear attitude question in the Cambridge and Bardsley surveys and by their response to

TABLE 5.1

RELATIONSHIP OF GENERAL ENERGY ATTITUDES
TO NUCLEAR POWER ATTITUDES

Survey	Response	Total				Pro Nuclear ^a				Con Nuclear				Don't Know No Opinion			
		73	74	75	76	73	74	75	76	73	74	75	76	73	74	75	76
Becker (73/6 and 74/5) ^b Which is better:	Build as many new power plants needed--use all electricity wanted.	52%	48%			61%	59%			37%	38%			--			
	Cut back electricity used--build fewer new plants.	35	39			31	34			50	51			--			
Becker (73/6 and 74/5) ^c	Need more nuclear plants in next 10-20 years OR	61	58			75	77			46	37			--			
	Have enough energy from other sources.	16	24			10	14			30	47			--			
Becker (73/6 and 74/5) ^d	Coal All right	37	44			44	59			29	33			--			
	OR Oil Plant Oppose	45	41			44	27			61	61			--			
Cambridge (75/8) ^e To say each of three non-nuclear solutions do alot to solve crisis.	Solar			54%				60%				54%				37%	
	Coal			31				35				28				24	
	Conservation			36				36				42				29	
Cambridge (76/4) ^f	Conservation means much Agree				54%			56%				52%					52%
	lower standard Disagree of living:				38			38				41					29

TABLE 5.1 (Continued)

Survey	Response	Total				Pro Nuclear ^a				Con Nuclear				Don't Know No Opinion			
		73	74	75	76	73	74	75	76	73	74	75	76	73	74	75	76
Cambridge (75/8) ^g	Economic growth requires increase in energy OR				41%			54%		31%						31%	
	Can have growth with conservation				45			36		57						40	
Cambridge (76/4)	"Conservation is a good alterna- tive, but frankly Agree				48%			44%		51%						--	
	there's not much I can personally Disagree do about it."				47			52		47						--	
Cambridge (75/8) ^h	For equality Need economic and stability growth OR				52%			59%		38%						46%	
	Simply dis- tribute more equally				36			30		51						33	
Bardsley (OR 76/9) ⁱ	Nuclear power con- Agree				80%			90%		66%						--	
	serves natural resources Disagree				10			5		20						--	

^aBecker (73/6 and 74/5) Pro/Con question: "Suppose your electric company announced that it planned to build a nuclear power generating plant in this general area producing electric power by means of atomic energy. Would building this kind of plant be all right with you or would you oppose it?"

Cambridge (75/8) Pro/Con question: "Do you generally favor or oppose building more nuclear power plants?"

TABLE 5.1 (Continued)

Cambridge (76/4) Pro/Con question: "Do you generally favor or oppose the construction of more nuclear power plants?"

Bardsley (OR 76/9): "Overall, would you say your opinion of nuclear power plants is--very favorable, somewhat favorable, somewhat unfavorable, or very unfavorable?"

^bBecker (73/6 and 74/5): "All things considered, which do you think is better: to build as many new power plants as are needed to let everybody use all the electricity they want or to try to limit or cut back the use of electricity so that fewer new power plants will have to be built?"

^cBecker (73/6): "The use of electric power is expected to double by 1980. Do you think that more nuclear power generating plants will be needed in order to have enough electric power for all needs, or will there be enough electric power from other sources such as coal, gas, oil, and power dams?"

Becker (74/5): "During the next ten or twenty years, do you think we will need more nuclear power plants in order to produce enough electricity for all needs, or can we produce enough electricity from other sources such as coal, oil, gas and power dams?"

^dBecker (73/6 and 74/5): "Suppose your electric company announced it planned to build an electric power plant in this general area that burned oil or coal for fuel. Would building this kind of plant be all right with you or would you oppose it?"

^eCambridge (75/8): "Three possible solutions to the energy problem have been proposed that do not involve nuclear power: construction of solar energy facilities, more extensive use of coal, and strict energy conservation. Do you think in the next 25 years each of these can do a lot to solve the energy crisis, something to solve the problem, or very little to solve the problem?"

^fCambridge (75/4): "Conservation is not a realistic solution to the energy crisis unless we are all prepared to accept a much lower standard of living."

^gCambridge (75/8): "Some people have argued that we can have economic growth here at home even if we don't increase energy supplies by conserving and using the energy we have more wisely. Other people say this is unrealistic and that we need to increase energy in order to have economic growth. Which is closer to your opinion?"

^hCambridge (75/8): "If we don't increase economic growth, some people say there will be increasing unrest in our society because the people at the bottom of the economic ladder will no longer be able to get ahead and will have to literally fight for a larger share of things. Other people say this won't really be a problem because there is plenty to go around in our society, and all we need to do is distribute it more equally. Do you think growth is essential or do you think we could solve the problem by simply distributing more equally?"

ⁱBardsley (OR 76/9): "Nuclear power plants help to conserve on other natural resources, such as coal, oil, water and gas."

a nuclear nearby question for the Becker surveys (see footnote "a" to Table 5.1).]

Pronuclear and antinuclear individuals took opposite positions on the issue of increasing the energy supply as opposed to cutting back electricity use (Becker, 73/6, 74/5). About 60% of the pronuclear group were in favor of building as many plants as needed compared to 38% of the antinuclear group, while about 50% of the antinuclear group preferred reducing electricity consumption in contrast to approximately 35% of the pronuclear group taking this position. In terms of specific energy sources, about 75% of pronuclear individuals saw a definite need for more nuclear plants in the future, while the antinuclear group changed from a plurality (46%) agreeing that nuclear energy would be needed in 1973 to a plurality (47%) saying other sources would be sufficient in 1974 (Becker, 73/6, 74/5). Although only 35% of the pronuclear and 28% of the antinuclear groups felt that coal could do a lot to solve the energy crisis (Cambridge, 75/8), the pronuclear group was favorable toward building coal plants (52% in favor and 36% opposed) while the antinuclear group was opposed to such plants (31% in favor and 61% opposed) (Becker, 73/6, 74/5). A majority of both groups, however, felt that solar energy could do a lot to solve energy problems (Cambridge, 75/8). Bardsley (OR 76/9) found that a large portion of both pronuclear and antinuclear groups believed that the use of nuclear power helps conserve other natural resources; 90% of the pronuclear and 66% of the antinuclear group agreed with this position.

Thirty six percent of the pronuclear and 42% of the antinuclear individuals felt that conservation could do a lot to solve the energy crisis (Cambridge, 75/8), and both groups were about equally divided on whether or not personal conservation efforts could have an impact on the energy situation (Cambridge, 76/4). The pronuclear and antinuclear groups took opposite positions, however, with respect to the relationship of economic growth to conservation (Cambridge, 75/8). Fifty-four percent of pronuclear individuals, compared to 31% of antinuclear individuals, believed that increased energy supplies are required to maintain economic growth; while 57% of antinuclear individuals believed

economic growth can continue with strict conservation programs, and only 36% of the pronuclear group held that belief. Furthermore, the pronuclear group believed that economic growth is essential to help the economically disadvantaged improve their position (59% of pronuclear agreed, and only 31% of antinuclear agreed); while 51% of the antinuclear group, compared to 30% of the pronuclear group, viewed the problem as one of unequal distribution rather than a need for higher production of goods and services. Over 50% of each group agreed that conservation will produce a lower standard of living for everyone (Cambridge, 76/4).

The cluster of attitudes surrounding pronuclear sentiments thus included positive attitudes about solar energy and coal as sources of energy in addition to nuclear energy; beliefs that alternative sources alone are not sufficient; and beliefs that conservation will not be effective, will result in lower economic growth that will hurt low-income individuals, and will lower the standard of living for everyone. Respondents with antinuclear attitudes, on the other hand, preferred cutting back the use of electricity to building more power plants, though they believed solar energy could contribute a great deal to solving energy problems. They opposed the building of coal plants in their general area. They felt that it is possible to maintain economic growth without increasing energy supplies, although a majority agreed with the pronuclear group that conservation causes a lower standard of living and will not solve the energy crisis.

These findings suggest that there may be two distinct energy perspectives influencing nuclear power attitudes. The first is a favorability toward increasing the energy supply; individuals in this group tend to have higher favorability to all types of energy sources. The second is favorability toward reducing energy consumption, which is associated with higher levels of opposition to the various sources. These two positions are not mutually exclusive. One may feel that a combination of conservation and increase in energy supply is necessary. However, we expect that there is a tendency to favor one approach and to focus on that strategy. This hypothesis will be examined in greater

detail toward the end of this chapter, after a discussion of further evidence on energy attitudes.

It is important to note that there are areas of agreement and disagreement between the pronuclear and antinuclear groups. Agreements center around the efficacy of various options to solve the energy crisis--with solar energy evaluated as being quite effective and both coal and conservation evaluated as being not very effective. In addition, both groups believed that one consequence of conservation would be to lower the standard of living for everyone.

5.3 Assessments of Energy Needs

Individual perceptions of the availability of energy resources to meet current and future demands for energy are likely to influence individual positions on a number of energy issues. For example, if one believes that no energy shortage exists, then the rapid expansion of nuclear power is unnecessary.

5.3.1 Energy Shortages

Surveys of the public perception of the energy situation were conducted throughout the period of the oil embargo that began in November 1973. NORC (74/5) reported data collected between November 1973 and May 1974 concerning public estimates of the energy shortage. Harris (76/7) reported similar data ranging from April 1973 through July 1976.

Due to differences in response categories, the data are not readily comparable. Structured responses to the NORC question, "How important a problem do you feel the energy shortage is for this country?" were "the most important problem, a very important problem, a fairly important problem, and not a problem." Harris asked, "How serious do you

feel the energy shortage is in this country--very serious, only somewhat serious, or hardly serious at all?" NORC had two response categories that measured a high degree of seriousness, while Harris had only one. Harris never recorded more than slightly above 50% of respondents who said that the energy shortage was very serious, while NORC reported a range of 82% in the winter of 1973 to 60% during May 1974 who said the energy shortage was either the most important or a very important problem (see Figs. 5.1 and 5.2).

The NORC data indicate that the high level of importance placed on the energy crisis remained stable from November 1973 through February 1974. A drop in concern was noted by March 1974 and continued through May of that year (see Fig. 5.2). The Harris data, however, show a drop of belief in a very serious energy shortage as early as January 1973 (see Fig. 5.1). The oil embargo was officially lifted by the OPEC countries (excluding Libya) in mid-March 1974, although impacts on oil availability in the United States continued for some time thereafter.

According to the Harris data, belief in the seriousness of the energy shortage peaked during the oil embargo in 1973; slightly over 50% thought the energy shortage was "very serious" (see Fig. 5.1). Concern decreased in 1974, so that in March through June of that year less than 25% thought the shortage was "very serious." Then, in 1975 and 1976, concern began to increase again.

Perceptions of future energy shortages show a pattern similar to that of assessments of current shortages (see Tables 5.2 and 5.3); that is, belief in an energy shortage was low during spring 1974, but increased by 1976. Over half of the respondents did not foresee a very serious shortage in the next 5 or 10 years (Harris, 75/4, 76/7; NORC, 74/5; Becker, 73/6, 74/5).

The variations in question wording and response categories, as mentioned above, appear to have influenced the findings. Both the NORC and the Becker questions on future energy shortages eliminated a middle range choice--"somewhat serious." The percentage of respondents (averaging

FIGURE 5.1

SERIOUSNESS OF THE ENERGY SHORTAGE TODAY

NOTE: "How serious do you feel the energy shortage is in this country--very serious, only somewhat serious, or hardly serious at all?" Data from Harris (76/7).

FIGURE 5.2

IMPORTANCE OF PROBLEM OF ENERGY SHORTAGE

NOTE: "How important a problem is the energy shortage to this country--the most important problem, a very important problem, a fairly important problem or not a problem?" Data from NORC (74/5).

TABLE 5.2
ENERGY SHORTAGES IN THE FUTURE
FIVE YEARS

Response	NORC ^a			Harris ^b	
	74/1	74/2	74/4	75/4	76/7
Very serious	--	--	--	40%	47%
Serious	40%	39%	34%	--	--
Only somewhat serious	--	--	--	26	26
Hardly or not serious	60	61	66	19	16
Not sure	--	--	--	15	11

TABLE 5.3
ENERGY SHORTAGES IN THE FUTURE
TEN YEARS

Response	Becker ^c		Harris ^d	
	73/6	74/5	75/4	76/7
Very serious (shortage likely)	44%	37%	33%	44%
Only somewhat serious	--	--	20	20
Hardly serious at all (company can supply)	35	46	26	19
Not sure (no opinion)	21	17	21	17

^a"How seriously will the energy shortage affect you in five years?
Serious, Not Serious"

^b"How serious do you feel the energy shortage in this country will
be in five years from now--very serious, only somewhat serious, or hardly
serious at all?"

^c"Do you think your local electric company will be able to supply all
the electricity that will be needed ten years from now, or is there likely
to be a shortage of electricity at that time?"

^d"How serious do you feel the energy shortage in this country will be
ten years from now--very serious, only somewhat serious, or hardly serious
at all?"

41%) selecting "very serious" on the Harris question is quite similar to the percentages (a mean of 38%) selecting "serious" for NORC and "shortage likely" for Becker (41%) (see Tables 5.2 and 5.3); while the combined percentages (about 44%) selecting "only somewhat serious" and "hardly serious" for Harris are close to the percentage (about 41%) selecting "company can supply" for Becker. This suggests that the group selecting the "somewhat serious" response in the Harris surveys was more likely to lean toward no problem than to a serious one.

Questions have been asked concerning perceptions of specific types of energy shortages. Table 5.4 contrasts the public's perception of current energy source shortages (Becker, 74/5; Harris, 75/4, 76/7) with expectations of future source shortages (Becker, 73/6; ORC, 75/1; Harris, 75/4, 76/7). The Harris (75/4, 76/7) data on current and future energy source shortages indicate that the majority of people did not believe that currently there is a shortage of any source. The percentage of respondents perceiving a current shortage ranged from a low of approximately 20% for coal to a high of 39% for oil. However, 50% of the respondents thought there would be a shortage of oil in the future. It appears that most people expected nuclear and solar energy to be developed; less than 20% of the respondents expected a shortage of solar energy in 10 years (compared to about 35% who perceived a shortage now) and 15% expected a nuclear shortage in the future (compared to about 30% who believed a nuclear shortage exists now).

5.3.2 Attitudes toward Increasing the Energy Supply

Assuming that there is a need for more energy, two basic approaches to deal with this need are available: increasing the energy supply and reducing energy demand. Although both approaches could be used simultaneously, Becker (73/6, 74/5) assessed the relative preferences of the public for building more power plants versus cutting back electricity use. Becker (73/6, 74/5) found more support for building additional power plants than for limiting electricity use: 52% for building versus

TABLE 5.4

SPECIFIC SOURCE ENERGY SHORTAGES

Energy Source	Becker (73/6) ^a Types shortages most likely (multiple)	Becker (74/5) ^b Types most serious shortage (multiple)	ORC (75/1) ^c Very or somewhat likely to run out in 50 years	Harris (75/4) ^d Shortage today	Harris (76/7) ^d Shortage today	Harris (75/4) ^e Shortage 10 years	Harris (76/7) ^e Shortage 10 years
Petroleum or oil	57%	82%	56%	39%	39%	48%	53%
Electricity	25	17	--	--	32	--	33
Solar	--	--	--	31	37	16	19
Coal	5	2	35	23	16	32	27
Natural gas	25	14	47	--	--	--	--
Nuclear power or uranium	<.5	1	15	27	32	13	17

^a"In which types of energy or fuels are shortages most likely to occur in this energy crisis as you understand it?"

^b"Much has been said lately about the energy crisis. In which types of energy or fuels are shortages most serious? Any others?"

^c"Likelihood of U.S. running out of oil (natural gas, timber, coal, uranium) in next 50 years. Very likely, somewhat likely, not very likely, don't know."

^d"Now let me ask you about different kinds of energy. Do you feel that today there is a shortage of oil (coal, nuclear power, solar energy, electric power [76 only]) or not?"

^e"Now, thinking ahead ten years from now, do you think there will be a shortage of oil (coal, nuclear power, solar energy, electric power [76 only]) or not?"

35% for conservation in 1973 and 48% for building versus 39% for conservation in 1974 (see Table 5.5). Both coal and nuclear energy supporters preferred building more plants to limiting electricity use, while the opposite held true for those against coal and nuclear plants. Men (by about a 59% majority) were much more in favor of building more plants than were women (43% in favor), and support for building all needed plants increases with age (see Fig. 5.3) while it decreases with educational level (see Fig. 5.4).

While, overall, there appears to be some preference for increasing the energy supply, there is considerable concern for the potential consequences of moving in this direction. Emphasis on environmental protection appears to be on the increase. ORC (74/11) found that 57% of respondents felt that production of more energy would result in a "fair amount" or a "great deal" of environmental damage. Data from Roper (76/10) illustrate a significant change in attitude concerning the assumed trade-off between environmental protection and energy production in the last year. Until 1976, opinion was slightly in favor of increasing energy over protecting the environment. In the 1976 survey, however, preference for protecting the environment increased, while favorability toward energy production decreased--44% preferred environmental protection and 33% preferred an energy increase (see Fig. 5.5 and Table 5.6).

As the demographic breakdowns in Table 5.6 demonstrate, almost all groups increased in environmental support, while they decreased in energy support from 1975 to 1976. The largest changes occurred among white collar and executive/professional occupations (increasing in preference for environmental protection by about 10%). In 1975 and 1976, the 18- to 29-year-olds were the most proenvironment group (about 54% for environment and 29% for energy). The major proenergy group included those in executive/professional occupations (50% proenergy in 1975 and 39% in 1976). Preference for increasing the energy supply increased with age and income, and men were more in favor of increasing energy than were women. Preference for environmental protection increased as educational level increased in both years. Between 1975 and 1976, the largest drops in support of energy over environment were among women,

TABLE 5.5

INCREASE ENERGY SUPPLY VERSUS LIMIT ELECTRICITY USE

Respondent Categories	Becker			
	Build		Limit	
	Plants		Electricity Use	
	73/6	74/5	73/6	74/5
<u>Total</u>	52%	48%	35%	39%
<u>Region</u>				
Northeast	50	54	32	35
Southeast	58	50	27	29
North Central	51	46	41	46
Southwest	60	54	26	33
West	47	37	43	47
<u>Sex</u>				
Male	60	57	30	34
Female	45	40	40	45
<u>Nuclear plant here</u> ^a				
Would be all right	61	59	31	34
Would oppose it	37	38	50	51
<u>Fossil fuel plant</u> ^b				
Would be all right	61	65	30	27
Would oppose it	48	33	42	56

NOTE: "All things considered, which do you think is better: to build as many new power plants as are needed to let everybody use all the electricity they want or to try to limit or cut back the use of electricity so that fewer new power plants will have to be built?"

^a"Suppose your electric company announced that it planned to build a nuclear power generating plant in this general area producing electric power by means of atomic energy. Would building this kind of plant be all right with you or would you oppose it?"

^b"Suppose your electric company announced it planned to build an electric power plant in this general area that burned oil or coal for fuel. Would building this kind of plant be all right with you or would you oppose it?"

FIGURE 5.3

INCREASE ENERGY VERSUS LIMIT ELECTRICITY BY AGE

NOTE: "All things considered, which do you think is better: to build as many new power plants as are needed to let everybody use all the electricity they want or to try to limit or cut back the use of electricity so that fewer new power plants will have to be built?" Data from Becker (73/6 and 74/5).

FIGURE 5.4

INCREASE ENERGY VERSUS LIMIT ELECTRICITY BY EDUCATION

NOTE: "All things considered, which to you think is better: to build as many new power plants as are needed to let everybody use all the electricity they want or to try to limit or cut back the use of electricity so that fewer new power plants will have to be built?" Data from Becker (73/6 and 74/5).

FIGURE 5.5
ENERGY VERSUS ENVIRONMENT

NOTE: "There is continuing talk about an energy crisis and the idea that there won't be enough electricity and other forms of energy to meet consumer demand in the coming years.

Some people say that the progress of this nation depends on an adequate supply of energy and we have to have it even though it means taking some risks with the environment. Others say the important thing is the environment, and that it is better to risk not having enough energy than to risk spoiling our environment. Are you more on the side of adequate energy or more on the side of protecting the environment?" Data from Roper (76/10).

TABLE 5.6
ENERGY VERSUS ENVIRONMENT

Demographic Breakdowns

Respondent Category	Roper					
	Energy			Environment		
	75	76	Difference	75	76	Difference
<u>Total</u>	40%	33%	- 7%	39%	44%	+ 5%
<u>Sex</u>						
Male	44	39	- 5	36	40	+ 4
Female	36	28	-12	42	47	+ 5
<u>Age</u>						
18-29	32	25	- 7	51	57	+ 6
30-44	41	35	- 6	41	41	0
45-59	44	38	- 4	32	37	+ 5
Over 60	45	36	- 9	29	36	+ 7
<u>Income</u>						
\$0-5,999	34	34	0	38	33	- 5
\$6-11,999	40	29	-11	38	45	+ 7
\$12-18,000	40	33	- 7	38	44	+ 6
<u>Region</u>						
Northeast	37	29	- 8	36	41	+ 5
Midwest	41	29	-12	42	47	+ 5
South	41	39	- 2	38	41	+ 3
Western	38	34	- 4	43	47	+ 4
<u>Education</u>						
Grade school	37	34	- 3	32	32	0
High school	41	32	- 9	39	44	+ 5
College	38	34	- 4	43	47	+ 4
<u>Occupation</u>						
Blue collar	40	32	- 8	41	44	+ 3
White collar	40	31	- 9	40	49	+ 9
Executive/professional	50	39	-11	33	43	+10

NOTE: "There is continuing talk about an energy crisis and the idea that there won't be enough electricity and other forms of energy to meet consumer demand in the coming years."

the lower middle income group, those in executive/professional occupations, and those living in the Midwest. It should be noted that both the ORC and the Roper questions assume that there is a trade-off between providing more energy and protecting the environment.

There appears to be a growing awareness of the potential negative consequences of both increasing and decreasing the energy supply. This is the dilemma facing the public: paying a price for more energy (in terms of anticipated environmental and health damage) or paying a price for less energy (in terms of expected life style and economic structure changes). We will look into attitudes toward specific aspects of these expected trade-offs in the following two sections, alternative energy sources (5.4) and conservation (5.5).

5.4 Alternative Energy Sources

The examination of the relative preferences of the public for the various energy sources currently and potentially available adds an important dimension to understanding the position of the public on nuclear energy. One's assessment of the advantages and disadvantages of alternatives such as coal, oil, and hydroelectric power is likely to influence one's attitude toward nuclear power.

5.4.1 General Preferences

5.4.1.1 Direct comparisons of energy sources. A number of surveys have asked direct comparison questions, requesting respondents to select one or two "best" long-term sources of energy (see Tables 5.7 and 5.8). A consistent finding across the national, state, and area samples is the strong preference for both solar and nuclear energy. When only one best choice was allowed, as in the state and area surveys, nuclear energy was generally preferred to solar energy [except for the Phoenix (75/7) and

TABLE 5.7

ONE OR TWO BEST LONG TERM SOURCES OF ENERGY

	Roper (75/4)				
	Solar	Nuclear	Coal	Offshore Oil	Water Dams/Rivers
<u>Total</u>	50%	47%	18%	18%	12%
<u>Sex</u>					
Male	53	57	19	16	12
Female	47	38	18	19	13
<u>Age</u>					
18-29	56	49	13	15	13
30-44	55	50	16	17	10
45-59	47	52	20	16	12
Over 60	38	36	26	24	14
<u>Income</u>					
\$0-5,999	31	32	23	25	16
\$6-11,999	44	42	18	18	14
\$12-17,999	60	55	15	14	11
Over \$18,000	62	59	19	15	9
<u>Region</u>					
Northeast	54	47	18	21	9
Midwest	55	47	20	13	13
South	56	45	19	22	12
Western	62	53	14	12	15
<u>Education</u>					
Grade school	26	28	24	24	17
High school	49	47	18	20	13
College	63	58	16	11	9
<u>Occupation</u>					
Blue collar	49	49	19	17	12
White collar	53	60	14	18	10
Exec/prof	67	54	17	9	8

NOTE: "Looking ahead to the year 2000, which of these sources do you think offers the best long term source of energy--which one or two do you think we should spend the greatest effort on to develop? [coal, water power, ocean tides, wind power, offshore oil, oil from shale, nuclear, solar]"

TABLE 5.8

BEST LONG TERM SOURCE--STATE AND AREA SAMPLES

Survey	Source							
	Nuclear Power	Solar Power	More Dams	Coal- burning	Geo- thermal	Wind Power	Gas/ Oil- burning	Undecided
<u>State</u>								
Bardsley (OR 72/2) ^a	52%	--	17%	2%	--	--	--	29%
Bardsley (OR 75/7) ^b	32	27%	16	8	9%	4%	1%	3
Bardsley (OR, WA 75/12) ^c								
Total Oregon	37	21	19	7	7	4	1	4
Total Washington	39	21	20	9	5	3	0	3
Bardsley (WA 76/8) ^d	23	23	33	9	3	5	1	3
<u>Local</u>								
IGR (Phoenix 75/7) ^e	26	60	24	12	--	--	5	--
Bardsley (San Diego 76/9) ^f	45	37	--	5	6	--	1	6
<u>Site</u>								
Bardsley (Miles Lake 73/5) ^g	56	--	18	1	13	--	2	10

^a"Which do you feel is the best way to supply the future electricity needs of the state--through more dams, nuclear power plants or coal-fed generators?"

^b"On this card (HAND CARD D) are different ways to generate electricity. Which one of these do you feel is the best way to supply most of the additional electricity needed for Oregon in the next 15-20 years? Just call your answer by letter please. Which is next best?"

^c"Speaking of future needs, this card (HAND CARD C) lists different ways of generating electricity. Which one of these do you feel is the best way to supply most of the additional electricity needed in the Northwest for the next 15-20 years? Just call your answer by letter please."

TABLE 5.8 (Continued)

^d"Speaking of future needs, here is a list of different ways of generating electricity. Which one of these do you feel is the best way to supply most of the additional electricity needed in the Northwest for the next 15-20 years?"

^e"If energy demand in the state should grow beyond present capacity, which of the following sources of electrical energy would you rate as desirable? Please rate the desirability for Arizona of the following sources of electrical energy, 1 through 6. 1 = most desirable, 2 - second most desirable."

^f"If it turns out that more electricity is needed, which of these methods of generation do you feel is the best way to supply most of the additional electricity needed for this area?"

^g"If more electricity is needed, which one of these methods of generating electricity do you think is the best way to supply additional power for the area?"

Washington (76/8) samples (see Table 5.8)]. When one or two choices were allowed, as in Roper (75/4), solar energy received a slightly higher favorable percentage than did nuclear power (see Table 5.7). It appears that having solar energy included in the list of alternatives cuts substantially into the percentage selecting nuclear energy as the best source (in the state and area surveys). The mean percentage choosing nuclear power when solar energy is also an option is 34%, while the mean percentage selecting nuclear energy when solar energy is not listed is 54%. A mean of 32% support solar first when nuclear was among the alternatives (see Table 5.8).

Demographic data from Roper (75/4) (see Table 5.7) indicate that the greatest amount of support for solar energy was from the high-income (62%), college-educated (63%), executive/professional (67%), under-45 (56%), and Western region (62%) groups. It is of considerable interest to note that nuclear supporters also came from some of the same groups as those in favor of solar energy: the high-income, college-educated, and Western region groups. These data indicate that support for nuclear energy is not inconsistent with support for solar energy.

There is a substantial disparity between Washington State attitudes toward nuclear energy in the Bardsley (WA 75/12) survey as opposed to the Bardsley (WA 76/8) survey. The Bardsley (WA 76/8) study, limited to registered voters, found 16% less support for nuclear energy and 13% more support for hydropower than did the Bardsley (WA 75/12) study (see Table 5.8). One possible explanation is that the change was partly due to the nuclear initiative campaign that summer. As noted in the discussion of general nuclear attitudes (Chapter 3), however, responses to the general pro/con nuclear energy questions usually have changed only slightly during the course of initiative campaigns. Although a chemical explosion occurred at the Hanford Nuclear Reservation on August 30, 1976, this incident was after the period of data collection (between August 6-21, 1976), so that the attendant publicity cannot account for the loss of nuclear support reported in the Bardsley (WA 76/8) survey.

The extremely limited support for coal as a preferred choice is evident in both the Roper (75/4) survey, where 18% favored coal (see Table 5.7), and the state and area surveys that found a median favorability of 7% (see Table 5.8). The state and area data are limited to the Western states and therefore do not provide a representative range of responses. However, the Roper (75/4) data, when broken down by region, only range from a low of 14% in the West to a high of 20% in the Midwest preferring coal. Harris (75/4, 76/7) data indicate a potentially higher favorability toward coal. Slightly less than half of the general public respondents (about 45%) felt that coal "is a reliable form of energy for the U.S. to depend on in the long run," compared to about 25% feeling that way about oil, and about 65% feeling that way about nuclear power.

5.4.1.2 Steps to solve the energy crisis. Another comparative approach for evaluating energy preferences has been to assess favorability toward a series of possible steps to solve energy shortages. The context of the questions focuses on the existence of an energy crisis. The time frame is also quite different from that of the previous comparative questions. The emphasis is placed on actions that could be taken now as opposed to the long-term perspective of the "best source" questions.

Table 5.9 shows the percentage of people endorsing each of seven steps that could be taken to help solve the energy crisis (Harris, 73/9, 74/7, 74/11, 75/4, 76/7; Roper, 73/12, 74/6, 75/6, 76/6).¹ Speeding up the development of solar energy receives the highest level of support, with 82% of the public in favor (Harris, 76/7). Speeding up the building of nuclear plants received 64% favorable responses in the Harris (76/7) survey. Given the approximately equal support for nuclear and

¹The Roper question referred to steps for conserving energy supplies and included some conservation items, while the Harris question referred to steps for solving the energy crisis and included primarily ways of increasing the energy supply. See the bottom of Table 5.9 for exact question wording.

TABLE 5.9

STEPS TO SOLVE ENERGY CRISIS
% FAVOR

Energy Policy	1973		1974			1975		1976	
	Harris ^a	Roper ^b	Roper ^b	Harris ^a	Harris ^a	Harris ^a	Roper ^b	Roper ^b	Harris ^a
	73/9	73/12	74/6	74/7	74/11	75/4	75/6	76/6	76/7
Speed solar development	--	--	--	--	--	--	--	--	82%
Increase or start offshore oil drilling	67%	72%	68%	67%	--	66%	70%	61%	64
Expand atomic energy program or speed building new nuclear plants ^c	64	62	57	75	66%	67	53	47	62
Allow more strip mining	42	57	46	48	--	49	48	42	49
Eliminate automobile pollution devices	--	--	45	--	--	--	48	42	--
Relax pollution standards on fuels	--	54	39	--	--	--	45	33	--
Slow down clean-up of water and air pollution	29	--	--	--	39	26	--	--	20

^a"I am going to read you a list of steps which have been suggested to help solve the energy crisis. For each one, tell me if you favor or oppose it." [Also included: increase efforts for oil shale, speed construction of Alaska pipeline, use naval oil reserves, eliminate electric power plants that use oil by 1980.]

^b"There has been much talk about the problem of a fuel and energy shortage in this country, here is a list of steps that have been or could be taken to conserve supplies of energy. Is that something you think we should do or should not do?" [Asked for each item; also included: limit home use of air conditioning, homes heated at no more than 68° in winter, build enough plants for steady supply of electricity, place penalty tax on large cars, charge substantially more for home electricity used during peak day time hours.]

^cRoper question worded: "Go into a greatly expanded program to develop atomic energy."

solar power (47% and 50% respectively) in the Roper (75/4) "best sources" question, the considerable difference between nuclear and solar support in Harris (76/7) merits some comment. Although both these sources are considered good long-term energy providers, the public may feel nuclear power is already sufficiently developed while solar energy needs a major technical development program. The significance of the support level for solar energy is that 82% represents a considerable degree of consensus for the development of solar power. Unfortunately, none of the earlier surveys included solar energy in the "steps to solve the energy crisis" question, so the consistency of support for solar development cannot be evaluated. The ranking of the other alternatives--with offshore oil slightly preferred to nuclear, and strip mining and lowering pollution standards least preferred--is generally consistent across the nine studies done between September 1973 and July 1976, although the specific level of support for each step differs across time (see Table 5.9).

The trend of support levels for nuclear energy over time is somewhat inconsistent. The Roper studies indicate a downward trend in nuclear support over time (see Fig. 5.6). The Harris data, however, show some variability (an increase in support between 73/9 and 74/7, followed by a decrease in 74/11) that is difficult to interpret. The Harris (74/7) high level of support (75%) for nuclear energy did occur after the peak of belief in the energy shortage during the winter of 1973, although belief in a "very serious" shortage was at its lowest point by the summer of 1974 (see Fig. 5.1). The fact that the level of nuclear support went down to its pre-oil-embargo level of around 65% between July and November of 1974, while belief in a "very serious" energy shortage increased by over 20% during that same period, indicates that increased concern over an energy shortage did not appear to enhance the acceptability of nuclear power. Since this change occurred between summer and winter weather, it is possible that concern was related primarily to heating fuel, with greater emphasis on gas, coal, and oil than on nuclear-generated electricity. Evidence in support of this hypothesis is found in the public response to strip mining, which has the least support of any of the energy source alternatives, averaging 48% favorability (see Table 5.9). Favorability was above 50% only once during the period between fall 1973 and summer 1976. Fifty-seven

FIGURE 5.6

TREND COMPARISON FOR OFFSHORE OIL, NUCLEAR, AND STRIP MINING

^a"I am going to read you a list of steps which have been suggested to help solve the energy crisis. For each one, tell me if you favor or oppose it." [Also included: increase efforts for oil shale, speed construction of Alaska pipeline, use naval oil reserves, eliminate electric power plants that use oil by 1980.] (Harris)

^b"There has been much talk about the problem of a fuel and energy shortage in this country, here is a list of steps that have been or could be taken to conserve supplies of energy. Is that something you think we should do or should not do?" [Asked for each item; also included: limit home use of air conditioning, homes heated at no more than 68° in winter, build enough plants for steady supply of electricity, place penalty tax on large cars, charge substantially more for home electricity used during peak day time hours.] (Roper)

percent of the respondents in the Roper (73/12) survey were in favor of allowing more strip mining. The fact that this was during the winter of the oil crisis when belief in an energy shortage was relatively high (see Fig. 5.1) suggests that public attitudes toward coal are influenced by the energy situation.

The relatively high preference for increasing offshore oil drilling, averaging around 67% favorability (see Table 5.9), is striking when compared to the low level of support for oil as an energy source reported in Table 5.7, where only 18% of the respondents selected offshore oil among the one or two best sources. Effort to develop nuclear energy received far more support than effort devoted to offshore oil in the "best source" question, while nuclear power and offshore oil received very similar levels of support in the "steps to solve the energy crisis" questions. The different time perspectives of the two questions may explain this variation. The "energy crisis" question seems to emphasize short-run immediate responses, while the "best source" question explicitly focuses on long-term solutions. The data suggest that the public is in favor of increasing offshore oil drilling as a temporary measure to solve current problems, but clearly does not see offshore oil as a long-term solution to energy needs.

From 1973 to 1976, people appear to have become more strongly opposed to relaxing pollution controls. In 1976, 42% of the respondents were in favor of eliminating automobile pollution devices (compared to 48% in 1975 and 45% in 1974), 33% were in favor of relaxing pollution standards on fuels (compared to an average of 44% from 1973 to 1975), and 20% were in favor of slowing down the cleanup of water and air (compared to an average of 31% between 1973 and 1975) (see Table 5.9). There is less willingness to give up environmental protection to permit greater energy production, which is consistent with the trend discussed earlier for the question on the trade-off between energy supply and the environment (see Figure 5.5).

Demographic breakdowns on the "steps to solve the energy crisis" question for Roper (75/6, 76/6) are presented in Table 5.10. The most

striking differences in responses are by sex. Women are less in favor of all the steps than are men, although they rank the alternatives in almost exactly the same order. It is important to note that women's opposition to nuclear power appears to be more than an expression of opposition to increasing the energy supply by all means. The greatest gap between the sexes is over support for expanding the nuclear energy program: a mean difference of 19% between men and women is reported for nuclear power, while for the other listed items the mean difference ranged from 5% to 14% (see Table 5.10). Allowing more strip mining, one of the least-supported alternatives overall, received about the same level of support from women as expanding nuclear energy (a mean of 42% favorable to nuclear energy and a mean of 43% favorable to strip mining).

Those aged 45-59 tended to support almost all alternatives to a higher degree than did younger age groups (18-29 and 30-44). As with sex differences, however, the ranking of the set of alternatives was consistent in all three of these age groups. Only the over-60 group differed in their relative preferences, placing strip mining slightly above nuclear energy. The less educated (those with grade school education only) showed less support for all of the steps than did the more educated (those with high school and college educations). For less-educated respondents, developing nuclear energy was the least preferred of all suggested steps. The high school and college-educated groups showed the same rank order of energy preferences, but the college educated showed a higher level of support for nuclear energy and a lower level of support for relaxing pollution standards than did the high school group (see Table 5.10).

Support for all of the alternatives dropped to some degree between 1975 and 1976 in every demographic category presented, indicating a decline in overall support for the various solutions presented to the respondents (see Table 5.10). It should be mentioned, though, that belief in the existence of an energy shortage remained stable during that period (see Figure 5.1). The youngest age group (18-29) showed the greatest decline in support for all alternatives--averaging a 10% drop in favorability across the board (see Table 5.10). This overall drop in

TABLE 5.10

SELECTED DEMOGRAPHIC BREAKDOWNS
STEPS TO HELP ENERGY CRISIS
% IN FAVOR

Respondent Category	Roper							
	Offshore Oil Drilling		Develop Nuclear		More Strip Mining		Relax Pollution Standards	
	75/6	76/6	75/6	76/6	75/6	76/6	75/6	76/6
<u>Total</u>	70%	61%	53%	47%	48%	42%	45%	33%
<u>Sex</u>								
Male	77	68	63	57	51	45	50	37
Female	63	54	45	38	46	40	39	29
<u>Age</u>								
18-29	70	59	53	45	44	36	40	28
30-44	73	63	54	48	45	40	40	29
45-59	68	66	56	52	51	46	52	35
Over 60	68	55	50	44	55	48	49	42
<u>Education</u>								
Grade school	58	47	38	39	50	47	49	46
High school	71	61	52	47	53	44	49	34
College	72	66	63	51	39	37	36	26

NOTE: "There has been much talk about the problem of a fuel and energy shortage in this country, here is a list of steps that have been or could be taken to conserve supplies of energy. Is that something you think we should do or should not do?" [Asked for each item; also included: limit home use of air conditioning, homes heated at no more than 68° in winter, build enough plants for steady supply of electricity, place penalty tax on large cars, charge substantially more for home electricity used during peak day time hours.

support for all alternatives could be interpreted as indicating dissatisfaction with the range of options presented or as suggesting that willingness to pursue the various options has decreased as time has passed since the oil crisis of the winter of 1973.

Cambridge (75/8) assessed public perceptions of the potential contributions of three alternative approaches to energy problems: (1) construction of solar energy facilities, (2) more extensive use of coal, and (3) strict energy conservation. Cambridge referred to these as "solutions . . . that do not involve nuclear power" (see Table 5.11). Over half of the public believed that solar energy could do a lot to solve the energy crisis in the next 25 years. On the other hand, only about one-third of the respondents felt that coal or conservation could be very effective.

There were distinctive demographic patterns of support for these three alternatives (see Table 5.11 and Figs. 5.7, 5.8, and 5.9). In general, support for solar energy was directly related to income and educational level and inversely related to age. Men were stronger supporters of solar energy than were women, and the Pacific and Industrial regions showed higher support for solar energy than did other regions. Again, note that some of these groups, e.g., men and the West region, are the same as the major nuclear energy supporters. The high-income respondents, the young, those with technical/vocational or graduate school education, those in the Industrial region, and opponents of nuclear energy were most likely to believe in the potential for conservation to solve the energy crisis. Coal, which had the lowest overall support, was predominantly favored by respondents who were older, male, from the Central region, or either of lowest or highest educational rank.

5.4.1.3 Comparison of coal and nuclear favorability. Becker (73/6, 74/5) reported data on the degree of favorability toward coal and nuclear plants in the respondents' own area (see Table 5.12). While coal is one of the least-preferred energy alternatives, it is interesting to note that support for coal increased between 1973 and 1974 in

TABLE 5.11

NON-NUCLEAR ALTERNATIVES

Respondent Category	Cambridge (75/8)					
	Solar		Coal		Conservation	
	"A lot"	"Very little"	"A lot"	"Very little"	"A lot"	"Very little"
<u>Total</u>	54%	9%	31%	22%	36%	17%
<u>Sex</u>						
Male	59	10	36	21	36	19
Female	49	8	26	23	36	15
<u>Region</u>						
Northeast	53	8	26	22	32	21
Industrial	60	10	36	20	42	19
Midlands	56	7	31	24	38	16
South	44	10	30	17	32	14
Central	55	9	38	21	37	17
Pacific	61	7	19	33	30	15
<u>Nuclear plant proximity</u>						
No nuclear plant	53	10	35	18	39	17
Nuclear plant	57	7	20	31	30	19
Potential plant	54	8	33	21	36	15
<u>Build more nuclear plants</u> ^a						
Favor	60	9	35	24	36	20
Oppose	54	9	28	23	42	13

NOTE: "Three possible solutions to the energy problem have been proposed that do not involve nuclear power: construction of solar energy facilities, more extensive use of coal and strict energy conservation. Do you think in the next 25 years each of these can do a lot to solve the energy crisis, something to solve the problem, or very little to solve the problem?"

^a"Do you generally favor or oppose the building of more nuclear power plants?"

FIGURE 5.7.

DEMOGRAPHIC PATTERNS--INCOME
THREE NON-NUCLEAR ALTERNATIVES

NOTE: "Three possible solutions to the energy problem have been proposed that do not involve nuclear power: construction of solar energy facilities, more extensive use of coal and strict energy conservation. Do you think in the next 25 years each of these can do a lot to solve the energy crisis, something to solve the problem, or very little to solve the problem?" Data from Cambridge (75/8).

FIGURE 5.8

DEMOGRAPHIC PATTERNS--EDUCATION
THREE NON-NUCLEAR ALTERNATIVES

NOTE: "Three possible solutions to the energy problem have been proposed that do not involve nuclear power: construction of solar energy facilities, more extensive use of coal and strict energy conservation. Do you think in the next 25 years each of these can do a lot to solve the energy crisis, something to solve the problem, or very little to solve the problem?" Cambridge (75/8)

FIGURE 5.9

DEMOGRAPHIC PATTERNS--AGE
THREE NON-NUCLEAR ALTERNATIVES

NOTE: "Three possible solutions to the energy problem have been proposed that do not involve nuclear power: construction of solar energy facilities, more extensive use of coal and strict energy conservation. Do you think in the next 25 years each of these can do a lot to solve the energy crisis, something to solve the problem, or very little to solve the problem?" Data from Cambridge (75/8).

TABLE 5.12

OIL/COAL AND NUCLEAR PLANT FAVORABILITY
National Data

Respondent Category	Percent saying "Would be all right"			
	Becker			
	1973		1974	
	Oil/Coal	Nuclear	Oil/Coal	Nuclear
<u>Total</u>	37%	56%	44%	55%
<u>Sex</u>				
Male	43	64	52	66
Female	30	46	37	46
<u>Age</u>				
18-29	31	55	37	55
30-44	35	55	44	60
45-64	40	60	46	55
Over 65	41	49	52	52
<u>Region</u>				
Northeast	37	50	44	52
Southeast	40	56	48	59
North Central	41	54	48	52
Southwest	36	55	50	61
West	23	66	29	61
<u>Attitude toward new plants^a</u>				
Build all plants needed	43	64	60	59
Limit use of electricity	31	49	31	34
<u>Nuclear plant here</u>				
Would be all right	44	--	59	--
Would oppose it	29	--	33	--

NOTE:

Oil/Coal: "Suppose your electric company announced it planned to build an electric power plant in this general area that burned oil or coal for fuel. Would building this kind of plant be all right with you or would you oppose it?"

Nuclear: "Suppose your electric company announced that it planned to build a nuclear power generating plant in this general area producing electric power by means of atomic energy. Would building this kind of plant be all right with you or would you oppose it?"

^a"All things considered, which do you think is better: to build as many new power plants as are needed to let everybody use all the electricity they want or to try to limit or cut back the use of electricity so that fewer new power plants will have to be built?"

almost every demographic group, increasing on the average from 37% in favor to 44% in favor. The occurrence of the oil embargo between these two surveys probably accounts for a major part of this change. However, favorability toward nuclear energy remained stable during this period (approximately 55% in favor). These findings further confirm the evidence presented above that attitudes toward coal seem to be influenced by energy shortages, while nuclear attitudes do not appear to be so affected. Demographic groups that support both coal and nuclear energy include men and respondents from the Southern and Central regions. Those groups that support nuclear energy but are unfavorable toward coal include the Western region and the young (aged 18-29). Women are unfavorable toward both coal and nuclear energy. Those with the highest support levels for coal are individuals with pronuclear attitudes and those who prefer building all necessary power plants to cutting back on electricity use (Becker, 73/6, 74/5).

Comparisons of attitudes toward coal and nuclear plants for state and area surveys are presented in Table 5.13. In contrast to Becker's (73/6, 74/5) national findings, favorability toward nuclear plants usually was not found to be much higher than favorability toward coal plants in the statewide surveys (a difference on the average of only 3% greater favorability for nuclear energy). However, much greater support for nuclear plants than coal plants was found in the local and site-specific surveys (an average difference of approximately 25% more support for nuclear energy). The area surveys that asked direct comparison questions on the choice of coal versus nuclear power (Central, NH 71/10; Marble Hill, 76/11), indicate a clearcut preference for nuclear energy, except in Kentucky where coal contributes greatly to the state's economy (see Table 5.13).

The percentage of respondents that selected "makes no difference" when the option was given was similar for both coal (36% mean, 32% median) and nuclear energy (32% median and mean) in the statewide surveys (see Table 5.13). This finding suggests that the respondents who selected "makes no difference" were not influenced by familiarity or the length of time in the past that a particular energy source had been used.

TABLE 5.13
COAL AND NUCLEAR PLANT FAVORABILITY
State and Area Data

Survey by Question Type	Pro		Con		Makes No Difference	
	Coal	Nuclear	Coal	Nuclear	Coal	Nuclear
<u>Reaction to hypothetical plant</u>						
<u>State</u>						
Central (IN 75/11) ^a	28%	35%	32%	14%	30%	34%
Central (MI, WI 77/3) ^b	29	27	14	19	48	37
Central (OK 75/3) ^c	28	44	23	15	37	29
Central (OK 76/3) ^c	38	38	22	16	28	27
Bardsley (WA 76/8) ^d	44	49	38	36	--	--
Central (WI 75/6) ^e	49	52	29	25	--	--
<u>Local</u>						
Central (Tulsa 74/1) ^f	18	44	23	3	49	44
<u>Site</u>						
Central (Black Fox 74/1) ^g	25	37	9	4	55	50
Central (Matagorda 73/3) ^h	9	49	58	17	--	--
<u>Reaction to proposed plant</u>						
Bardsley (OR 75/7) ⁱ	59	58	24	29	--	--
ORNL (Hartsville 75/4) ^j	48	69	30	31	--	--
<u>Direct comparisons</u>						
	Prefer Coal/Oil		Prefer Nuclear		No opinion, No preference	
<u>State</u>						
Central (NH 71/10) ^k	9		56		35	
<u>Site</u>						
Central (Marble Hill 76/11) ^l						
Indiana	29		50		21	
Kentucky	41		42		17	

^a"One type of power plant is called a nuclear power plant, to produce electric power from nuclear fuel. Do you favor building nuclear power plants in Indiana, or oppose them, or doesn't it make much difference to you either way?"

"Another type of power plant would burn coal. Do you favor building additional coal burning power plants in Indiana, or oppose them, or doesn't it make much difference to you either way?"

TABLE 5.13 (Continued)

^b"If your electric company proposed to build a coal-fired electric power plant somewhere in your county, would you favor such a plant, oppose it, or wouldn't it make any difference to you either way?"

"If your electric company proposed to build a nuclear power plant somewhere in your county, would you favor such a plant, oppose it, or wouldn't make any difference to you either way?"

^c"If your local electric company proposed to build an electric power plant that would burn coal somewhere in this county, would you favor such a plant, oppose it, or wouldn't it make much difference to you either way?"

"If your local electric company proposed to build a nuclear power plant to produce electricity from atomic energy somewhere in this county, would you favor such a plant, oppose it, or wouldn't it make much difference to you either way?"

^d"If your local electric utility proposed to build an electric power plant that would burn coal somewhere [in this area] would you favor or oppose such a plant?"

"If your local electric utility proposed to build a nuclear power plant to produce electricity somewhere [in this area] would you favor or oppose such a plant?"

^e"If your electric power company proposed to build a power plant somewhere in this county that would burn coal to generate electricity, would that be all right with you, or would you be against such a plant?"

"If your electric power company proposed to build a nuclear power plant to generate electricity from nuclear energy somewhere in this county, would that be all right with you or would you be against such a plant?"

^f"If your electric power company proposed to build an electric power plant that would burn coal near Inola, would you favor it, or oppose it, or wouldn't it make any difference to you either way?"

"Do you favor building a nuclear power plant there, or oppose it, or doesn't it make any difference to you either way?"

^g"If your electric power company proposed to build an electric power plant that would burn coal near Inola, would you favor it, or oppose it, or wouldn't it make any difference to you either way?"

"Do you favor building a nuclear power plant there, or oppose it, or doesn't it make any difference to you either way?"

^h"If someone proposed to build a large electric power plant that would burn coal here in this area, would you favor, or oppose such a plant?"

"If someone proposed to build a large electric power plant to produce electricity from atomic energy in this area, would you favor, or oppose such a plant?"

ⁱ"Here is another map, showing the location of where a coal-fed power plant will be built in Eastern Oregon. Do you generally approve or disapprove of this coal power plant?"

TABLE 5.13 (Continued)

"It has been proposed that a second nuclear plant be built at this approximate location in Eastern Oregon. Would you generally approve or disapprove of a nuclear plant here?"

^j"Suppose the power plant planned for Hartsville was going to burn coal instead of using nuclear fuel. If it were up to you, would you permit construction of this type of facility?"

"If it were up to you, would you permit construction of the TVA power plant near Hartsville?"

^k"If new electric power plants were built here in this area, would you rather have them be nuclear power plants that burn oil or coal?"

^l"If you knew that some type of large power plant would be built here in the county, would you prefer that it was a nuclear power plant, or a coal-burning plant?" (Indiana)

"If you knew that some type of large power plant would be built in that general area on the Ohio River, would you prefer that it was a nuclear power plant, or a coal-burning plant?" (Kentucky)

The different response patterns in Central (OK 75/3) and Central (OK 76/3) are of considerable interest (see Table 5.13). In 1975, nuclear energy received more support than did coal; but by 1976, favorability toward coal increased while favorability toward nuclear power decreased, resulting in approximately equal levels of support for both coal and nuclear energy.

5.4.1.4 Summary of general preference findings. The major conclusions in terms of the general preferences of the public for specific energy sources are: (1) Solar power is the most highly supported energy option, (2) Nuclear energy is the next-most-preferred alternative. Favorability toward nuclear power was not found to be influenced by the degree to which the public believes in the energy crisis.² (3) Coal is not supported as a desirable source of energy, although favorability increased significantly during the oil embargo of 1973. (4) Strip mining is opposed by over half of the American public.

5.4.2 Comparison of the Advantages and Disadvantages of Different Energy Sources

The public's evaluation of specific aspects of alternative energy sources is an important element in understanding why certain types of energy are preferred over others. Although there are limited data available that compare the perceived characteristics of energy options, assessments of the public's evaluation of health, safety, environmental impacts, availability, technical capacity, and cost factors of various energy options have been made.

²Based on variation or lack of variation in overall response rates (1) favorable to nuclear energy and (2) stating a belief in the existence of an energy shortage in given time periods, as opposed to the relationship of these two variables in specific individuals.

5.4.2.1 Health and safety. When compared to other energy sources, nuclear energy was perceived to create the greatest problems for health and safety (see Table 5.14). Harris (75/4, 76/7) found both coal and oil preferable to nuclear power in this respect, although the differences are not great (5% more respondents felt coal raised fewer health hazards and 10% more felt that way about oil compared to nuclear energy). Cambridge (75/4) indicated a consensus (73%) that nuclear power is the "most dangerous" source (see Table 5.14). A NORC study in 1974, however, found only 19% of the sample saying radiation from nuclear plants resulted in "a lot of damage to people's health." (Overall assessments of energy sources were not requested in that study.) Cambridge (75/4) also showed that solar energy was evaluated most often as the safest energy source (46% selected solar energy), while hydropower was the second-most-selected choice (23%).

TABLE 5.14
HEALTH AND SAFETY

Energy Source	Cambridge ^a 75/4		Harris ^b	
	Safest	Most Dangerous	75/4 Raises Few Health Hazards	76/7 Health Dangers
Oil	7%	4%	46%	45%
Coal	13	2	40	39
Nuclear	4	73	34	36
Natural gas	8	16	--	--
Hydro electricity	23	3	--	--
Solar	46	2	--	--

^aCambridge 75/4. "Which energy source is safest (most dangerous)?"

^bHarris (75) (76). "Now let me ask you about three different sources of energy which can be used to make electric power. Do you think oil (coal, nuclear) raises few health hazards and dangers in using it?"

5.4.2.2 Environment. Nuclear power was seen as preferable to coal or oil in terms of its pollution characteristics. About 59% of the respondents [see Table 5.15 Harris (75/4, 76/7)] felt that nuclear power is a clean source of energy. There seemed to be recognition of the problem of water thermal pollution associated with nuclear energy, but even in this respect it was perceived as better than coal or oil. About 45% thought that nuclear power "doesn't pollute the water so much" (Harris, 75/4, 76/7). Cambridge (76/4) data also confirmed this: 55% agreed that "nuclear power is good because it doesn't pollute the air or water like coal or oil." Furthermore, the environmental impact of nuclear power was evaluated positively for its contribution to conserving other natural resources (see Table 5.16) (Bardsley, OR 71/4, OR 76/9, WA 76/8). (Refer to Section 4.8 for further discussion of nuclear power and pollution.)

TABLE 5.15
ENVIRONMENTAL IMPACTS: POLLUTION

Energy Source	Low Air Pollution ^a		Low Water Pollution ^b	
	Harris		Harris	
	75/4	76/7	75/4	76/7
Oil	24%	25%	24%	24%
Coal	10	14	27	27
Nuclear	57	60	44	46

^a"Do you think oil (coal, nuclear) is a clean source of energy and doesn't pollute the air so much?"

^b"Do you think oil (coal, nuclear) is a clean source of energy and doesn't pollute the water so much?"

5.4.2.3 Availability. The availability of energy sources is a particularly crucial element in the concern over long-term energy shortages. The relative importance of this factor was heightened during the 1973 oil embargo. There are two aspects to the issue of availability--first, the existence of a recoverable supply and second, energy independence (i.e., the degree of self-sufficiency in energy

TABLE 5.16

ENVIRONMENTAL IMPACTS:
NUCLEAR POWER HELPS THE CONSERVATION OF NATURAL RESOURCES
State Samples

Survey	Agree	Disagree	Undecided
Bardsley (OR 71/4) ^a	74%	9%	17%
Bardsley (OR 76/9) ^b			
Total	80	10	10
Pro Nuclear	90	5	5
Con Nuclear	66	20	14
Bardsley (WA 76/8) ^c	85	10	5

^a"Nuclear power plants will conserve our natural resources, such as oil, gas and coal--agree or disagree?"

^b"Nuclear power plants help to conserve on other natural resources, such as coal, oil, water and gas--agree or disagree?"

^c"Using nuclear power helps to conserve other natural resources such as oil, gas or coal--agree or disagree?"

production that the United States can achieve). As Table 5.17 shows, nuclear energy was regarded as highly available for the United States. Coal was also evaluated positively in terms of its supply characteristics, although somewhat less so than nuclear energy. Oil, on the other hand, was seen as problematical in terms of supply (Harris, 75/4, 76/7).

TABLE 5.17
AVAILABILITY: SUPPLY ASPECTS
OF OIL, COAL, AND NUCLEAR POWER

Energy Source	Unlimited Quantities		Will Not Run Out in Near Future		Obtained Almost Entirely in U.S.		Lessens Dependence on Foreign Sources	
	75/4	76/7	75/4	76/7	75/4	76/7	75/4	76/7
Oil	28%	26%	33%	33%	38%	36%	40%	37%
Coal	44	48	45	41	69	70	69	66
Nuclear power	65	63	53	51	73	73	76	73

NOTE: "Now let me ask you about three different sources of energy which can be used to make electric power. Do you think:

Oil/coal/nuclear power can be produced in almost unlimited quantities, or not?

Oil/coal/nuclear power will not run out of supply any time soon in the future, or not?

Oil/coal/nuclear power can be obtained almost entirely within the United States, or not?

Oil/coal/nuclear power makes us less dependent on foreign sources, or not?"

Approximately 80% of both the 1975 and 1976 Harris respondents said they would like to see the U.S. become totally independent of foreign sources of energy. As Cambridge (75/5, 76/4) surveys demonstrated, however, (1) safety was considered more important than energy independence and (2) nuclear energy was not perceived as the only means to achieve such independence (see Table 5.18). In 1975, 63%, and in 1976, 71% of the respondents disagreed that "we should run any risks to build nuclear plants" to achieve energy independence. In Cambridge (75/5),

55% of the sample disagreed with the statement that "only by building nuclear plants can we free ourselves from dependence on Arab oil."

TABLE 5.18
NUCLEAR POWER AND ENERGY INDEPENDENCE

Response	Cambridge		
	Build Nuclear Plants to Achieve Energy Independence ^a	Run Any Risks for Energy Independence ^b	
	75/5	75/5	76/4
Agree	26%	25%	17%
Disagree	55	63	71
Don't know	19	12	12

^a"Only by building nuclear plants can we free ourselves from dependence on Arab oil."

^b"If nuclear power can help achieve energy independence we should run any risks to build nuclear plants."

It is interesting to note that some of the demographic groups supporting nuclear power disagreed most often with the above two statements. For example, those with the highest income and those with the most education showed over 80% disagreement, although disagreement was widespread throughout all groups. Although nuclear opponents most often disagreed that we should "run any risks" for the sake of energy independence (87%), 63% of nuclear supporters also took this position. (See Table 5.19.) The high levels of disagreement were to some extent a reaction to the extreme wording of the statements.

5.4.2.4 Technical capability. Harris (75/4, 76/7) found that close to 70% of the respondents believed that technical know-how for nuclear energy is currently available and around 40% believed that solar technical know-how is available. However, the median number of years the public estimated are required to build enough plants to meet a major part of electricity needs differed by only four between nuclear (13 years) and solar (17 years) plants. Response to a Roper (75/4) question on which sources realistically could replace foreign oil in the next five years indicated that nuclear energy (55%), coal (50%), and solar energy (48%) are the top three selections. This question was asked of only the

TABLE 5.19
ENERGY INDEPENDENCE

Respondent Category	Cambridge (76/4)	
	Agree	Disagree
<u>Total</u>	17%	71%
<u>Sex</u>		
Male	21	67
Female	14	74
<u>Age</u>		
18-25	14	71
26-35	14	78
36-45	18	69
46-55	21	68
56-65	18	69
Over 65	21	63
<u>Income</u>		
\$0-3,999	21	63
\$4-6,999	23	65
\$7-9,999	12	72
\$10-12,999	21	68
\$13-14,999	16	65
\$15-19,999	16	76
\$20-24,999	19	73
Over \$25,000	14	81
<u>Region</u>		
Northeast	13	75
Industrial	17	72
Midlands	21	72
South	16	64
Central	19	70
Pacific	19	73
<u>Education</u>		
Some grade school	20	62
Some high school	25	59
High school graduate	17	72
Technical/vocational	10	85
Some college	17	70
College graduate	13	81
Graduate school	7	84
<u>Nuclear plant proximity</u>		
No nuclear plant	14	71
Nuclear plant	17	71
Potential plant	20	72
<u>Construction of nuclear plant</u>		
Favor	27	63
Oppose	7	97
Don't know	10	62

NOTE: "If nuclear power can help us achieve energy independence we should run any risks to build nuclear power plants."

44% of the total sample who said other sources could replace foreign oil. Thus, both nuclear and solar energy were perceived as significant energy sources for the future.

5.4.2.5 Cost. The extremely limited data available on public opinion about comparative energy costs is somewhat inconsistent with respect to both nuclear energy and coal. Harris (75/4, 76/7) found that about 52% of the respondents expected nuclear power to become cheaper in the future, compared to about 28% who thought that coal would become cheaper and about 17% who thought that oil would become cheaper (see Table 5.20). Cambridge (75/4), on the other hand, found that nuclear energy was selected least often as the cheapest energy source (6%). Solar energy was identified most often as the cheapest source (by 29% of the sample), and coal was a close second (24%) (see Table 5.20). The assumption that solar energy is least expensive is likely to be based on the perceived cost of the source element itself (the sun) as opposed to the cost of transformation for end use, particularly for electricity.

TABLE 5.20
ECONOMIC COMPARISONS

Energy Source	Cheapest ^a Source Cambridge	Cheaper in Future ^b	
	75/4	75	76
Oil	7%	18%	15%
Coal	24	28	27
Nuclear	6	53	50
Natural gas	17	--	--
Hydro electricity	17	--	--
Solar	29	--	--

^aCambridge. "Which energy source is cheapest?"

^bHarris. "Do you think oil (coal, nuclear) will be a cheaper form of energy in the future than it is now?"

5.4.2.6 Summary. The public's evaluation of the characteristics of various energy sources appears compatible with the general preferences data presented in Section 5.4.1. Solar power received positive assessments in terms of its health and safety impacts and cost. A majority of the public did not feel solar technology is available now, although the public estimate of the time required to have enough solar plants to meet a major part of electricity needs was less than 20 years. In the surveys reported, no questions were asked concerning the environmental impact or the availability of solar power. Nuclear power was evaluated positively on environmental and availability aspects, but negatively in terms of health and safety. Public assessments of the economic costs of nuclear power were mixed. Technical knowledge for using nuclear power was seen as currently available. These findings, in a comparative context, are consistent with the analysis of public attitudes toward specific nuclear issues detailed in Chapter 4. Coal received negative assessments for health, safety, and environmental impact, although it was evaluated positively in terms of source availability. Oil was evaluated negatively on virtually all characteristics, relative to other energy alternatives.

5.5 Conservation

Conservation is the approach to energy needs that focuses on the demand side of the energy equation. Conservation can have two distinct meanings: (1) it can refer to increasing energy efficiency (e.g., developing appliances that operate on lower amounts of energy), and (2) conservation can mean reducing energy consumption (e.g., using fewer appliances, or using appliances less often). The surveys of public attitudes have focused exclusively on the latter meaning of conservation. These surveys have been concerned with the public's willingness to change existing life styles that depend on high energy consumption habits.

Viewed in this manner, the issue of conservation involves two kinds of assessments: (1) a value decision on whether it is better to reduce consumption or to continue to meet rising energy demand, and (2) a practical assessment of whether or not conservation programs can be implemented that will reduce energy consumption sufficiently to eliminate the need to produce significantly more energy.

5.5.1 Economics and Conservation

Roper (73/12, 74/8, 75/2, 76/6, 76/7) addressed the value issue of a more austere life style. The percentage of respondents that felt "doing without" would be good was very stable from the end of 1973 through the middle of 1976 (ranging from 55% to 59%) (see Table 5.21).

TABLE 5.21
AUSTERITY DUE TO SHORTAGES

Response	Roper				
	73/12	74/8	75/2	76/6	76/7
<u>Doing without</u> <u>would be a:</u>					
Bad thing	17%	20%	21%	18%	21%
Good thing	56	59	55	59	55
Mixed; volunteered	22	17	20	20	22

NOTE: "There's been talk about various kinds of shortages which may mean that we will have to live a more austere life than we have grown accustomed to. Some people say this is bad because life will be more difficult without some of the important conveniences of life. Others say there are some good things about it, and that a simpler life would be better. What do you think--that on the whole, doing without some things and living a more austere life would be a bad thing or a good thing?"

The response patterns are quite similar across demographic groups. The only groups that varied from the norm are (1) the Western region, in which the largest majority (two-thirds) said that austerity is a good

thing and (2) the Northeast, low-education, and low-income groups, in which the lowest percentages (46% to 48% took that position. (See Table 5.22)

The assessment of conservation's relationship to economic structure may influence one's attitude toward relying on conservation to alleviate energy problems. Cambridge looked at several aspects of this issue. First, Cambridge (75/8) asked respondents whether economic growth is dependent on continuous energy supply increases (see Table 5.23 and Figs. 5.10 and 5.11). Although public opinion was fairly evenly divided on this issue (41% said that conservation is compatible with economic growth and 44% said that an energy increase is necessary), there are some clear demographic patterns of interest.

Belief in conservation being compatible with economic growth was greatest among the youngest age group (18-25) and the highest educated group (graduate school) (see Figs. 5.10 and 5.11). Fifty percent of the men, 49% of the respondents from the Northeast and Industrial states, and 53% of the respondents from the Pacific states believed an energy supply increase is required for economic growth to continue (see Table 5.23). Pronuclear and antinuclear individuals differed to the greatest extent on this issue. Fifty-four percent of the pronuclear group believed that an increase in the energy supply is needed, while 36% of this group believed that conservation is compatible with economic growth. In contrast, 31% of the antinuclear group believed in the need for increased energy for economic growth, while 57% believed that economic growth can continue with conservation.

Cambridge (75/8) also assessed people's beliefs about the relationship of economic growth to economic equality (see Table 5.24). A majority of the public (52%) felt that economic growth is essential to improving the position of lower-income individuals. Belief in this relationship increased with income and educational level. Nuclear opponents and those aged 18-25 were the groups most likely to see the problem as one of unequal distribution as opposed to the need for increased economic growth. About 50% of these groups, compared to 36% of the total sample, selected "unequal distribution."

TABLE 5.22

AUSTERITY

Respondent Category	Roper (76/7)			
	Bad Thing	Good Thing	Mixed (Vol.)	Don't Know/No Answer
<u>Total</u>	21%	55%	22%	3%
<u>Sex</u>				
Male	21	54	22	2
Female	20	55	21	4
<u>Age</u>				
18-29	19	58	20	3
30-44	20	56	22	2
45-59	21	55	21	3
Over 60	22	49	24	5
<u>Income</u>				
\$0-5,999	22	48	22	8
\$6-11,999	24	50	22	3
\$12-17,999	17	61	20	2
Over \$18,000	18	58	23	1
<u>Education</u>				
Grade school	25	48	20	7
High school	20	55	22	3
College	18	58	22	1
<u>Region</u>				
Northeast	22	46	26	6
Midwest	15	59	24	2
South	27	52	19	2
Western	15	65	17	2

NOTE: "There's been talk about various kinds of shortages which may mean that we will have to live a more austere life than we have grown accustomed to. Some people say this is bad because life will be more difficult without some of the important conveniences of life. Others say there are some good things about it, and that a simpler life would be better. What do you think--that on the whole, doing without some things and living a more austere life would be a bad thing or a doog thing?"

TABLE 5.23

CONSERVATION AND ECONOMIC GROWTH

Respondent Category	Cambridge (75/8)	
	Conserve	Need Increase
<u>Total</u>	41%	44%
<u>Sex</u>		
Male	39	50
Female	43	39
<u>Region</u>		
Northeast	39	49
Industrial	44	49
Midlands	43	44
South	40	40
Central	44	40
Pacific	39	53
<u>Build more nuclear plants^a</u>		
Favor	36	54
Oppose	57	31

NOTE: "Some people have argued that we can have economic growth here at home even if we don't increase energy supplies by conserving and using the energy we have more wisely. Other people say this is unrealistic and that we need to increase energy in order to have economic growth. Which is closer to your opinion?"

^a"Do you generally favor or oppose building more nuclear power plants?"

FIGURE 5.10

CONSERVATION AND ECONOMIC GROWTH BY EDUCATION^a

NOTE: "Some people have argued that we can have economic growth here at home even if we don't increase energy supplies by conserving and using the energy we have more wisely. Other people say this is unrealistic and that we need to increase energy in order to have economic growth. Which is closer to your opinion?" Data from Cambridge (75/8).

FIGURE 5.11

CONSERVATION AND ECONOMIC GROWTH BY AGE

NOTE: "Some people have argued that we can have economic growth here at home even if we don't increase energy supplies by conserving and using the energy we have more wisely. Other people say this is unrealistic and that we need to increase energy in order to have economic growth. Which is closer to your opinion?" Data from Cambridge (75/8).

TABLE 5.24
ECONOMIC GROWTH AND EQUALITY

Respondent Category	Cambridge (75/8)		
	Growth Essential	Distribute More Evenly	Don't Know
<u>Total</u>	52%	36%	12%
<u>Sex</u>			
Male	56	35	9
Female	48	37	15
<u>Age</u>			
18-25	41	50	9
26-35	57	33	10
36-45	58	32	10
46-55	52	33	15
56-65	58	29	14
Over 65	49	33	19
<u>Income</u>			
\$0-3,999	49	35	15
\$4-6,999	46	44	11
\$7-9,999	48	41	11
\$10-12,999	46	40	14
\$13-14,999	52	38	11
\$15-19,999	55	34	11
\$20-24,999	65	26	9
Over \$25,000	60	34	5
<u>Education</u>			
Some grade school	36	40	24
Some high school	47	35	18
High school graduate	53	38	10
Technical/vocational	52	34	14
Some college	55	35	10
College graduate	62	32	6
Graduate school	60	32	7
<u>Region</u>			
Northeast	47	39	14
Industrial	56	33	11
Midlands	54	39	7
South	49	33	17
Central	49	39	11
Pacific	54	36	11
<u>More nuclear power plants^a</u>			
Favor	60	30	11
Oppose	38	51	10
Not sure	46	33	21

NOTE: "If we don't increase economic growth some people say there will be increasing unrest in our society because the people at the bottom...will no longer be able to get ahead and will have to literally fight for a larger share of things. Other people say this won't really be a problem because there is plenty...and all we need to do is distribute it more equally. Do you think growth is essential or do you think we could solve the problem by simply distributing more equally?"

^a"Do you generally favor or oppose building more nuclear power plants?"

There was across-the-board majority agreement with the statement that conservation would entail a "much lower standard of living" (Cambridge, 76/7). Fifty-four percent of the total sample agreed, and only one demographic group--the Midlands--had less than a majority (48%) agreeing (see Table 5.25).

5.5.2 Conservation Policy

There is limited information on the kinds of policies the public would support as means to promote energy conservation. Table 5.26 indicates the relative preferences of the public over time for a number of conservation mechanisms. The highest support was for the development of mass transit (78% favor), followed by keeping daylight saving time all year (53% favor). Utilizing pricing mechanisms (for either large cars or home electricity) received much less support, although the percentages in favor increased over time from 19% to 30% for taxing cars and from 10% to 17% for higher peak hour electricity rates (Roper, 74/6, 76/6). These findings are consistent with the Cambridge (76/4) finding that 76% of the public preferred rules to "force conservation" as opposed to 10% of the public that preferred raising energy prices.

The different response rates that ORC (75/1) reported for favorability toward taxing large cars (44%) and high pricing of peak hour electricity (32%) compared to Roper (74/6, 75/6, 76/6) findings (about 31% and 16% respectively) illustrate the important effect of question wording. The ORC question on taxing large cars specified "at time of purchase" while the Roper statement did not set any boundaries on the frequency of the tax, which may account for the lower favorability to the Roper question. The ORC question on electricity pricing said only that the charge would be higher, while the Roper question explicitly said "substantially" higher rates, probably again decreasing favorability. Both Roper and ORC reported similar response levels on the issue of having daylight saving time all year, with the question essentially the same in both studies: 52% favorability for ORC (75/1) and a mean of 54% favorability for Roper (74/6, 76/6) (see Table 5.26).

TABLE 5.25

CONSERVATION AND STANDARD OF LIVING

"Conservation is not a realistic solution to the energy crisis unless we are all prepared to accept a much lower standard of living."

Respondent Category	Cambridge (76/4)	
	Agree	Disagree
<u>Total</u>	54%	38%
<u>Sex</u>		
Male	53	39
Female	55	36
<u>Age</u>		
18-25	50	40
26-35	51	44
36-45	57	35
46-55	56	36
56-65	58	30
Over 65	51	35
<u>Income</u>		
\$0-3,999	54	28
\$4-6,999	56	30
\$7-9,999	53	41
\$10-12,999	49	42
\$13-14,999	48	44
\$15-19,999	57	40
\$20-24,999	53	44
Over \$25,000	53	44
<u>Education</u>		
Some grade school	55	26
Some high school	59	27
High school graduate	53	39
Technical/vocational	56	39
Some college	54	41
College graduate	49	48
Graduate school	50	47
<u>Region</u>		
Northeast	52	40
Industrial	56	33
Midlands	48	44
South	51	33
Central	54	45
Pacific	59	37
<u>Nuclear plant proximity</u>		
No nuclear plant	55	35
Nuclear plant	54	37
Potential plant	50	42
<u>Construction of nuclear plant</u>		
Favor ^a	56	38
Oppose	52	41

^a"Do you generally favor or oppose the construction of more nuclear power plants?"

TABLE 5.26

CONSERVATION POLICY ATTITUDES

Conservation Policy	% Favor or Say "Should"			
	Roper 74/6 ^a	ORC 75/1 ^b	Roper 75/6 ^a	Roper 76/6 ^a
Federal government spend more to develop mass transit	--	78%	--	--
Have daylight saving time all year	56%	52	--	52%
Extra tax on large cars with low gas mileage	19	44	32%	30
Charge more for electricity used at peak hours	10	32	15	17

^aRoper (74/6; 75/6; 76/6):

"There has been much talk about the problem of a fuel and energy shortage in this country. Here is a list of steps that have been or could be taken to conserve supplies of energy. (Card shown respondent) The first is keep homes heated at no more than 68° in the winter. Is that something you think we should do or should not do?"

"Have daylight saving time all year round."

"Place a penalty tax on large cars that get less miles per gallon."

"Put a time clock on home electric meters so that electricity used during peak daytime hours costs substantially more."

^bORC (75/1):

"Solutions to Energy Shortage"

"The Federal Government should spend more money to improve and develop mass transit."

"Daylight Saving Time should be continued all year."

"At the time of purchase, an extra tax should be levied on large cars or engines that get low gas mileage."

"People who use electricity during peak hours should pay more for the electricity used at that time."

5.5.3 Personal Conservation

Roper (76/2) presented trend data on self-reported changes in consumption patterns, including energy conservation behavior (Tables 5.27 and 5.28). Cutting down electricity use (mentioned by about 67% of the respondents) was highest on the respondents' list of changes due to high prices or shortages, followed by driving at lower speeds (reported by about 64%). The greatest change over time occurred for "using the car less often," which decreased from 52% in 1974 to 33% in 1976 (see Table 5.27). Roper (76/2) also presented respondents with a list of activities to reduce energy consumption. The only energy conservation behaviors reported by a majority of the public are (1) turning off lights (mean of 71%) and (2) lowering the heat thermostat (mean of 68%). The percentage conserving in any of the other ways listed drops to approximately one-third or less of the total sample (see Table 5.28). NORC (75/4) found a similar pattern. Eighty-one percent of the respondents interviewed in the winter of 1973-1974, during the oil embargo, reported turning lights off when not needed and 66% reported lowering the thermostat setting, but less than 20% reported cutting down on the use of particular electrical appliances.

Cambridge (76/4) assessed the public's beliefs about the efficacy of personal conservation, and found respondents evenly divided on whether individual behavior would have an impact. The belief that personal attempts are not effective (i.e., agreeing with the statement "conservation is a good alternative, but frankly there's not much I can personally do about it") increased with age and decreased with income and educational level (see Table 5.29 and Fig. 5.12). Respondents in the Central and Pacific regions disagreed most often with the Cambridge statement. Somewhat paradoxically, Cambridge (75/8) found that 90% of the public said they would be willing to cut down energy use if they were convinced there was an energy crisis, and 52% of this group said they thought they could cut their use by at least one-third (see Table 5.30). The four main steps anticipated by the 52% who felt they could reduce their energy by one-third were: (1) cutting down on the use of appliances (23%), (2) turning off lights (15%), (3) lowering the thermostat in the

TABLE 5.27

CHANGING CONSUMPTION PATTERNS--SELF REPORT

Conservation Behavior	Roper (76/2)		
	May 1974	May 1975	May 1976
Cut down electricity use	66%	73%	62%
Drive at lower speeds	71	65	56
Economize on food	51	65	51
Economize on clothing	36	62	44
Spend more time at home	39	56	38
Economize on recreation and entertainment	34	52	37
Cut down on eating out in restaurants	35	51	37
Use or repair things you normally would replace	28	48	37
Use the car less often	52	49	33
None of the above	6	4	9

NOTE: "From time to time during the past year of high prices and shortages, people have reported that they made changes in purchasing patterns and the way they live. Here is a list of some of them. (Card shown) Would you look down the list and call off all those you have been doing either because of high prices or shortages."

TABLE 5.28

CONSERVATION BEHAVIOR
SELF REPORTS--LIMITING USE OF ELECTRICITY

Conservation Behavior	Roper (76/2)		
	January 1974	January 1975	February 1976
Been more careful about turning off lights	71%	69%	72%
Kept house temperature lower than usual	74	65	66
Shut off some rooms of the house to avoid heating them	36	32	37
Used major appliances less frequently	26	26	29
Started using lower watt bulbs in some lamps	20	22	28
Weather stripped doors and windows	19	19	26
Installed new storm windows or doors	10	11	17
Used fireplace more	13	11	13
None of these	8	7	8

NOTE: "Which of these things, if any, have you been going to cut down on the use of electricity and heating fuel in your home?"

TABLE 5.29

PERSONAL CONSERVATION

"Conservation is a good alternative, but frankly there's not much I can personally do about it."

Respondent Category	Cambridge (76/4)	
	Agree	Disagree
<u>Total</u>	48%	47%
<u>Sex</u>		
Male	47	48
Female	48	46
<u>Region</u>		
Northeast	53	41
Industrial	52	43
Midlands	44	52
South	59	33
Central	36	60
Pacific	32	67
<u>Nuclear plant proximity</u>		
No nuclear plant	51	41
Nuclear plant	47	48
Potential plant	48	48
<u>Construction of nuclear plant^a</u>		
Favor	44	52
Oppose	51	47

^a"Do you generally favor or oppose the construction of more nuclear power plants?"

FIGURE 5.12
IMPACT OF PERSONAL CONSERVATION

NOTE: "Conservation is a good alternative, but frankly there's not much I can personally do about it." Data from Cambridge (76/4).

TABLE 5.30
WILLINGNESS TO REDUCE ENERGY CONSUMPTION

Respondent Category	Cambridge (75/8)		
	Yes	No	Not Sure
<u>Total</u>	52%	29%	19%
<u>Sex</u>			
Male	51	32	18
Female	53	26	21
<u>Age</u>			
18-25	57	25	18
26-35	55	26	19
36-45	50	27	23
46-55	53	30	18
56-65	53	31	16
Over 65	42	36	22
<u>Income</u>			
\$0-3,999	49	26	25
\$4-6,999	46	34	20
\$7-9,999	54	27	19
\$10-12,999	46	30	25
\$13-14,999	59	22	19
\$15-19,999	55	30	15
\$20-24,999	56	31	12
Over \$25,000	59	28	13
<u>Region</u>			
Northeast	46	30	24
Industrial	53	30	17
Midlands	51	30	19
South	53	26	22
Central	63	20	17
Pacific	45	37	18
<u>Education</u>			
Some grade school	41	29	29
Some high school	53	26	21
High school graduate	55	23	22
Technical/vocational	52	39	10
Some college	54	34	13
College graduate	52	32	16
Graduate school	51	33	16
<u>Nuclear plant proximity</u>			
No nuclear plant	55	27	18
Nuclear plant	48	31	21
Potential plant	51	29	20
<u>More nuclear power plants</u>			
Favor	53	31	17
Oppose	61	24	15
Not sure	39	28	33

NOTE: (Asked of respondents (90%) willing to curtail their own energy use.) "Do you think you could cut your energy use by at least one-third?"

winter (19%), and (4) giving up summer air conditioning (11%). Thirteen percent said they did not know what specific steps they would take to save energy (see Table 5.31). The groups most likely to say they could reduce consumption by one-third were nuclear opponents (61%) and individuals in the Central region (63%), although a majority in most demographic categories believed in the ability to cut energy use by one-third (see Table 5.30).

5.5.4 Summary

The findings on conservation attitudes and behaviors do not constitute a consistent pattern. There is a clear preference for rules and rationing as opposed to market pricing mechanisms to achieve energy conservation. Although a majority professes favorability toward an austere life, current reported behavior patterns do not indicate the practice of austerity. The belief by much of the public that conservation will limit economic growth and depress the current standard of living may be an important reason for reluctance to rely heavily on conservation to solve energy problems.

TABLE 5.31

POSSIBLE STEPS TO REDUCE ENERGY CONSUMPTION

Response	Cambridge (75/8)
	(% of those who feel they could cut)
Cut down on electrical appliances	23%
Cut lighting, turn-off lights when not in use	15
Lower thermostat in winter	19
Stop air conditioning in summer	11
Cut down on television time	7
Drive less	6
Other	6
Don't know	13

NOTE: "If you can cut by a third: What would you cut in your home to save that much energy? Where specifically would you cut?"

5.6 Conclusion

The major general findings concerning public attitudes toward broad energy issues are:

1. Beliefs in the existence of an energy shortage vary dramatically over time depending on immediate circumstances, e.g., the oil embargo of 1973. Although the expectation of a long-term shortage of energy has increased in recent years, over half of the American public does not believe that there is or will be a very serious energy problem. Belief in the seriousness of an energy shortage appears to increase the acceptability of coal as an energy source, but does not seem to affect favorability toward nuclear energy.
2. The relative preferences of the public for specific energy sources rank solar energy the most desirable, nuclear energy the next preferred source, and coal as one of the least preferred sources.
3. The public appears somewhat ambivalent concerning conservation. There is evidence that the majority of the public values conservation as a good thing. However, many people believe that conservation will reduce both the standard of living and economic growth. Furthermore, most of the public is fairly pessimistic about the likelihood that conservation efforts will have a substantial impact, even though many individuals claim they would be able to reduce their own use of electricity by one-third.

Determining the interrelationships of attitudes toward specific energy issues is of considerable importance to understanding the position of various sectors of the public concerning the development of nuclear power. There are two ways of using the survey data to make inferences about attitude relationships: (1) by a direct examination of

cross-tabulations, looking at attitudes toward one specific issue (e.g., reducing electricity use) classified by attitudes toward another given issue (e.g., favorability versus opposition to nuclear energy) and (2) by noting the demographic characteristics of those with general pronuclear and antinuclear attitudes and comparing these findings with demographic response patterns on other questions.

The use of the cross-tabulations approach has been limited, in this section of the report, to the small number of surveys that include these kinds of distributions. The major attitude breakdown we have been able to discuss is for pro versus con attitudes toward nuclear power (see Section 5.2). The pronuclear group was positive toward increasing the energy supply and toward alternative sources such as coal and solar in addition to nuclear energy. This group was pessimistic about the efficacy of conservation and believed that conservation would curtail economic growth and result in a lower standard of living. The antinuclear group preferred limiting electricity use to increasing the energy supply and was anticoal, though this group was positive toward solar development. The antinuclear group was also pessimistic about the efficacy of conservation, though they did not feel that economic growth was inconsistent with conservation.

The examination of demographic patterns generally confirms the hypothesis that two distinct energy perspectives exist: (1) favorability toward energy supply is associated with favorability toward a wide range of energy source alternatives, and (2) favorability toward energy conservation is associated with greater opposition toward most of the various energy sources.

As in the case of pronuclear and antinuclear energy attitudes, men and women held two considerably different sets of attitudes on a wide range of general energy issues. Women, who were one of the groups least supportive of nuclear energy, preferred limiting electricity use to building more power plants, and they supported virtually all energy supply options (e.g., coal, solar energy, offshore oil, and strip mining) to a lesser degree than did men. Women were also more strongly

in favor of environmental protection than were men. Though women preferred conservation as an alternative, they held the same beliefs as men concerning conservation efficacy and the economic consequences of conservation.

Age group was also associated with distinct clusters of energy attitudes. The young probably presented the most clear-cut pattern in the area of energy attitudes. They were in favor of conservation, they were the most proenvironment group, and they showed low support for all energy source alternatives except solar power. The middle-aged respondents were strong nuclear supporters and favored building as many power plants as needed. They supported all the energy supply steps suggested to solve the energy crisis; they were pro solar energy, were mild in their opposition to coal, and split over whether environmental protection or increasing the energy supply should take precedence. The set of attitudes of the older group differed from both the young and the middle-aged groups. The older group favored increasing the energy supply, was not supportive of conservation, and believed that conservation limits the economic growth that is believed necessary to achieve equality. This group preferred coal to nuclear energy, and was less supportive of solar energy than the other age groups. Older individuals were also among those most willing to relax pollution standards as a means to provide more energy for consumption.

The high-income group was favorable toward both nuclear and solar energy. This group believed more than did most other income groups in the potential efficacy of conservation and in the impact of individual conservation efforts on the total energy picture. This group was also proenvironment.

The highly educated group was quite interesting since it combined elements of both attitude clusters. This group, which was pronuclear, was also strongly in favor of solar energy, supportive of conservation, and highly supportive of environmental protection.

Although each demographic group had its own specific set of energy attitudes, there is evidence of some general attitude interrelationships. Preference for increasing the energy supply tends to be associated with higher levels of support for the whole range of energy source alternatives. Favorability toward energy conservation, on the other hand, is associated with stronger support for environmental protection and lower support for the various energy source options.

6 SECONDARY ANALYSIS OF SURVEY FINDINGS

6.1 Introduction

Although the data in the preceding chapters are informative and, in many cases, extensive, we have limited our review to the specific findings reported by the survey organizations. The answers to other important questions, which arise during any inquiry such as this, could not be statistically ascertained because such analyses require that the original data are in hand. For one set of surveys, Harris (75/4, 76/7) we were able to obtain full data tapes for further secondary analysis.

It is the purpose of this chapter to extend our survey review and analysis and answer some important theoretical questions about nuclear power through secondary analysis of the Harris (75/4, 76/7) data. Specifically, we will address the following general questions.

1. How do those respondents who say they "don't know" what their general attitude toward nuclear power is compare with those respondents who have a pro or con general attitude toward nuclear power? If those respondents were forced to choose a pro or con position, which position would they choose?
2. What variables best explain why a respondent holds his/her general nuclear power attitude? Specifically, which demographic characteristics, attitudes about general energy issues, and attitudes about specific nuclear issues are most related to general nuclear attitudes?

Before proceeding, however, it is important to discuss the generalizability of the Harris (75/4, 76/7) data, knowing that at times the Harris (75/4, 76/7) findings are discrepant from the findings provided by other survey organizations. For instance, Harris (75/4, 76/7), in general, found a higher level of support for constructing more nuclear

power plants (type 3 question), than did the seven Cambridge surveys conducted during 1975 and 1976, and the Harris surveys found a higher level of support for constructing more nuclear power plants to meet energy needs (type 4 question) than did ORC (75/1) and Roper (75/6, 76/6). Also, Harris (75/4, 76/7) found a slight decline in support for nuclear power from 1975 to 1976, as did Roper (75/6, 76/6), whereas the Cambridge surveys found no significant change between 1975 and 1976. At a finer level of analysis, Harris (75/4, 76/7) showed a decline in nuclear support among the highly educated group, whereas Becker (73/6, 74/5) and the Cambridge surveys do not support this finding (see Section 3.2.3).

Despite these differences, we feel that the Harris (75/4, 76/7) findings have been consonant enough with those of other survey organizations to validate the use of these data as representative of the overall survey findings regarding nuclear power. The implications of nonreplicated findings (such as the differential relationship between educational groups and decline in support for nuclear power) will be discussed when appropriate.

6.2 Methodology

6.2.1 Measurement Considerations

The first measurement decision dealt with the large number of "don't know" responses to some of the attitude questions. A "don't know" response is hard to interpret, because a respondent could have made the response for several reasons: (1) the respondent truly did not know his/her attitude on the matter; (2) the respondent answered "don't know" because it was the easiest response to make; (3) the respondent did not agree or disagree with the question, but instead had a "neutral" position on the attitude, which he/she indicated by the "don't know" response. "Don't know" was not offered to respondents as a structured response choice, but a "don't know" response category was included on

the survey protocol for the interviewer to score. Therefore, we assume that once a respondent volunteered a "don't know" response and it was accepted, the respondent considered it an option.

From a measurement standpoint, there are two main choices in this situation: (1) consider the "don't know" responses as missing data; or (2) scale the "agree," "disagree," and "don't know" responses in some nominal, ordinal, or interval fashion. On most of the attitude items, we chose to scale the "don't know" response as a neutral response on an interval scale, so that the response scale would be, 1=agree, 2=don't know, 3=disagree. We made this decision because we were unwilling to consider the "don't know" response as missing data, which would have had detrimental effects on most of the main statistical analyses. Past experience has also shown this to be an acceptable scaling technique, which basically turns the scale into a commonly used, three-point Likert attitude scale with a neutral category.

However, we did not automatically scale the four Harris (75/4, 76/7) questions, which qualify as general nuclear attitude questions. Instead, we chose to first carefully examine one of the four questions, so that the "don't know" respondents could be compared with the other respondents on demographic and attitudinal variables. On the basis of this analysis the placement of the "don't know" respondents for the four general nuclear attitudes was determined. As will be detailed in the following section, the "don't know" response was found to be generally scalable as a neutral response. Given this result, we felt justified in combining the four general pro-con attitude questions into one composite score for more extended analysis, assigning middle range scores to the "don't know" responses.

On the basis of the composite scores, three groups were determined--pro, neutral, and con. We then ran a discriminant analysis program four separate times to predict these groups using four sets of variables: (1) sociodemographic variables, (2) attitudes about specific nuclear power issues, (3) attitudes about general energy issues, and (4) a combination of the three sets of variables listed in (1) through (3).

6.2.2 Statistical Analysis

We have chosen to use one main statistical technique, discriminant analysis, which can be helpful in answering the general questions that we have posed. Although a detailed description of this technique is not appropriate here, a simple explanation of this statistical analysis is presented. (For a more detailed discussion see Morrison, 1969.)

Most simply put, discriminant analysis is a statistical technique that can be used to predict a respondent's position on one variable (e.g., attitude toward nuclear power) by using his/her positions on a number of other variables (e.g., demographic characteristics, general energy attitudes). For our purposes, we will use discriminant analysis to predict whether a respondent has a pro, con, or neutral attitude about nuclear power by using other known information about the respondent (demographic characteristics, attitudes about general energy issues, and attitudes about specific nuclear power issues).

At least four features of this statistical technique make it particularly suited for our purposes. First, it is a multivariate statistical technique--i.e., it simultaneously analyzes numerous variables. Second, the technique can be used for testing theory (significance testing) as well as for prediction or classification purposes (to determine how substantive the differences are). Third, the major output from the classification portion of the program--the classification matrix--is easy to interpret. Fourth, the specific discriminant analysis program that we have used adds variables to the prediction function in a stepwise fashion; that is, it selects the most discriminating variable first and uses it in the prediction function, then it selects the next most discriminating variable and adds it to the prediction function, etc. We controlled the number of variables added to the prediction function by a stringent significance criterion ($p < .001$).

One final decision relating to an important aspect of discriminant analysis must be discussed before presenting the results. This decision relates to the question of how much we should let certain a priori (known) information affect our predictions. Specifically, a decision

had to be made whether to include information about the relative sizes of the groups to be predicted during the prediction phase of the program. For example, if we know that about 60% of the public is pronuclear, 22% is antinuclear, and 18% has a neutral attitude (these percentages are called base rates), this information could be utilized by the discriminant analysis technique for prediction purposes (because the prediction is done using Bayesian considerations). If this known information is used, respondents are classified as being pronuclear, etc., as a function of the base rate information as well as a function of their attitudes and sociodemographic characteristics.

Whether to use the base rate information is an important decision, since--at the extreme--if all other things are equal, respondents are classified into the group having the largest base rate. Of course, "all other things" are never equal, but largely discrepant base rates among the predicted groups of interest often means that base rates influence the prediction more than do differences among groups on attitudes and sociodemographic variables. For this reason, we did not use base rates for our prediction, but will predict purely as a function of attitudes and sociodemographic variables.

6.3 Results

6.3.1 Analysis of the "Don't Know" Respondents

In order to determine the variables that were the best discriminators of the pro, con, and "don't know" respondents on the general nuclear attitude question ("In general, do you favor or oppose the building of more nuclear power plants in the United States?"), about 30 variables, including demographic characteristics and attitudes toward nuclear power issues and general energy issues, were selected for use in the discriminant analysis. In a number of instances, several individual questions were combined to form a composite variable. For instance, the "major problems" questions and the "major advantages" questions were separately

added together (see Tables 4.3 and 4.8) to form two composite scores that are interpreted to be, respectively, a general attitude about the severity of purported nuclear power problems and a general attitude about the importance of purported nuclear power advantages. The entire set of variables was analyzed to see which variables best predicted the general nuclear power attitude and to see how the three types of respondents compared on these predictor variables.

The discriminant analysis was first used to analyze the Harris (75/4) respondents only. Nine variables were especially important in discriminating among the pro, con, and "don't know" respondents (listed in order of entry into the program): (1) the response to the question, "All in all, from what you have heard or read, how safe do you think nuclear power plants that produce electric power are . . . ?" (coded: 1=very safe, 2=somewhat safe or not sure, 3=not so safe or dangerous); (2) a composite score (ranging from 6 to 18) of six questions designed to determine the effects of certain requirements (e.g., tough government standards or proper security) on the perceived risk of allowing more nuclear power plants to be built; (3) a composite score (ranging from 9 to 27) of nine questions concerning source characteristics of nuclear power (see Tables 5.16 and 5.17 for most of the questions included); (4) education; (5) a composite score (ranging from 7 to 21) on the perceived likelihood that seven positive consequences would result if a nuclear power plant were built in the respondent's community (e.g., less air pollution, cheaper electricity, more jobs); (6) sex; (7) a composite score (ranging from 0 to 7) of the seven "major problem" questions asked both in 1975 and 1976 (see Table 4.3); (8) the response to the question that determined whether a respondent felt that a nuclear power plant would be acceptable as a function of the cost of nuclear-generated electricity compared with other types of power (e.g., 20% more, about the same, 25% less--see Table 4.20); and (9) composite score (ranging from 0 to 9) of the nine "major advantage" questions asked both in 1975 and 1976 (see Table 4.8).

The ability of these nine variables to predict the general nuclear power attitude of interest was quite good (see Table 6.1). Using the nine variables just discussed, the respondent attitude was predicted correctly for 71.6% of the 1975 respondents. By chance alone, only

TABLE 6.1

PREDICTION OF GENERAL NUCLEAR POWER ATTITUDE
TO EXAMINE THE "DON'T KNOW" RESPONDENTS

Actual Attitude		Predicted Attitude			Total
		Pro	Don't Know	Con	
1975	Pro	769 79.0%	152 15.6%	53 5.4%	974
	Don't know	58 21.0%	163 59.1%	55 19.9%	276
	Con	52 18.1%	67 23.3%	168 58.5%	287
	Column total	879	382	276	1537
1976	Pro	683 75.0%	150 16.5%	78 8.6%	911
	Don't know	52 20.6%	127 50.2%	74 29.2%	253
	Con	31 9.3%	44 13.2%	259 77.5%	334
	Column total	766	321	411	1498

Percent correctly predicted 1975 = 71.6%

Percent correctly predicted 1976 = 71.4%

Chance prediction = 33.3%

about 33% of the individuals would have been correctly classified. Our chance criterion is computed in the following manner. Since the base rates are considered equal, this is equivalent to assuming that the respondents are randomly distributed across the three groups. If 33.3% of the respondents are randomly placed in each group, then we know, for instance, that the probability that a pronuclear individual will be correctly classified equals 33.3% times the percentage of respondents (63.4% for the 1975 data) who actually are pronuclear respondents. The percentage of "don't know" respondents and antinuclear respondents that would be correctly classified on a chance basis is computed in a like manner. Using this definition of chance prediction, 33.3% of the respondents, on the average, would be correctly classified by chance.

Also of interest are the facts that: (1) those with a pro attitude were classified correctly most often; (2) those with a pro attitude, when incorrectly classified, were most often classified "don't know" rather than as having a con attitude (about 3:1); (3) those who responded "don't know", when incorrectly classified, were equally likely to be classified as either pro or con; and (4) those with a con attitude, when incorrectly classified, were slightly more likely to be classified as "don't know" than as having a pro attitude (about 4:3). Thus, these findings indicate that the "don't know" respondents generally lie between the pronuclear and antinuclear respondents on the important discriminating variables.

In order to cross-validate the prediction equations, the equations determined for the 1975 data were used to predict the same attitude on the 1976 respondents (see Table 4.1). A very similar prediction pattern, as discussed for the 1975 data, was found for the 1976 data, and 71.4% were correctly classified. The main difference, which was anticipated because of the known slight increase in nuclear power opposition from 1975 to 1976 in the Harris data, was that a higher percentage of those with a con attitude were correctly classified for the 1976 data compared to 1975.

In analyzing the "don't know" respondents, relative to those with a pro or a con attitude, it is also important to look at the group means

of the nine discriminating variables. On the seven attitudinal variables, the "don't know" respondents' group mean always fell between the group means for the pro and the con respondents. However, on the two predictive demographic characteristics--education and sex--this was not the case. Here, the "don't know" respondents included a higher proportion of women than did the other two groups, and the "don't know" respondents had a lower educational level than did the other two groups. The above analyses indicate that, in general, respondents in the "don't know" category have attitudes about specific nuclear power issues that lie between the corresponding attitudes for pronuclear and antinuclear respondents.

Another way of analyzing these relationships is to run the discriminant analysis program on just those respondents who volunteered a pro or con attitude, and then predict the "don't know" respondents as having either a pro or a con attitude on the basis of their position on the nine discriminating variables. In short, when this analysis was run, the "don't know" respondents were predicted almost exactly evenly into the pro and con groups, suggesting that they do tend to take middle range positions, and are not more similar to the pronuclear respondents than they are to the antinuclear respondents.

Thus, we conclude that the "don't know" respondents have a neutral attitude about nuclear power that is scalable midway between the pro and con attitude. That is, we feel justified in scoring the responses as: 1=pro, 2=don't know (neutral), 3=con.

6.3.2 The General Attitude toward Nuclear Power Composite Score

Since the responses were scalable, we then looked at three composite scores that had potential use as measures of a general nuclear power attitude: (1) a composite formed by adding together the scores for the responses on two general questions asking about the construction of more nuclear power plants; (2) a composite formed by adding together the scores for the responses on two questions asking about having a nuclear

power plant in the respondent's own community; and (3) a composite formed by adding together the scores of the four questions discussed in (1) and (2).

After these three composites were formed, they were analyzed to determine which one should be used for further analysis. This was done by examining the correlations (a measure of how two variables are associated) among the three composites and the correlation between the composites and other attitude and demographic variables of interest. The three composite measures, as expected, were significantly correlated ($p < .001$): (1) the Pearson correlation coefficient (r) between the attitude regarding building more nuclear power plants and the attitude regarding building a nuclear power plant in the respondent's community was $r = .69$; (2) the correlation between the attitude regarding building more nuclear power plants and the attitude composite utilizing all four questions was $r = .91$; and (3) the correlation between the attitude regarding building a nuclear power plant in the respondent's community and the attitude composite utilizing all four questions was $r = .93$. The composites are obviously highly correlated.

When the correlations between the three composites and other variables of interest were computed, the composite comprised of all four questions appeared to be the best attitude measure. That is, the correlation between this composite and the other variables of interest was, in almost every case, higher than the corresponding correlations regarding the two two-question composites. For that reason, the composite score that comprised all four questions regarding the building of nuclear power plants was chosen for further analytic purposes. This composite score will be said to measure a respondent's general attitude toward nuclear power.

Three groups of individuals were formed on the basis of this composite score, which ranged from 4 through 12. We considered those respondents (56.6%) with scores of 4, 5, or 6 to be decidedly pronuclear respondents--a score of 4 required four pronuclear responses to the attitude questions; a score of 5 required three pronuclear responses and one undecided response; a score of 6 required either two pronuclear and

two undecided responses or three pronuclear responses and one antinuclear response. We considered those respondents (19.9%) with scores of 10, 11, or 12 to be decidedly antinuclear respondents. Those respondents (23.5%) with scores of 7, 8, and 9 were considered to have a largely neutral or mixed attitude toward nuclear power. Scores of 7, 8, or 9 could be assigned in a variety of ways--for instance, a score of 7 requires either two pro, one undecided, and one con response or one pro and three neutral responses; and a score of 8 requires four undecided responses or two pro and two con responses or one pro, one con, and two undecided responses.

The pattern of responses is interesting. Combining the 1975 and 1976 data, 1,157 respondents (38.1%) responded in a pronuclear fashion on all questions, 219 respondents (7.2%) responded in a pronuclear fashion three times and an antinuclear fashion one time, only 124 respondents (4.1%) were undecided on all four questions, 102 respondents (3.4%) responded in an antinuclear fashion three times and a pronuclear fashion one time, and 330 respondents (10.9%) responded in an antinuclear fashion all four times. Also, 81 respondents (2.7%) gave pronuclear responses to the two questions regarding building nuclear power plants in general and antinuclear responses to the two questions regarding building a power plant in the respondent's community.

6.3.3 Prediction of the General Attitude toward Nuclear Power

The relationships of the sociodemographic variables, attitudes about specific nuclear power issues, and attitudes about several energy issues with the general nuclear power attitude were examined next. First, we combined the 1975 and 1976 data, since the earlier discriminant analysis cross-validation indicated that the relationships between these variables were the same in 1975 and 1976. That is, even though Harris found slightly less support for nuclear power in 1976 than in 1975, the data were combined because the relationships between the general nuclear power attitude and the other variables of interest remained the same. Then we predicted the three attitude groups, using the three sets of predictor variables.

6.3.3.1 Prediction of the general attitude toward nuclear power with sociodemographic variables. As discussed in Chapter 3, several socio-demographic variables were related to attitudes about building more nuclear power plants. Specifically, we looked at how well the variables of sex, age, income, education, race, region of the country, number of children under age 18 at home, marital status, and occupation of the head of the household could predict whether a respondent had a pro, neutral, or con general attitude toward nuclear power. A strict significance criterion was set ($p < .001$), so that only the most statistically, as well as substantively, significant variables would be allowed to enter the prediction equation.

Four variables entered the prediction equation (listed in order of entry): (1) sex; (2) education; (3) income; and (4) region of the country (specifically, the importance of this variable is the indication of whether the respondent was from the East as opposed to any other region of the country). Although these variables were highly statistically significant, when they were used for prediction purposes, only 45.8% of the cases were correctly classified (see Table 6.2). By chance alone, we again would have expected 33.3% of the respondents to have their attitude correctly predicted (using the same manner of calculating the expected chance prediction discussed earlier).

TABLE 6.2
PREDICTION OF GENERAL NUCLEAR POWER ATTITUDE
USING DEMOGRAPHIC VARIABLES

Actual Nuclear Power Attitude	Predicted Nuclear Power Attitude			Row Total
	Pro	Neutral	Con	
Pro	846 49.2%	488 28.4%	385 22.4%	1719 56.6%
Neutral	206 28.9	319 44.7	188 26.4	713 33.5
Con	190 31.5	189 31.3	224 37.1	603 19.9
Column total	1242 40.9	996 32.8	797 26.3	3035

Cases correctly classified, 1389 = 45.8%.

Chance prediction = 33.3%.

Closer inspection of the group means on the prediction variables revealed nonlinear relationships between most of the predictors and the nuclear power attitude. That is, the neutral group was not in between the pro and con group, but had a more extreme distribution on these demographic variables. For instance, the average education for those with a pronuclear attitude was 11.8 years; for those with a neutral attitude 11.4 years; and for those with an antinuclear attitude, 12.6 years. The Harris data, which show a higher mean educational level for antinuclear respondents than for pronuclear respondents, differ from the other survey findings. In most of the other surveys, the respondents with high educational attainment were more likely to be pronuclear than respondents with low levels of educational attainment. The average family income for those with a pronuclear attitude was \$13,817; for those with a neutral attitude, \$12,210; and for those with an antinuclear attitude, \$13,021. Also, the pronuclear group was 41% female, the neutral group was 62% female, and the antinuclear group was 56% female. Thus, the neutral group was, on the average, lower educated, lower income, and more female than either the pronuclear or antinuclear groups.

This analysis has confirmed the significant relationships of sex, income, education, and area of the country with the general nuclear power attitudes that were discussed in Chapter 3. However, knowledge of only the demographic characteristics of the respondents is not sufficient information to predict with a high degree of accuracy a respondent's general attitude toward nuclear power.

6.3.3.2 Prediction of the general attitude toward nuclear power with attitudes about general energy issues. Fourteen variables measuring attitudes about general energy issues were selected for analysis. Of these, six were used in the prediction equation under the established significance criterion (listed in order of entry into the equation): (1) favorability toward speeding up the Alaska pipeline to help solve the energy crisis, (2) an attitude about the seriousness of air pollution in this country, (3) favorability toward starting off-shore oil

drilling in order to help solve the energy crisis, (4) a measure of confidence in Ralph Nader and environmentalist groups, (5) an attitude about the advantages of oil as an energy source, and (6) favorability toward increasing efforts to produce oil shale to help solve the energy crisis.

Again, several general energy attitudes were significantly related to the general nuclear power attitude, but knowledge of respondents' positions on general energy issues did not result in correct nuclear attitude predictions for a substantial portion of the respondent population (see Table 6.3). Only 47.9% of the respondents were correctly predicted, while the chance expectation is 33.3% correct.

TABLE 6.3

PREDICTION OF GENERAL NUCLEAR POWER ATTITUDE
USING ATTITUDES ABOUT GENERAL ENERGY ISSUES

Actual Nuclear Power Attitude	Predicted Nuclear Power Attitude			Raw Total
	Pro	Neutral	Con	
Pro	962 56.0%	385 22.4%	372 21.6%	1719 56.6%
Neutral	279 39.1	233 32.7	201 28.2	713 23.5
Con	203 33.7	140 23.2	260 43.1	603 19.9
Column total	1444 47.6	758 25.0	833 27.4	3035

Cases correctly classified, 1455 = 47.9%.

Chance prediction = 33.3%.

The variables that entered the prediction equation basically confirm some of the findings presented in Chapter 5. Three of these variables (the first, third, and sixth) related to increasing energy production in order to help solve the energy crisis. In all three cases, the

pronuclear respondents favored the steps the most, the antinuclear respondents favored the steps the least, and the neutral respondents took a position almost exactly midway between the two groups. Thus, a pro-energy supply stance is related to pronuclear attitudes.

Such an ordering did not hold for the three other prediction variables, however. On the perceived seriousness of the problem of air pollution (1=very serious, 2=only somewhat serious, 3=not serious at all), the pronuclear and neutral respondents did not differ from each other (average scores of 1.52 and 1.53, respectively), but did differ significantly from the antinuclear respondents, who averaged 1.34 on this variable. The same held for confidence in Ralph Nader and environmentalist groups (2=great deal of confidence, 4=only some confidence, 6=hardly any confidence). The pronuclear respondents averaged 3.94 and the neutral respondents averaged 3.87, while the antinuclear respondents averaged 3.58.

The other variable that entered the prediction equation, a composite score ranging from 9 to 27 that measured a respondent's attitude about the advantages of oil as an energy source, found the pronuclear and antinuclear respondents in basic agreement, but the neutral respondents were somewhat more positive towards oil. Here, where a lower score indicates a belief in the advantages of oil as an energy source, the neutral respondents averaged 19.74, the pronuclear respondents averaged 20.45, and the antinuclear respondents averaged 20.84.

6.3.3.3 Prediction of the general nuclear power attitude with attitudes about specific nuclear power issues. Thirty-two variables that measured attitudes about nuclear power issues were selected for discriminant analysis. The issue areas included safety, health, waste disposal, economics, pollution, characteristics of nuclear power as an energy source, safeguards and terrorism, and confidence in technology and the Atomic Energy Commission (AEC). No composite scores were used in the analysis. Sixteen variables entered the prediction under the established significance criterion. Of the 16 variables, two related to safety, three related to health, one related to nuclear wastes, four

related to economics, one related to pollution, three related to characteristics of nuclear power as an energy source, one related to confidence in the AEC, and one related to confidence in the technical ability to build nuclear power plants.

These variables were substantively as well as significantly related to the general nuclear power attitude. They accurately predicted the nuclear attitudes of 70.9% of the respondents (see Table 6.4). All of the attitude categories discriminated well from each other. Only 3.3% of the pronuclear respondents were incorrectly classified as being antinuclear, and only 18.8% of the antinuclear respondents were incorrectly classified as being pronuclear. Of those respondents with a neutral attitude about nuclear power, about 21% were misclassified as being pronuclear and 19% were misclassified as being antinuclear. Obviously, attitudes about specific nuclear power issues are highly related to the general nuclear power attitude.

TABLE 6.4

PREDICTION OF GENERAL NUCLEAR POWER ATTITUDE USING
ATTITUDES ABOUT SPECIFIC NUCLEAR POWER ISSUES

Actual Nuclear Power Attitude	Predicted Nuclear Power Attitude			Raw Total
	Pro	Neutral	Con	
Pro	1304 75.9%	358 20.8%	57 3.3%	1719 56.6%
Neutral	151 21.2	427 59.9	135 18.9	713 23.5
Con	53 8.8	129 21.4	421 69.8	603 19.9
Column total	1508 49.7	914 30.1	613 20.2	3035

Cases correctly classified, 2152 = 70.9%.

Chance prediction = 33.3%.

Because the stepwise nature of the discriminant analysis program selects the "best" discriminating variable at each step in the program, the first variables that enter are therefore the most important (at least in a statistical sense). For this reason, a more lengthy discussion of the first few variables that entered the prediction equation is appropriate. The first variable to enter the prediction equation, the single best discriminating variable, was a respondent's attitude about nuclear power plant safety. As expected, pronuclear individuals believed most in the safety of nuclear power plants, while antinuclear individuals believed that nuclear power plants are not so safe or dangerous. In fact, on a scale from "1=safe" to "3=not safe," pronuclear respondents averaged 1.65, neutral respondents averaged 2.16, and antinuclear respondents averaged 2.90; that is, most of the antinuclear respondents believed that nuclear power plants are not safe.

The second variable to enter the prediction equation measured a respondent's attitude about when it would be worthwhile to have a nuclear power plant in the community as a function of the effect on the electric power rates (see Table 4.20 for responses). On this eight-response variable that ranged from "1=worthwhile even if nuclear is 20% more than other sources" to "3=worthwhile if nuclear power is the same as other sources" "to 8=not worthwhile even if nuclear is 50% less," the group average for pronuclear respondents was 2.74; for neutral respondents, 3.91; and for antinuclear respondents, 5.68.

The third variable to enter the prediction equation measured the respondents' attitude about whether they think that nuclear power is a reliable form of energy for the U.S. in the long run (1=do think, 2=not sure, 3=do not think). The group average for pronuclear respondents was 1.24; for neutral respondents, 1.61; and for antinuclear respondents, 1.93.

The fourth variable to enter the prediction equation dealt with economic considerations (as did the second variable), but in a slightly different way. Whereas the second variable measured a respondent's attitude about how economical nuclear power would have to be to make it

worthwhile to have a nuclear power plant in the community, the fourth variable measured how likely a respondent thought it would be that a nuclear power plant in the community would make electric power a better buy for the money (1=more likely, 2=no real change, 3=less likely). Here, the average response for pronuclear respondents was 1.30; for neutral respondents, 1.73; and for antinuclear respondents, 1.85. The fifth variable also dealt with perceived effects on the community--whether a nuclear power plant would result in less pollution. The pronuclear respondents (on the same scale as above) averaged 1.35, the neutral respondents averaged 1.86, and the antinuclear respondents averaged 2.03.

The sixth variable to enter the prediction equation measured a respondent's attitude about how much of a problem the disposal of radioactive waste materials is (0=not a major problem, 1=a major problem). Here, 59% of the pronuclear respondents and 62% of the neutral respondents felt that nuclear waste disposal is a major problem, while 86% of the antinuclear respondents felt that waste disposal is a major problem.

The seventh and eighth variables again dealt with economic considerations--whether nuclear power is cheaper than oil and the likelihood that a nuclear power plant would bring more business to the community. Responses to the likelihood of more business question followed the same pattern as did the second and fourth variables. However, on the belief that nuclear power is cheaper than oil (1=yes, 2=not sure, 3=no), the pronuclear respondents averaged 1.80, whereas the neutral and antinuclear respondents averaged 2.52 and 2.46, respectively.

The remaining eight variables that entered the prediction equation are also highly statistically significant. They include: 9th--a variable that measured a respondent's belief that a major radiation leakage could kill many people; 10th--a variable measuring confidence in the Atomic Energy Commission; 11th--a variable measuring a belief about whether communities that have had nuclear power have had cheaper electricity and no health problems; 12th--a variable measuring a belief

about whether the chance of a nuclear power plant accident is greater than or less than the chance of being hit by a bolt of lightning; 13th--a variable measuring a respondent's belief about nuclear power raising few health hazards and dangers; 14th--a variable measuring a respondent's belief about nuclear power being produced in almost unlimited quantities; 15th--a variable measuring a respondent's belief about whether we have the technological ability to build enough nuclear power plants to meet our electric power needs; and, 16th--a variable measuring whether respondents believe that plutonium breeder reactors can do away with any possible energy material shortage.

6.3.3.4 Prediction of the general attitude toward nuclear power with sociodemographic variables, attitudes about general energy issues, and attitudes about specific nuclear power issues. As a final way of looking at which variables best explain a respondent's general attitude about nuclear power, all 26 sociodemographic and attitudinal variables that significantly predicted this attitude in the three preceding analyses (see 6.3.3.1 through 6.3.3.3) were selected for further analysis. One last discriminant analysis was run on these 26 variables.

The stepwise program selected 18 variables under the established significance criterion. Of these 18, three were sociodemographic variables (education, 5th; sex, 9th; region of country, 16th), one was a general energy attitude (attitude toward speeding up the Alaska pipeline to help solve the energy crisis, seventh), and the remaining 14 were attitudes about specific nuclear power issues. The attitudes about specific nuclear power issues entered the prediction equation in pretty much the same order as discussed in Section 6.3.3.2.

As anticipated, the prediction was quite good (see Table 6.5). Here 71.9% of the respondents had their general nuclear power attitude correctly predicted compared to the chance prediction of 33.3%. This prediction, of course, was much better than what was found when only sociodemographic or only general energy attitudes were used to predict the general nuclear power attitude. However, only 1% more of the respondents (29 respondents) were correctly classified using all variables

as opposed to using only attitudes about specific nuclear power issues. The main difference was that a few more neutral respondents were correctly classified when all of the variables were used for prediction purposes.

TABLE 6.5
PREDICTION OF GENERAL NUCLEAR POWER ATTITUDE
USING ALL PREDICTOR VARIABLES

Actual Nuclear Power Attitude	Predicted Nuclear Power Attitude			Raw Total
	Pro	Neutral	Con	
Pro	1313 76.4%	359 20.9%	47 2.7%	1719 56.6%
Neutral	146 20.5	446 62.6	121 17.0	713 23.5
Con	44 7.3	137 22.7	422 70.0	603 19.9
Column total	1503 49.5	942 31.0	590 19.4	3035

Cases correctly classified, 2181 = 71.9%.

Chance prediction = 33.3%.

6.3.4 Summary

The purpose of this section is to determine whether the "don't know" respondents would be pronuclear or antinuclear if they were forced to make a decision; and to determine what variables best explain, in a statistical sense, why a respondent holds a given nuclear power attitude. A stepwise, discriminant analysis statistical technique was used to answer these questions, since the technique can be used to ascertain statistical and substantive significance.

Analysis of the "don't know" respondents showed that, in general, they took a middle position on most nuclear power issues and general energy issues when compared to the pronuclear and antinuclear groups. Although this was not the case regarding sociodemographic characteristics ("don't know" respondents, for instance, had less education than did either pronuclear or antinuclear respondents), the group means for the "don't know" respondents on most other variables fell between the group means of pronuclear and antinuclear respondents. Thus, we concluded that "don't know" respondents actually had a neutral attitude, rather than no attitude, about nuclear power.

This conclusion was supported by a second analysis. Using the discriminant analysis program, prediction equations were determined for predicting pronuclear and antinuclear respondents only. Then the "don't know" respondents were predicted in either the pronuclear or antinuclear group on the basis of their positions on other attitudes and their demographic characteristics. Since about 50% of the "don't know" respondents were predicted to be pronuclear, and the remaining 50% were predicted to be antinuclear, this also supports the conclusion that the "don't know" respondents actually have an attitude about nuclear power midway between pronuclear and antinuclear respondents. That is, the "don't know" respondents have a neutral attitude toward nuclear power.

The final sets of analyses determined which set of variables--sociodemographic characteristics, attitudes about specific nuclear power issues, or attitudes about general energy issues--best explained why a respondent held his/her specific nuclear power attitude. Although the analyses found that individual variables among all three sets of variables are statistically highly significantly related to the general attitude toward nuclear power, attitudes about specific nuclear power issues seem to be by far the most important in substantively predicting the general attitude toward nuclear power.

Among the attitudes about specific nuclear power issues, a respondent's attitude about the safety of nuclear power plants was the most important predictor of the general attitude toward nuclear power. The

second best predictor, substantively--as well as significantly--important, was a respondent's attitude about when a nuclear power plant in the community would be acceptable as a function of the cost of the nuclear-generated electricity compared to the present community cost of electricity. Other attitudes about specific nuclear power issues that were substantive predictors of the general nuclear power attitude included: attitudes about nuclear power's long-run reliability; attitudes about nuclear power and air pollution, waste disposal, and radiation leakage; confidence in the AEC; and other attitudes about nuclear power economic considerations.

Although we concluded that sociodemographic characteristics and attitudes about general energy issues were not as highly related to the general nuclear power attitude as were attitudes about specific nuclear power issues, some of these variables were important enough predictors to bear mentioning. Two sociodemographic characteristics, education and sex, were good predictors and especially useful for distinguishing the neutral respondents from those respondents holding either pronuclear or antinuclear attitudes. Also, income and region of the country had some predictive usefulness. With regard to attitudes about general energy issues, attitudes about ways to help solve the energy crisis were predictive of the general nuclear power attitude. Specifically, attitudes toward increasing the energy supply (speeding up the Alaska oil pipeline, starting offshore oil drilling, increasing efforts to produce oil shale) were closely related to the general nuclear power attitude. Also, a respondent's attitude about the seriousness of the air pollution problem, a respondent's confidence in environmentalists, and a respondent's attitudes about oil were also somewhat predictive of the respondent's general attitude toward nuclear power.

6.4 Conclusion

The secondary analysis of the Harris data has focused on determining which variables, among demographic characteristics, general energy

issues and specific nuclear issues, best explain the general attitude toward nuclear power. While the comparative analysis of survey data indicated the importance of many of these variables, the discriminant analysis of the Harris surveys provided a means to determine the relative importance of specific attitude positions and demographic characteristics for predicting general attitudes toward nuclear energy.

Theoretically, it would be expected that nuclear specific attitudes would best predict general nuclear attitudes since they are closest in content to the overall evaluation of nuclear energy. In fact, these specific nuclear issue questions were excellent predictors of the pronuclear, neutral, and antinuclear respondents. Of particular importance is the identification of the specific kinds of nuclear issues which best distinguished between pronuclear and antinuclear individuals. First in importance was the evaluation of nuclear power plant safety. Second in importance was an attitude on how economically competitive nuclear power must be for a respondent's acceptance of a local nuclear plant. While pronuclear individuals considered nuclear power worthwhile if it costs the same as other sources, many antinuclear respondents felt that nuclear power must be considerably less expensive than other sources to be worthwhile. This implies that antinuclear individuals feel characteristics of nuclear power other than cost are negative relative to alternative sources, and thus a compelling economic advantage must be demonstrated to achieve acceptability. Furthermore, antinuclear respondents believed that nuclear power is not, in fact, less expensive while pronuclear respondents believed it is cheaper than other sources. Concern over waste disposal, although significantly related to general nuclear attitudes, was not as important a predictor of the general attitude toward nuclear power as were the plant safety and economic variables. This is important, because the distribution of responses indicated that waste disposal is an area of concern to pronuclear and neutral respondents (of whom approximately 60 percent see waste disposal as a major problem) as well as to antinuclear respondents (of whom 85 percent perceive waste disposal as a major problem).

Although attitudes about specific nuclear power issues statistically explain most of the variation in the general attitude toward nuclear power, different explanations at a more distant level of analysis are possible. To examine other kinds of explanations it is useful to look at responses to non-nuclear related questions. The set of attitudes about general energy issues was utilized to determine the degree to which a respondent's orientations to the total energy picture affected a respondent's general attitude toward nuclear power. The most important predictor variables were those related to attitudes toward increasing the energy supply. The pronuclear individuals were favorable toward speeding up the Alaskan pipeline, increasing offshore oil drilling, etc., while antinuclear respondents favored limiting the energy supply. Respondent's estimates of the seriousness of air pollution were also important--those who considered air pollution most serious indicated greater opposition to nuclear energy. Thus, concern over the environment and opposition to increasing the energy supply tend to be associated with an antinuclear attitude. The relationship, however, is much weaker than that between attitudes about specific nuclear power issues and the general attitude toward nuclear power.

The discriminant analysis also indicated which variables were not strongly related to general nuclear power attitudes. This analysis determined that beliefs about the energy shortage were not substantively related to the general attitude toward nuclear power. This finding is consistent with the results of the comparative survey analysis presented in Chapter 5, which indicated that the level of favorability toward nuclear power did not appear to be related to the extent to which the general public believed in the seriousness of the energy crisis. Unfortunately, the degree to which respondents' attitudes toward conservation might explain their general attitude toward nuclear power could not be determined with the Harris data.

Sociodemographic characteristics were also examined. These variables in a causal sense would be expected to be furthest from the general attitude toward nuclear power. They are personal characteristics that pertain

to an individual's position in the larger society. As such, relationships between sociodemographic characteristics and attitudes are expected, but the degree of association is also expected to be weaker than for attitude interrelationships. Findings consistent with the comparative survey results were obtained in the secondary analysis. Sex was the most important demographic variable, with women more likely to be antinuclear than men. Education and income primarily distinguished the neutral group from those with pronuclear or antinuclear attitudes. Respondents from the eastern region of the country reported higher levels of opposition to nuclear power than those from other regions.

7 CONCLUSION

We conclude this review of survey research on public attitudes toward issues surrounding nuclear power by highlighting the major substantive findings of the comparative survey analysis. Following the substantive conclusions, a number of methodological issues are presented. Finally, the implications of these findings for public policy in the area of energy decisions are discussed.

7.1 Substantive Conclusions

7.1.1 General Pro-Con Nuclear Attitudes

The basic finding of the survey data concerning the public's general assessment of nuclear power is that a majority of the public favors the use of nuclear energy. In essence, the issue is not so much whether the public supports nuclear power but the degree and variability of support across time, space, and social groups. The most global attitude questions, e.g., "Are you generally in favor of or opposed to nuclear power?" (Type 1 question) resulted in a mean of 63% favorable in the national surveys and a mean of 61% favorable in the state surveys. Unfavorable opinions were indicated by means of 19% in the national surveys and 31% in the state surveys. The use of nuclear power to generate electricity (Type 2 question) was favored by means of 72% in the national surveys and 62% in the state surveys, while opposed by means of 13% in the national surveys and 15% in the state surveys. Favorability toward continuing to build nuclear power plants (Type 3 question) was indicated by a mean of 53% in both the national and the state surveys. Opposition to the continued building of nuclear plants had means of 28% (national surveys) and 29% (state surveys). Favorability toward building nuclear plants when placed in the context of the energy crisis (Type 4 question) increased to means of 62% (national surveys) and 69% (state surveys).

Opposition declined, resulting in mean opposition levels of 21% for national surveys and 16% for state surveys (see Tables 3.6 and 3.7).

It is clear that there is much greater support for than opposition to nuclear energy. There is also a substantial percentage of the public, however, that does not take a position when asked these questions. The percentage of undecided respondents range from 11% to 32% in the national surveys, and from 2% to 41% in the state surveys. The "don't know" response may indicate ambivalence for some respondents and indifference towards this issue for other respondents.

To understand the meaning of the general level of public approval, which centers around 63%, it is useful to compare these data with survey results concerning other issues. Public approval for expanding the use of alternative energy sources ranged from a low of 42% for strip mining of coal to a high of 82% for solar energy (see Table 5.9). In comparison to a number of other areas of technological development, nuclear power, on a list presented in two Roper polls (74/8, 76/8), ranked fourth. The results were as follows: (1) medical transplants (a mean of 89% would like to see continued advances), (2) methods of local public transportation (mean 81%), (3) development of new food sources (mean 80%), and (4) nuclear power for peaceful purposes (mean 70%). Items that ranked below nuclear power included exploration of space (mean 46%), advanced weaponry (mean 43%), automated and self-service shopping facilities (mean 40%), synthetic foods (mean 35%), speed of jet planes for long distance travel (mean 30%), and electronic surveillance devices (mean 26%).

A number of respondents seem to feel that nuclear power is a good thing somewhere else. That is, a higher percentage of the public is favorable toward nuclear power in general than toward having a nuclear plant located nearby. However, respondents living near existing nuclear plants tend to be more supportive of local nuclear power than the general public. At a number of nuclear sites, favorability toward a local nuclear plant increased as the possibility of a nearby plant became a reality.

One important question regarding public attitudes toward nuclear power is whether any differences in favorability or opposition have been found over time. It is of considerable interest that no clear trends over time have been documented. Fluctuation over time was common but, generally, it did not follow a consistent pattern. It appears that the increased level of media coverage and public debate in recent years has not resulted in either a substantial increase or decline in public support for nuclear power. Findings reported by different research organizations for the same time period often varied more widely and more consistently than results obtained by one research organization across time. Harris surveys tended to obtain favorability levels at the high end of the pronuclear range, while Cambridge surveys obtained favorability levels at the low end of the range. Roper surveys generally reported findings between these two extremes. The reasons for these differences have not been determined. Since all three organizations use scientifically acceptable sampling techniques, we suspect that the different response patterns are more likely to reflect subtle differences in question wording and/or ordering and survey context than differences in the samples surveyed. Despite these differences among the levels of pronuclear support, it is important to emphasize that the basic pattern of a plurality of support for nuclear power was reported consistently by all the survey organizations in all time periods.

Several demographic characteristics were found to be related to nuclear favorability and opposition. Demographic findings were generally consistent over time and across the various research organizations. The greatest differences were between men and women. Women were considerably less favorable and more opposed to nuclear power than men, although in most cases a plurality of women were supportive of nuclear power. Women also tended to select the "don't know" response to a higher degree than men. Age differences were less pronounced than were sex differences. However, a clear trend of greater support for nuclear power among the middle-aged and less support among the young has been documented. Again, a plurality of the young generally is favorable toward nuclear power. In general, support for nuclear power increases with educational level. Those with low educational attainment tend to indicate greater opposition

to nuclear power. This group is also more likely to select the "don't know" category than the highly educated group. There is some question as to whether there has been a decrease in support over time among the highly educated respondents. The evidence was inconclusive, with some survey organizations reporting such a decline while others found no change. Income level, similarly to educational level, was positively related to favorability toward nuclear power. This is not surprising, since education and income are positively correlated. Regional differences are small in magnitude, though greater support for nuclear power has consistently been found among residents of the Western states, while lower levels of support have been found for residents of the Northeastern section of the country.

7.1.2 Specific Nuclear Issues

The major reasons stated for approving the development of nuclear power are (1) low cost, which was found most often in the early surveys (1960-72), (2) low levels of pollution, which was reported primarily in the 1973 pre-oil embargo surveys, and (3) energy need, which emerged after the oil embargo and has remained strong through the most recent surveys. The main reason for opposing nuclear power--danger--has remained stable throughout the period of survey research on this question, from 1960 to the present. For those instances where specific types of danger were mentioned, dangers related to reactor operation and nuclear waste were most frequently cited.

In response to structured questions, the disposal of radioactive waste was considered a more serious problem than were radiation discharge, power plant accidents or explosions, or thermal pollution. There was majority belief, however, that technology could solve the safety problems associated with nuclear power, including those that involved waste disposal. Considerable support was found for delaying the construction of nuclear plants to allow for further safety research. In general, however, a plurality of the public opposed discontinuing nuclear plant construction permanently on the basis of existing knowledge and experience with nuclear energy.

The economic aspects of nuclear power have usually been seen as an advantage, e.g., a majority of the public anticipated that nuclear-generated electricity would be less expensive than other types and expected that construction of a nuclear plant would stimulate the local economy. Most of the public also evaluated nuclear power positively in terms of its pollution characteristics and its availability for future fuel needs. There is some evidence that between 1975 and 1976 there was a small overall decline in the perceived advantages of nuclear power and a small general increase in the perceived problems of nuclear power.

Demographic patterns related to positions on specific nuclear issues are generally consistent with the results reported for overall pro-con nuclear attitudes. For example, the groups that most often believed that nuclear power plants are safe--men, the higher educated, and the Western region residents--are the same as the groups that were most favorable to nuclear energy in general. Similarly, the groups that were less likely to feel that nuclear power was safe--women and the lower income and less educated respondents--were the same as those least favorable to nuclear energy. In terms of a belief in the ability of technology to solve waste disposal problems, the demographic patterns are also consistent: male, middle-aged, highly educated, high income, and Western region respondents were most likely to feel that technology can solve nuclear waste problems.

7.1.3 General Energy Attitudes

The major findings concerning the relative preferences of the public for various energy source alternatives are: (1) solar energy is favored by the largest majority of the public, (2) nuclear power is consistently supported by a plurality, and (3) coal is the energy source alternative that is least preferred by the general public. The attitudes of the public concerning the role of conservation in the total energy picture appear to be ambivalent. While the majority of the public feels conservation is a good idea, many people expect conservation to reduce the standard of living and retard economic growth.

The comparison of pronuclear and antinuclear respondents regarding general energy attitudes indicated that those in favor of increasing the energy supply tended to be favorable toward nuclear energy, while those who preferred conservation were likely to be opposed to nuclear power. Respondents with pronuclear attitudes were favorable toward both solar energy and coal. They believed that not only would conservation fail to solve the energy crisis but also it would curtail economic growth, which they felt would be detrimental to low income individuals. Those with antinuclear attitudes preferred reducing electricity consumption to building more power plants, and felt that conservation was consistent with continued economic growth. However, these respondents did not believe that conservation would be able to solve the energy crisis. They did expect, however, that solar energy could significantly help this crisis. Respondents unfavorable to nuclear development were also unfavorable toward coal plants.

Comparisons of the general energy attitudes of specific demographic groups also suggest a degree of clustering of positions around energy supply versus energy conservation approaches. For example, women, who are consistently less supportive of nuclear energy than are men, are also less supportive of other energy supply options (including coal, solar energy, and offshore oil) and are more likely to prefer limiting electricity use to building more power plants than are men. In addition, they are more strongly in favor of environmental protection than are men.

The young hold a similar cluster of attitudes, except that they show strong support for the development of solar energy. Middle-aged respondents tend to favor increasing the energy supply. They are strong nuclear power supporters and favor the expanded use of all other suggested energy sources as well.

Respondents with high education and respondents with high income do not tend to emphasize one approach to energy problems--they favor both increasing energy supply and relying on conservation. These respondents are also very supportive of environmental protection. Thus, it appears that those who have high incomes and those with high educational levels

favor attempts on all fronts to solve energy problems while continuing a commitment to maintain environmental quality.

7.1.4 Secondary Analysis of the Harris Surveys

The secondary analysis of the Harris survey data focused on (1) characterizing the "don't know" respondents relative to the pronuclear and antinuclear respondents, and (2) determining which variables--among demographic characteristics, general energy issues, and specific nuclear issues--best explain a respondent's general attitude toward nuclear power.

The "don't know" respondents tended to take middle range positions on general energy and nuclear specific issues when compared to pronuclear and antinuclear respondents. However, the "don't know" respondents generally had lower educational and income levels than both the antinuclear and pronuclear respondents.

The analysis of the importance of demographic characteristics, attitudes about general energy issues, and attitudes about specific nuclear issues found that several specific items from all three of these sets of variables were significantly related to a respondent's general attitude toward nuclear power. By far the best predictor variables, however, were those involving specific nuclear issues. A respondent's opinion of the safety of nuclear power plants was the best predictor of his/her general attitude toward nuclear power. Next in importance was the respondent's evaluation of how economically competitive nuclear power must be for a respondent's acceptance of a local nuclear plant. Other considerations that were also highly significantly related to general nuclear attitudes included assessments of (1) the long-run reliability of nuclear power, (2) the cost of nuclear power relative to other sources, and (3) the pollution impact of nuclear power. Concern over nuclear waste disposal did not distinguish as well as the above variables between respondents with different positions on nuclear energy. This is essentially because nuclear waste is a general public issue; it is an issue of concern to a majority of pronuclear and neutral respondents as well as to most of the antinuclear respondents.

The most important general energy attitudes were those related to the issue of increasing the energy supply. Respondents favorable to increasing the energy supply through alternatives such as speeding up the Alaskan pipeline, offshore oil drilling, etc. were also favorable toward nuclear energy. Those unfavorable to these alternatives tended to be unfavorable toward nuclear power. Respondents who believed strongly that there was a serious air pollution problem were more likely to be unfavorable to nuclear energy. Belief in the seriousness of the energy shortage was not found to be substantively related to one's general nuclear attitude.

Important demographic variables included sex, education, income, and region. The findings were generally consistent with those reported in the comparative survey analysis. Women were more likely to be anti-nuclear and neutral than men, education and income primarily distinguished those with neutral attitudes from those with pronuclear or antinuclear attitudes, and Eastern region residents were more opposed to nuclear power than those from other sections of the country.

7.2 Methodological Issues

Throughout the text of this report, comments have been made where necessary to indicate problems of interpretation related to survey methodology. Although this is not the place for an extended analysis of methodological issues concerning the design and execution of survey research, problems with instrument design, sampling procedures, and survey reporting have presented particular difficulties in the comparative analysis of survey data, and some discussion of these concerns is merited.

7.2.1 Instrument Design

The wording and ordering of questions has been found to influence response patterns and to create comparability problems in analyzing the

survey data. At times, the question wording contained built-in assumptions that tend to lead the respondent. For example, we have noted the common practice of asking respondents "how serious" the energy shortage is, rather than whether there is an energy shortage (e.g., Harris 75/4, 76/7). The question itself assumes an energy shortage of some magnitude and therefore tends to preclude the option of saying there is no shortage.

Inability to interpret responses due to questions and statements with multiple clauses has also been problematical. For example, people were asked to indicate whether the following statement was completely true, partly true, partly untrue, or completely untrue: "Some communities have had nuclear power plants for as long as 14 years and have had cheaper electric power and no health problems" (Harris, 75/4, 76/7). It is quite difficult to interpret responses to this question, since it cannot be determined whether respondents who say "partly true" or "partly untrue" are referring to the cost or health impact part of the question as being either true or untrue. Interpretation can be more accurate when positions on each individual issue have been separately established. An example of this is found in the Cambridge (75/8) survey where respondents are asked first whether economic growth is possible with conservation and later whether economic growth is helpful to the advancement of the low income group. It was then possible to utilize the responses to both of these questions to determine the degree to which people would be likely to link conservation to maintaining inequality between income groups.

Positive versus negative wording of questions in different surveys has also created some comparative difficulties due to a general tendency for respondents to respond positively rather than negatively to questions. Nuclear attitude questions have usually been asked so that a favorable response is pronuclear; e.g., "Do you generally favor or oppose building more nuclear power plants?" (West, AZ 75/11). In a few instances, however, it has been stated in the opposite way; e.g., "How do you feel-- would you favor or oppose a delay in the building of more nuclear power plants in Oregon?" (Bardsley, 75/7). The Arizona survey (West AZ 75/11)

obtained a 69% favorable response rate to building nuclear plants, while the Oregon survey (Bardsley, 75/7) reported 54% of respondents favorable to building nuclear power plants (i.e., opposed to a delay in building more plants) (see Table 3.3). It cannot be determined on the basis of these particular survey findings whether the substantial difference in support for building nuclear power plants reflects a real difference in attitudes of Arizona versus Oregon residents or reflects the influence of question wording on the respondents in both states.

The selection of structured response categories has also led to some ambiguous conclusions. When there are more positive response categories than negative ones, the level of agreement or support may be inflated. For example, Harris (75/4, 76/7) structured response categories to a question determining respondents' assessments of the safety of nuclear power plants as "very safe," "somewhat safe," or "not so safe." The response categories do not provide an "unsafe" category, and, in fact, about 5% of respondents volunteered the response "dangerous." A more balanced set of response categories would be "very safe," "somewhat safe," "somewhat unsafe," "very unsafe."

There is some debate over the merits of providing a neutral response category. Often survey researchers prefer to have respondents make a choice to obtain some indication of preference than to allow respondents to claim neutrality. On the other hand, it may be important to know if respondents are neutral or indifferent on certain issues. For instance, the Central (IN 75/11) survey offered the response "it doesn't make much difference either way" as an answer to a general question on attitudes toward building nuclear power plants. Thirty-four percent of respondents indicated this position, while only 35% indicated favorability and 14% indicated opposition (see Table 3.3). Since this category was not available in most other surveys, we cannot assess the degree to which the pronuclear and antinuclear response levels include individuals who are in fact indifferent.

Question ordering has also probably influenced responses. For example, referring to the energy crisis in the phrasing of questions

on attitudes toward nuclear power has the effect of increasing the favorable response level and decreasing the opposition response rate. It is likely, therefore, that a series of questions on the energy crisis preceding a general pro-con nuclear question also tends to elevate the pro-nuclear response rate.

7.2.2 Sampling Procedure

As we discussed in Chapter 2, sampling techniques are very important determinants of the generalizability and validity of conclusions that can be drawn from survey research. Our analysis has focused primarily on data obtained from probability samples of the United States, and state and local areas so that comparisons of findings could be made with considerable confidence in the results obtained. We have tended to limit our use of surveys based on self-selected samples due to problems in determining the generalizability of results. For example, mailed-in questionnaires are dependent on individuals choosing to answer and return the surveys. The degree to which the respondent sample (the group that returns the questionnaire) resembles the population of interest must be determined so that potential biases in the sample can be taken into account. For instance, the IGR (Phoenix 75/7) survey report noted that the respondents who returned the mailed questionnaire were somewhat older and considerably better educated than the general population of Arizona. Since both older (particularly middle-aged) and better educated individuals tend to be more supportive of nuclear power, there is the possibility that the IGR (Phoenix 75/7) finding of approximately 70% favorable to a nuclear plant in Arizona may overstate the general Arizona population's support for nuclear power. The Cousteau (75/7) survey, which also relied on mail-in questionnaires, did not indicate how the characteristics of the returnees (45% of those who received the survey) compared to those of their membership population.

7.2.3 Survey Reporting

A major issue in utilizing survey reports for the comparative analysis of survey data is the need to rely on the types of analyses conducted by the individual research organizations. Since questions of interest to us were not necessarily of interest when the original data analyses were carried out, there has been a substantial problem of shortfall in the reporting of the kinds of data analyses that would be especially useful for this comparative study. In particular, attitude cross-tabulations were rarely provided and, in a number of surveys, demographic breakdowns were not reported. Multivariate analysis, as was presented in the secondary analysis of Harris (75/4, 76/7) (Chapter 6) was generally not available, though these kinds of approaches are more appropriate for special studies than for general public opinion survey reports. Clearly, the opportunity to conduct secondary analyses on original data from surveys in addition to the Harris (75/4, 76/7) studies would greatly enhance our understanding of the reasons for an individuals' position on nuclear power issues.

7.2.4 Interpretation of Results

Although much more could be said about these methodological concerns, we have limited our discussion to the most salient issues. The most important areas have been presented to alert the reader to problems in drawing definitive conclusions from these survey data. It is important, however, to evaluate the survey research presented here in terms of the consistency of identifiable patterns of responses, rather than to debate the validity of exact percentage distributions. Thus, we are confident of the conclusion that there is considerably more support for nuclear power than opposition to it, though the exact levels of support and opposition fluctuate among the different survey results. Similarly, demographic findings, on the whole, have been consistent across surveys, leading to considerable confidence in the conclusions drawn concerning the relationship between demographic characteristics and nuclear attitudes.

7.3 Survey Research and Public Policy Decisions

7.3.1 Introduction

Public opinion polls are an established feature of American life and have been sponsored for decades by public and private sector organizations for various purposes. A political party may wish to find out how the public or segments of it feel about certain candidates or issues. Private companies may conduct polls to obtain marketing information about reaction to current or anticipated products or services or to predict emerging needs that new products might meet. Government agencies may wish to learn how past or anticipated policies are viewed.

In the case of energy policy decisions--deregulation of natural gas prices, building the Alaskan pipeline, gasoline rationing, mandatory energy conservation measures, accelerated development of nuclear energy, offshore oil drilling, incentives for increased coal production, expanded research and development support to solar energy, etc.--it is fair to ask what role, if any, the opinions of the public play. This report incorporates much more public opinion data than ever before assembled on the use of nuclear power, an important area of energy policy. So what? Some might argue that in the final analysis economic factors will determine the course of energy decisions. Others feel that the realities of fuel supply will ultimately determine our energy future. Still others hold the view that politicians will find a way to do what they want to do. As far as we know, no one has yet argued that public policy decisions are primarily determined by public opinions. In fact, this seems particularly unlikely in the case of energy policy decisions because there appear to be so many real constraints on the course that energy decisions can take.

7.3.2 Components of Energy Policy Decisions

With some apology for oversimplification, we feel that "good" energy policy decisions--those in the broad public interest, those that last, those that prove implementable, those that accomplish the results expected of them--are based on three components: (1) technical capability, (2) economic efficiency, and (3) social values.

Technical capability simply refers to demonstrated or estimated capability to do the job, taking into account the time frame within which technical capability can be demonstrated and the time required to actually bring various amounts of energy supply capability on line. These estimates always involve certain assumptions and bands of uncertainties (wide with technologies in the early research and development stage and narrower with proven technologies). Economic efficiency refers to the costs, direct and indirect, near and far term, of pursuing an energy policy alternative. These costs often are estimates which also involve assumptions and uncertainties.

The meaning of "social values" may require more explanation. Basic values such as freedom and social equity are involved, but in the context of energy policy decisions we mean something more specific. Namely, that the outcomes of energy decisions must be positively evaluated by the public. In times of gasoline shortage (e.g., when the supply is markedly less than the demand) the alternative policies of rationing versus allowing price to seek a level where supply and demand are balanced have different outcomes for the public. Those who have to cut back or do without are different in implementing the policies and the economic consequences are different. In short, alternative policies, if they are really different rather than merely appearing different, will result in different outcomes and involve different means or ways of achieving those outcomes. By saying that good energy decisions incorporate social values, we mean that the social implications of energy policy outcomes should be considered and tested for consonance with known social values. This is not easy to do.

The mechanisms by which social outcomes are forecasted, by which social values are measured, and by which they play a role in public policy decisions are not well worked out at present. For instance, the anticipated outcomes of involvement in Viet Nam viewed at the time of the Gulf of Tonkin Resolution were judged positive, in line with social values. Subsequent events and perhaps changing values showed the outcomes of this decision to conflict with social values. The anticipated outcomes of the development of a domestic SST were judged not desirable. Time will tell whether this decision is reserved or not. So, some observers from the technical, business, or governmental communities may ask, "Why try to consider what the public wants? It doesn't know and can't tell you." However, it seems to us that public poll data, carefully gathered, compared, and evaluated, can perform an important function in providing public input to the decision process.

7.3.3 Limitations on the Use of Survey Data in Energy Policy Decisions

Before addressing the question of how public poll data might influence energy policy decisions, we must first explore several limiting or contingent conditions. In other words, even if public opinion is carefully measured and clearly expressed, it may have only small influence on policy decisions. Among the limiting conditions are the following:

(1) Policy inertia: Policies that take effect over long time frames may have developed considerable inertia. It becomes very difficult to change directions. After a long period of concentrating research and development funds in a technology, that technology will usually have reached a stage of readiness that makes a major shift very difficult.

(2) Leader commitment: Decision makers sometimes have policy preferences that transcend technical, economic, and social considerations. When such policy preferences exist, it may be difficult to capture the decision maker's attention to present opposing views and have them taken seriously.

(3) Option availability: Because of technical or economic constraints or political assessments, decision makers may feel they have very few choices. For example, agency planners and technologists may feel that a dramatic speed-up in the development of solar energy is not possible, even if the public is strongly in favor of it (as some surveys show).

(4) Decision time scale: Major policy decisions almost always involve a series of choices over a period of time. Once these interim decisions are made and implemented, a new status quo is created. Public input may come too late in the decision process to have much influence.

(5) Public opinion strength: If decision makers have strong policy preferences they may ignore a broad majority of public opinion if they feel the opinions are only weakly held. Even issues of pressing collective importance may affect no particular segment or group of the public directly enough or locally enough to raise their salience to the point where direct action occurs.

Other factors could be mentioned. For instance, the media can elevate the salience of an issue and focus action contrary to majority public opinion. Decisions may be made in secrecy and thus avoid a test of public opinion until it is too late for change.

Thus, there are many reasons why public opinion may not, in a given case, have much influence on policy decisions. Acknowledging the above limiting conditions, it is still clear that in some cases public opinion does play a determining role in policy formation and change.

7.3.4 Survey Data Contributions to Energy Policy Decisions

Assuming that at least some of the contingent conditions are favorable enough to permit public opinion data to influence energy decisions,

what types of contribution might they make? In considering this question we postulate that the energy policy decision process involves several stages and, in fact, that several cycles of decisions are necessary. Stages of the decision process involve some form of the following: (a) determination of a need for policy action, (b) setting of policy goals, (c) generating policy options, (d) evaluation of policy options, including estimates of the short and long term effects of alternative policies, their desirability in light of policy goals and whether implementation appears possible, (e) choice among options, (f) selection of implementation strategies, (g) periodic evaluation of policy outcomes. Public survey data can contribute something to each of these stages. Decision makers require many kinds of information to deal effectively with the sequence of choices necessary. Public survey data can contribute information of several kinds. Among the kinds of contribution are the following:

(1) Evaluation of the status quo: Survey data can inform policy makers about public satisfaction with things as they are. For instance, is the current pace of nuclear power development acceptable? Is change needed?

(2) Expression of public needs and priorities: Survey data can indicate the relative strength of felt public needs. Is continued economic growth desirable? When tradeoffs among competing needs are involved, which are more important? If standard of living might be affected by a sharp shift to solar power, is this acceptable?

(3) Evaluation of alternative goals and outcomes: When policy formation reaches the stage where alternative goals and outcomes can be stated, how do they stack up in the public's opinion? Will a nuclear waste policy that reduces risks to future generations by concentrating risks in the present be acceptable?

(4) Evaluation of alternative courses of action: Public survey data can inform decision makers about the preferred means of reaching certain goals. Among those members of the public who feel

expanded energy supply is necessary, how do they feel it should be obtained? Strip mining? Offshore drilling? The breeder reactor? Expanded oil imports?

(5) Expression of fears and concerns: Items 2, 3, and 4 above focus on what the public would like to see happen. This item involves what the public would like not to happen. Surveys can discover public fears and concerns. Such data can inform choices among goals and means to goals as well as indicating what controls and regulations are seen as desirable.

(6) Expression of public beliefs: Polls can show what the public believes is possible, and may also indicate what the public wants to have happen. Can technologists solve the waste disposal problems? Is solar energy a likely solution to energy shortfall in the next ten years? Are the statements of agency spokespersons or those of public interest groups credible?

These several contributions that public survey data can make are not separate and distinct. The six categories above obviously overlap. It is also true that there is no one-to-one relationship between the information needs of policy makers and the several kinds of information available from public surveys. From the perspective of energy decision makers, perhaps the wrong questions are asked, or the timing of the questions is inappropriate to the timing of decision points, or the assumptions behind the questions are questionable, or the sample is too narrow or too regional, or the results have not been analyzed to expose the preferences of key segments of the public, or the really useful results are secret, or the findings are simply too numerous, too diverse, and too confusing to be of value. It may even be that survey results are rejected simply because they fail to confirm the preexisting beliefs and assessments of the decision maker. No doubt one reason for the plethora of surveys on nuclear power questions is that available survey data are judged not to meet the particular needs or square with the preconceptions of particular organizations that sponsor surveys. They may feel the only way to get better information is to do their own survey (and do it differently).

This has, of course, been both a benefit and a burden to us in our comparative analysis. On the one hand, it has led to a large quantity of information, but differences in methodology, question form and content have often made informative comparison difficult.

It should also be clear that public survey data are only one of several sources of input to the several stages of the decision process. Sometimes sources of information from the scientific/technical community or from the economic and engineering forecasts will be in conflict with public survey data. A good example is the belief (held by a substantial portion of the public) that nuclear power plants might explode like atomic bombs. Scientific opinion both from supporters and opponents of nuclear power is that this can't happen. Policy makers should obviously not veto nuclear power because nuclear power plants might blow up, but neither can they ignore the fact that this concern exists. It may indicate the public feels that the technology control mechanisms need strengthening. It may also signify a need for more (and more credible) information about nuclear power in forms readily understandable by the general public.

Another example of apparent conflict between the technical community and the public concerns the public belief that substantial help in meeting the nation's energy needs can be expected from solar energy in the near future. Obviously, if the public believes something is technically possible that doesn't make it so. Even so, data of this type can constitute an important enabling condition for policy formation and implementation. If the public thinks a technical development is clearly possible, whether it is going to the moon or bringing solar power on line, it is easier to gather support for research, development, and demonstration expenditures, and technical achievements are more readily accepted. Similarly, if the public believes that conservation can plug the energy gap, conservation programs may be easier to implement.

Energy decision makers, particularly those whose positions place them in the direct line of fire of active supporters and opponents on a polarized issue like the pace of nuclear power development, might

understandably feel that "actions speak louder than words." Survey results are, after all, only words. Most survey respondents are not joining special interest groups to focus their action, not writing elected officials, not hiring professional lobbyists, not carrying signs in demonstrations, not voting on a one-issue basis, and not bringing suit to stop energy projects. However, they might be moved to some of these activities if events conspire to increase the salience of nuclear issues. Because good survey methodology assures a representative sample, poll results can be a valuable supplement, providing balance and perspective, to the more active influence attempts that decision makers feel from committed supporters and opponents.

In summary, we feel that public survey data can make important contributions to energy decisions and should receive attention as one of several kinds of information necessary to good policy decisions. In fact, there may be cases when technical judgment and public opinion are in conflict and technical judgment should be discounted. The public itself may provide the best information on its willingness to pay more for an option with features it feels are desirable.

Whether public beliefs, opinions, attitudes, concerns, and values as expressed in public opinion polls will have important impact on energy policy and nuclear power development remains to be seen. In any case, making survey results available is a precondition of their having influence, and we feel that careful readers in industry, government, and among the technical/scientific community can learn from the collected findings presented here. They can receive guidance for energy policy formation and needed change, stimulus for new and more acceptable solutions, and forewarning of implementation problems. They can better understand the need for improved information distribution and more productive mechanisms for resolving disputes. They may even learn that some of their fears about public opinion are groundless and by contrast that unrecognized problems exist.

It is our hope that this effort to gether and comparatively analyze the available data on public attitudes about nuclear power will make

easier the task of learning from public opinion. The collected data may also be valuable for what they don't show. For example, they don't show dramatic and recent shifts of opinion. It also becomes clear that many potentially useful kinds of information are not available, either because the issues are relatively new and the right questions haven't yet been asked (questions about waste disposal, reprocessing, and alternative nuclear fuel cycles are in this category) or because we simply couldn't find or get permission to use certain material (questions on nuclear weapons proliferation fit in this category). At the very least, an extensive collection of survey findings lends weight to those conclusions that do appear justified from the data.

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APPENDIX

ANNOTATED SURVEY REFERENCE

National Surveys

Battelle (76)

Maynard, W. S., Nealey, S. M., Hebert, J. A., and Lindell, M. K. Public values associated with nuclear waste disposal. Seattle: Human Affairs Research Centers, Battelle Memorial Institute, 1976.

Public attitudes toward nuclear waste disposal were measured after 465 respondents had seen an informative and objective film on the topic. The sample included 22 groups in five regions of the United States including: junior high, high school, and university classes; men's and women's professional, civic, religious, and service organizations; recreational and environmental activist organizations; and scientists and public officials with technical backgrounds in nuclear engineering and physics. Questions covered long-term safety, short-term safety, cost, and accident detection and recovery. Analysis of the results compared the various assessment methods. A-A-E-G¹

Becker (73/76) (74/5)

Becker Research Corporation. The electric utility industry. A national survey of public knowledge and attitudes. Boston, 1973.

A probability sample of citizens of 48 states, 1,431 in the first wave and 1,252 in the second, were personally interviewed primarily on electric company services in May-June 1973. The few questions specifically on nuclear energy concerned favorability toward nuclear power and nuclear plants nearby. S-A-E-I-G-U

¹For this project, researchers were interested in demographic classifications of sex (S), age (A), education (E), income (I), occupation (O), geographic region where respondents reside (G), and rural or urban residence (U). The letters following each annotation indicate the data of this type that were collected.

Cambridge (75/5) (75/8) (75/12) (76/4) (76/7) (76/10) (76/12)

Cambridge Reports, Inc. The Cambridge Report. Cambridge, MA, 1975.

In a probability sample, 1,500-2,000 people were personally interviewed in each of these surveys, including several non-energy-content areas along with energy related questions. Questions about nuclear power concerned favorability toward it, concerns, waste storage, safety, and cost. General energy questions covered conservation, alternative energy sources, pollution, and energy needs. S-A-E-I-O-G-U

CBS (70/4)

Chandler, R. The environment. In Public opinion; changing attitudes on contemporary political and social issues. A CBS reference book.

New York: R. R. Bowker Co., 1972.

CBS News surveyed 900 randomly sampled telephone subscribers as background for their program, "The National Environment Test," presented May 19, 1970. Nuclear energy was the topic of two questions; the remainder were on environmental issues. Some demographic analysis of responses was discussed. S-A-E-G

Cousteau (75/7)

Cousteau Society. Energy questionnaire. In Supplement to Calypso Log, 2 (4), 1975.

The Cousteau Society surveyed 32,681 members by mail, receiving a 45% return rate. Questions covered nuclear power, environmental concerns, and willingness to conserve energy for the sake of the environment. Also included was a specific question on nuclear waste. No demographic information was obtained.

Gallup (76/6)

Gallup Poll. Nuclear power plants seen as key factor in energy quotient.

In Gallup Opinion Index (Report No. 134), September 1976, 12-16.

The Gallup organization personally interviewed 1,524 residents on June 11-14, 1976. Four nuclear power questions elicited information on knowledge of discussions of nuclear power plants, the importance of building more plants, the safety of current power plants, and tolerance of power plants nearby. S-A-E-I-O-G

Harris (75/4)

Harris, Louis, and Associates. A survey of public and leadership attitudes toward nuclear power development in the United States. New York City, 1975.

This was a comprehensive survey of 1,252 citizens selected by probability procedures and separate samples of leaders and residents near nuclear plants. Questions concerned beliefs, preferences for various phases of nuclear power, apprehensions, environmental issues, alternative power sources, and credibility of information sources. Leaders were also asked their estimate of public opinion on the topics. In addition to demographic breakdowns, data is reported for total public vs. nuclear plant neighbors, political leaders, business leaders, regulators, and environmentalists. S-A-E-O-G

Harris (76/7)

Harris, Louis, and Associates. A second survey of public and leadership attitudes toward nuclear power development in the United States. New York City, 1976.

A replication of the survey done in 1975 [Harris (75/4)], this survey polled 1,497 households, in addition to separate samples of leaders and neighbors of nuclear plants. S-A-E-I-O-G-U

NORC (74/5)

Murray, J. R., Minor, M. G., Cotterman, R. F., and Bradburn, N. M.
The impact of the 1973-1974 oil embargo on the American household
(NORC Report No. 126). Chicago: National Opinion Research Center, University of Chicago, December 1974.

A series of weekly probability samples of the U.S. population were conducted by personal interview, April 1973-May 1974 and primarily oriented to the energy crisis of 1973. The few questions about nuclear and solar energy are in the appendix and are not treated demographically. Sample size for the nuclear questions was 422. The report discusses at length responses to the crisis, analysis of conservation attitudes and behaviors, and reaction to daylight savings time. S-A-E-I-G

ORC (74/11) (75/1) (75/2) (75/4)

Rappeport, M., and Labaw, P. Federal Energy Administration, Highlight reports (Vols. 1-20). Opinion Research Corporation, Princeton, N.J., September 1974-April 1975.

Probability samples of 600-1,200 residents were interviewed by telephone at two-week intervals. The survey focused on behavior and attitudes toward energy conservation and included questions on nuclear power.

S-A-E-I-G-U

Roper (75/4) (75/6) (75/10) (76/6) (76/8) (76/10) (76/11)

Roper Organization, Inc. Roper Reports. New York City, 1975-1976.

(Permission to use selected items granted by Atomic Industrial Forum, Inc., Washington, D.C.)

Personal interviews were conducted with approximately 2,000 systematically selected adults. Question topics included alternative energy sources, conservation, and other energy concerns in the context of economic, political, and other general issues. A number of specific questions on nuclear power were also included. S-A-E-E-I-O-G

Sindlinger (60/6)

Sindlinger Company. A nation-wide survey of the public's attitudes and opinions towards atomic energy. Swarthmore, PA, March 1961.

Telephone interviews surveyed 1,300 phone subscribers during May and June, 1960. Questions concerned attitudes and feelings toward peaceful uses of atomic energy. Safety, economics, credibility, and technical capacity were specifically assessed. S-A-E-O-G

State Surveys

Arizona

PubResp (AZ 76/8)

Public Response Associates, Inc. Report on Arizona statewide survey.

San Francisco, 1976.

The nuclear initiative was the focus of this random sample survey of 885 Arizona residents. A section of Likert-type attitude items was included. S-A-E-I-O

PubResp (AZ 76/9) (AZ 76/10a) (AZ 76/10b) (AZ 76/10c)

Public Response Associates, Inc. Four tracking and election day surveys.

San Francisco, 1976.

Four waves of personal interview surveys included 600-700 respondents each wave. The questions included favorability toward nuclear power and voting intention on the initiative. S-A-E-I

West (AZ 75/11)

M. R. West Company. Attitudes toward nuclear energy. Phoenix, Arizona, 1975.

About the time the nuclear initiative effort first surfaced in Arizona, 775 residents of five cities were surveyed. Among the questions were favorability toward nuclear power, safety issues, and sections of Likert-type attitude statements. S-A-E-I-O-G

California

Field (CA 76/2) (CA 76/3) (CA 76/5) (CA 76/6)

Field Research Corporation. California poll (Release Nos. 887, 897, 905, 910). San Francisco, 1976.

Over 1,000 California residents were surveyed in each of four waves before the vote on the nuclear initiative. Sampling and method varied

over the waves, from personal interviews of a cross-section of people to telephone interviews of voters. Attitudes toward the initiative were tapped in the first two waves. The last two waves asked about power needs, safety, and construction of nuclear plants.

Colorado

Hamilton (CO 76/8]

William R. Hamilton and Staff. Colorado opinion survey. Denver, July 1976.

Before the vote on a nuclear power plant initiative, 650 residents of Colorado were selected for a modified area probability sample and were personally interviewed. About one-third of the questionnaire covered nuclear questions, such as safety, need, cost, alternatives, and environmental effects. Cross-tabulations of attitudes and voting positions were given. S-A-O-G

Connecticut and Massachusetts

Becker (CT, MA 76)

Becker Research Corporation. Boston, February 1976.

This telephone survey of a probability sample of 900 residents in utility operating areas assessed attitudes and knowledge of nuclear power in addition to other topics. Questions covered awareness of nuclear plants, favorability toward a nuclear plant in the area, reasons for opposing construction, awareness of the amount of power generated by nuclear plants, and costs. S-A-I

Four Corners (Arizona, New Mexico, Colorado, and Utah)

IGR (Four Corners 76)

Institute of Government Research, University of Arizona. A four-state study of public policy issues including energy issues. Arizona

Speaks, Fall 1976. Other data in personal letter from H. Ingram, Director of the Institute.

A survey of voters of Arizona (N=861), New Mexico (N=1,018), Colorado (N=1,054), and Utah (N=645) was conducted by mail. Questionnaires were mailed to 50 voters in each legislative district in each of the four states. Response rates varied from 60% to 70%. A Likert-type question asked about the benefits and hazards of nuclear power. A-E

Indiana

Central (IN 75/11)

Central Surveys, Inc. An opinion survey among Indiana customers . . .
Shenandoah, IA, 1975.

Attitudes toward electric companies were the focus of this telephone survey of 1,600 people. In addition to this focus, questions covered favorability toward a nuclear plant nearby, energy needs, concern for the environment, and alternative energy sources. Women were over-represented and data were weighted accordingly. S-A-E-O

Iowa

Iowa (IA 76/4)

The Iowa Poll. Majority of Iowans want N-plant halt. Des Moines Sunday Register, July 11, 1976.

This article reported a three-question poll on nuclear power plant construction among a probability sample of 600 Iowa citizens. S-I-U

Louisiana and Texas

Central (LA, TX 73/4)

Central Surveys, Inc. Customer opinion survey. Shenandoah, IA, 1973. In a probability sample, utility customers--400 from Texas and 400 from Louisiana--were personally interviewed about their attitudes toward utility companies. Nuclear power questions concerned pollution and construction of a plant nearby.

Michigan and Wisconsin

Central (MI, WI 77)

Central Surveys, Inc. Shenandoah, IA, March 1977.

Telephone interviews assessing the attitudes and opinions of 1,100 utility customers toward the company asked one nuclear power question: favorability toward a nuclear power plant in the area. A similar question regarding a coal-fired electric plant was also asked. S-A-E-I-O-G

Michigan

Nordhaus (MI 72/2) (73/5)

Nordhaus Associates, Inc. Michigan public issues survey. 1972, 1973.

Attitudes toward utility companies of Michigan residents were surveyed in two waves, 885 respondents in the first wave and 896 in the second. Questions included favorability toward nuclear power and nuclear plants nearby, energy needs, conservation attitudes, environmental issues, and participation in power source decision making. S-A-E-I-G

Missouri

Navarro (MO 74)

Navarro Opinion Research. Customer opinion survey. 1974.

Following up a survey the previous year, 500 Missouri residents were asked their attitudes toward a proposed nuclear power plant site near Fulton, Missouri. Sampling procedure, survey methods, and total questionnaire content are unknown. S

Navarro (MO 75)

Navarro Opinion Research. Customer opinion survey. 1975.

This survey of 500 Missouri residents included questions about favorability toward nuclear power and a nuclear power plant to be built in the state, reasons for attitudes about plant construction, and interest in further information. Sampling procedure and method of data collection are unknown. A-E-I-O-G

New Hampshire

Becker (NH 75/7)

Becker Research Corporation. . . . New Hampshire customer attitude study. Boston, 1975.

A random sample of 300 utility customers was personally interviewed about knowledge of nuclear power, approval of the yet to be constructed Seabrook nuclear plant, and the safety of nuclear power.

Central (NH 71/10)

Central Surveys, Inc. Customer opinion survey, October 6-22, 1971.
Shenandoah, IA, 1971.

A cross-section of 600 utility customers was personally interviewed. Respondents' preferences for nuclear-, coal-, or oil-powered plants were asked, as well as perceptions of the advantages and disadvantages of these. S-A-I-O-G

Oklahoma

Central (OK 75/3)

Central Surveys, Inc. Customer opinion survey, March 13-18, 1975.
Shenandoah, IA, 1975.

A cross-section of 1,346 utility customers was personally interviewed. While most questions centered on the utility company, other issues included were energy need and conservation, attitudes toward a nuclear plant nearby, and attitudes toward a coal-burning plant. S-A-I-O-G

Central (OK 76/3)

Central Surveys, Inc. Customer opinion survey, February 24-March 13, 1976. Shenandoah, IA, 1976.

This replication of the 1975 survey consisted of 1,046 personal interviews with a representative cross-section of utility customers. In addition to topics assessed in the previous study, questions on nuclear plant safety and energy conservation were included. S-A-E-I-O-G

Oregon

Bardsley (OR 68/1] (OR 69/6] (71/4] (71/8]

Bardsley and Haslacher, Inc. Oregon looks at atomic power plants.

Portland, OR.

These four separate reports constitute a replication series. In the first, a probability sample of Oregon residents (N=1,088) and a cross-section of Columbia County residents (N=200) were personally interviewed prior to construction of the Trojan nuclear power plant in Columbia County. The second study included 330 respondents. In May of 1971, 1,128 were personally interviewed, and the August survey included 794 respondents. Interviews included questions on attitudes toward economic growth, preferred location of the Trojan plant and a second proposed plant, anticipated benefits/detriments, and environmental effects. S-A-E-I-O-G-U

Bardsley (OR 72/2)

Bardsley and Haslacher, Inc. Oregon re-evaluates nuclear power plants.

Portland, OR, March 1972.

A sample of 800 residents representing a cross-section of Oregonians were asked in personal interviews about the Trojan nuclear plant, the proposed Boardman nuclear plant, and an additional plant nearby. Also assessed were attitudes toward the environment, economic growth, and industrial needs. S-A-E-I-O-G

Bardsley (OR 72/7)

Bardsley and Haslacher, Inc. Nuclear power and electric energy needs.

A public opinion report. Portland, OR, Summer 1972. .

Personal interviews were conducted with about 800 Oregon residents. Questions regarded the Trojan nuclear plant, additional proposed plants, the environment, industrial growth, and population growth.

Bardsley (OR 75/3]

Bardsley and Haslacher, Inc. A moratorium on nuclear power plants?

Portland, OR, April 1975.

Oregon voters (N=804) were asked two questions regarding a moratorium on construction of nuclear power plants. Comparisons with answers to a similar question in 1972 were drawn. S-A-E-I-O-G

Bardsley (OR 75/7)

Bardsley and Haslacher, Inc. Regulation and development of power plants in Oregon. Portland, OR, Summer 1975.

A sample of 1,319 Oregon residents, including groups from Columbia County, location of the Trojan nuclear plant, and Morrow-Gilliam County where a coal-powered plant was proposed. Questions regarded support for Trojan, the nuclear initiative, energy options, and energy source comparisons. Included were trend charts on support for Trojan. S-A-E-I-O-G

Bardsley (OR 76/8)

Bardsley and Haslacher, Inc. A re-evaluation of Measure #9. Portland, OR, September 1976.

One month before the election, 1,047 Oregon voters were asked in personal interviews their attitudes toward nuclear power and their voting intentions on the nuclear initiative. S-A-E-I-O-G

Bardsley (OR 76/12)

Bardsley and Haslacher, Inc. A postmortem on Measure #9. Portland, OR, January 1977.

After the election, about 600 Oregon voters were personally interviewed on their voting behavior on the nuclear initiative. Included were questions concerning attitudes toward nuclear power. S-A-E-I-O-G

Oregon and Washington

Bardsley (OR, WA 75/12)

Bardsley and Haslacher, Inc. Electric energy and the environment.

A Washington-Oregon opinion report. Portland, OR, November-December 1975.

A probability sample of 1,206 resident adults, half each in Washington and Oregon, responded to questions about electricity needs, the energy

shortage, preferred methods of energy generation, etc. Only a few questions referred specifically to nuclear power. S-A-E-I-O-U

Washington

Bardsley (WA 76/8)

Bardsley and Haslacher, Inc. The nuclear climate in Washington.

Portland, OR, August 1976.

A random sample of 800 Washington voters were personally interviewed before voting on the nuclear initiative. Questions included favorability toward nuclear power, safety, alternative power availability, energy needs, and initiative-related items. Voters east of the mountains were reported separately. S-A-E-I-O-G

Gilmore (WA 76/3)

Northwest Certified Surveys, a division of Gilmore Research Group.

Northwest poll. Seattle, 1976.

The Seattle Post-Intelligencer sponsored this telephone poll of 600 probability-sampled residents. Respondents were asked to choose between reducing electricity use or building a nuclear plant. S-A-I-G

GMA (WA 76/8)

GMA Research. Poll No. 20. Bellevue, WA, August 4, 1976.

Voting intention on the initiative and attitudes toward construction of nuclear or conventional power plants were assessed in telephone interviews with 600 Washington residents. S-A-I-G

Summers (WA 76)

Summers, D., and Ashworth, C. Types of conflict in nuclear power plant disputes. Unpublished manuscript, Battelle Seattle Research Centers, 1976.

In a non-random sample, 208 Washington citizens and 50 electric utility company executives from the Northwest responded to questions about accepting nuclear plants in their communities, perceived outcomes of a nuclear plant, information about nuclear power, and citizenship participation in nuclear power decisions. Responses from those for whom nuclear power

was highly acceptable were compared with responses from those for whom nuclear power was relatively unacceptable. S-A-E-G

Wisconsin

Central (WI 75/6)

Central Surveys, Inc. Shenandoah, IA, Summer 1975.

A cross-section of utility customers totaling 600 were asked their favorability toward nearby nuclear and coal plants and opinions about the energy shortage. S-A-I-O-G

IES (WI 73)

Beane, M., and Ross, J. The role of technical information in decisions on nuclear power plants (University of Wisconsin Sea Grant College Program, Technical Report No. 225). Madison, WI: Institute for Environmental Studies, University of Wisconsin, 1974.

The knowledge of and attitudes toward nuclear power of those involved in the decision to site the Point Beach plant were assessed. Groups surveyed included residents near the Point Beach nuclear plant, community leaders, state officials, utility field managers, and leaders of environmental groups in the area.

Local Surveys

Albuquerque, New Mexico

Pendergrass (Albuquerque 70/5)

Pendergrass, M. L. Public attitudes toward the uses of nuclear energy. Albuquerque: Nuclear Engineering Department of the University of New Mexico, June 1970.

Questionnaires were distributed door-to-door to residents of Albuquerque. The 143 questionnaires returned by mail overrepresented the middle-class and middle-aged groups. Questions assessed knowledge and attitudes

about nuclear power, credibility of authorities, and environmental concerns. S-A-E

Boston, Massachusetts

Harvard PTS (Boston 70/6)

Taviss, Irene. A survey of popular attitudes toward technology.

Technology and Culture, 1972, 13, 606-621.

This survey conducted for the Harvard University Program on Technology and Society assessed the attitudes toward technology of residents in three greater Boston communities. About 200 randomly selected respondents were personally interviewed. Two questions dealt with nuclear power: one weighing the benefits and dangers of nuclear power and the other concerning who should make nuclear power decisions. S-A-E-I-O

Kasperson (Boston 76/7)

Kasperson, R., Burton, I., Guy, K., Whyte, A., and Wood, J. Project RARE (Risk Assessment of Rare Events): Interdisciplinary research on disaster prevention in the nuclear energy programs of Canada, the United Kingdom, and the United States. Unpublished draft manuscript, 1976. (Available from Kasperson, Clark University, Worcester, MA)

Several surveys using similar questionnaires to elicit the public's assessment of the risk of nuclear power were conducted in Boston, and at three nuclear power plant sites: Indian Point, New York; Seabrook, New Hampshire; and Waterford, Connecticut. A total sample of 300 were interviewed in their homes located near the plant sites. An interviewer in the streets of Boston surveyed a nonrandom sample of 243 people. Questions covered energy policies, safety of nuclear energy, advantages and disadvantages of a nuclear plant in the area, concerns and knowledge about nuclear power, and political activity. S-A-E-I-O-G

Eugene, Oregon

Fischhoff (Eugene 76)

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., and Read, S.

How safe is safe enough? A psychometric study of attitudes toward technological risk and benefits. University of California, Los Angeles. School of Engineering and Applied Science. January 1977, UCLA-ENG-7717, NSF/RA-77/0054. PB-266 045/1WS.

Members and spouses of the League of Women Voters of Eugene, Oregon were assessed as to their judgments on perceived benefits and risks of various technological developments, including nuclear power.

New York City, New York

Kay (NYC 47/6)

Kay, L. W., and Gitlin, I. J. Atomic energy or the atomic bomb: A problem in the development of morale and opinion. Journal of Social Psychology, 1949, 29, 57-84.

National polls conducted in 1945-1947 are summarized and presented. Also, data from a survey of 345 New York City citizens, assessed in groups, in 1947. Questions assessing knowledge about atomic weapons and atomic power were designed to elucidate factors influencing opinions. A brief attitude change experiment on atomic energy was reported. S-A-I-E

Phoenix, Arizona

IGR (Phoenix 75/7)

Detloff, J., Federhar, A., and Ingram, H. M. Public attitudes about nuclear energy in Arizona. Draft. Phoenix: Institute of Government Research, University of Arizona, 1975.

Residents of Phoenix randomly selected from telephone listings were mailed questionnaires in June and July of 1974 and again in 1975.

Response rates of 33 and 43 percent brought a total sample of around 800. Nuclear power questions included general favorability, environmental and safety concerns, and advocacy of other power options. Some of the

research was funded through the National Science Foundation undergraduate research program. Arizona had no nuclear plants at the time and plans for them were for the 1980's. A-E

Sacramento, California

IGA (Sacramento 76/6)

Groth, A. J., and Schutz, H. G. Voter attitudes on the 1976 California nuclear initiative. Davis: Institute of Government Affairs, University of California, 1976.

Voters in Sacramento County were randomly selected and mailed surveys after the initiative election. A return rate of 63 percent brought 633 responses. Included were 28 Likert-type items assessing nuclear power attitudes. Responses to these were cross-tabulated with respondents' reported votes on the initiative. S-A-E-I-O

San Diego, California

Bardsley (San Diego 76)

Bardsley and Haslacher, Inc. The customer relations climate of San Diego . . . An opinion survey. Portland, OR, September 1976.

Randomly selected residents of greater San Diego were personally interviewed about their attitudes toward electric utility company, nuclear safety, and support of a nuclear plant in the area. Questions also related to energy needs, conservation, environment, and credibility of information sources. S-A-E-I-O-G

Central (San Diego 72/8)

Central Surveys, Inc. Customer opinion survey, greater San Diego. Shenandoah, IA, August 18-31, 1972.

The vote on Proposition #9 (Environmental Initiative) was the topic of this survey of 400 residents of greater San Diego plus 200 from areas voting heavily for or against it. Respondents were asked how they would have voted if they could have voted separately on the nuclear provisions for a moratorium on construction of plants and also were asked to compare nuclear and oil plants. S-A-I-O

Seattle, Washington

Battelle (Seattle 74)

Burnham, J. B., et al. A technique for environmental decision making using quantified social and aesthetic values. Seattle: Battelle Pacific Northwest Laboratories, 1974.

Groups of Seattle environmentalists, high school students, and businessmen participated in this detailed and lengthy survey. The instrument asked for ratings of plant designs and sites and included 54 Likert-type statements concerning nuclear energy and related topics. S-A-E-O

Syracuse, New York

Mazur (Syracuse 77/3)

Mazur, A., and Conant, B. Controversy over a local nuclear waste repository. New York: Social Science Program, Syracuse University, 1977.

A large salt formation near Syracuse was suggested as a possible site for nuclear waste deposits. Data was collected from 124 randomly selected Syracuse residents by telephone during the height of the publicity and again four months later when attention to the project had subsided. Questions covered waste storage knowledge, conceptions of safety, favorability toward nuclear power plants, and attitudes toward the nation's energy policy. S-O

Tulsa, Oklahoma

Central (Tulsa 74/1)

Central Surveys, Inc. Customer opinion survey, Tulsa, Oklahoma. Shenandoah, IA, January 17-24, 1974.

Attitudes toward and knowledge of gas, electricity, energy needs, utility company, and a proposed nuclear plant were assessed of 300 randomly selected Tulsa residents in personal interviews. A site survey was conducted at the same time. S-A-I

Site Surveys

Black Fox, Oklahoma

Central (Black Fox 74/1)

Central Surveys, Inc. An opinion survey, Black Fox Nuclear Plant site.
January 15-17, 1974. Shenandoah, IA, 1974.

Residents in a 25-mile radius of a recently proposed nuclear plant site were personally interviewed (N=200). Questions concerned attitudes toward the construction and comparison of nuclear power plants with coal plants. S-U

Colorado River Area, Arizona and Colorado

Central (Colorado River 74/4)

Central Surveys, Inc. An opinion survey regarding the proposed desert nuclear project in the Colorado River area, April 16-26, 1974.
Shenandoah, IA, 1974.

Southeastern California and southwestern Arizona residents totalling 655 were surveyed about the proposed nuclear plant. Questions covered perceived benefits and disadvantages of the plant, the proposed locations, possible effects on water, the environment, and recreation. S-A-E-I-O-G

Hanford, Washington

Woodward (Hanford 75/2)

Woodward-Clyde Consultants. Supplement to socioeconomic study: Nuclear Projects 1 and 4. Richland, WA, April 1975.

When a proposal was made to construct additional nuclear plants at Hanford, a probability sample of 576 residents and community influentials were telephone interviewed in January and personally interviewed in February. The focus of the survey was on knowledge and attitudes toward growth, community planning, participation in decisions, roles of federal

and local government, and the effects of nuclear plants on the community. S-A-E-I-O

Hartsville, Tennessee

ORNL (Hartsville 75/2)

Schuller, C. R., et al. Citizens' views about the proposed Hartsville Nuclear Power Plant. A preliminary report of potential social impacts. Oak Ridge National Laboratory, Energy Research and Development Administration, May 1975.

A probability sample of 350 residents of Trousdale County, Tennessee, was interviewed by local interviewers. Participants were paid \$5. Among the questions covered in the report are satisfaction with the community, attitudes towards the proposed plant, and assessment of outcomes of plant construction. This was first in a series of assessments. S-A-E-O

ORNL (Hartsville 75/8)

Sundstrom, E. D. et al. Citizens' views about the proposed Hartsville Nuclear Power Plant: A survey of residents' perceptions in August 1975. Oak Ridge, TN: Oak Ridge National Laboratory, Energy Research and Development Administration.

Second in a series, this assessment interviewed 288 of the original respondents. The questions were similar to those in the first assessment, ORNL (Hartsville 75/2). The survey took place one to two months before licensing hearings for the plant. S-A-E-I-O

Indian Point, New York

ORC (Indian Point 60/6)

Opinion Research Corporation. Public attitude toward Con Edison's Indian Point Atomic Power Plant. Princeton, N.J., 1960.

Residents of Westchester County and New York City (N=1,057) were asked their attitudes towards the Indian Point plant while it was under

construction. During data collection a nuclear missile burned at a New Jersey missile base; attitudes before and after were compared. Responses to one question were compared to the responses to the same question in a 1955 study. S-E-I

Marble Hill, Indiana

Central (Marble Hill 76/11)

Central Surveys, Inc. Opinion survey, Marble Hill Nuclear Station,
November 12-19, 1976. Shenandoah, IA, 1976.

This survey about the proposed Marble Hill plant consisted of personal interviews of a representative sample of 300 residents at the plant site in Jefferson County, Indiana, and 400 residents downstream near Louisville, Kentucky. Questions covered favorability toward nuclear power or a plant nearby, environmental issues, knowledge, alternative energy sources, and credibility of information sources. S-A-E-I-O

Matagorda, Texas

Central (Matagorda 73/3) (74/9)

Central Surveys, Inc. An opinion survey, Matagorda County, Texas.
March 13-15, 1973.

Before an announcement that Matagorda County had been chosen as a nuclear power plant site, 200 residents were surveyed in personal interviews. Questions asked for attitudes toward energy shortages, air and water pollution, costs of electricity, and a possible nuclear, coal, or oil plant in the area. After the announcement, data were again collected from a sample of 200 residents. Questions in the second study varied somewhat from the first. S-A-I

Central (Matagorda 76/5)

Central Surveys, Inc. An opinion survey, Matagorda County, Texas,
May 24-28, 1976. Shenandoah, IA, 1976.

Attitudes of a third sample of 200 residents in the county where the nuclear plant had begun construction were assessed. In addition to questions used in the previous studies, questions about benefits or disadvantages resulting from the plant were included in the interviews.

S-A-I

Miles Lake, Oregon

Bardsley (Miles Lake 73/5)

Bardsley and Haslacher, Inc. Tillamook County attitudes toward a nuclear facility on Miles Lake. Portland, OR, May 1973.

A survey of a cross-section of residents of Tillamook County, Oregon included 354 personal interviews. Questions included attitudes toward the proposed nuclear power plant site, environmental effects, and alternative power preferences.

Oyster Creek, New Jersey

Metro (Oyster Creek 73/6)

Williams, J. S., and Spigel, S. Socioeconomic impact of estuarine thermal pollution. A study of the social, recreational, and economic consequences of the construction and operation of the Oyster Creek Nuclear Station. Metro Study Corporation, Washington, D.C.

A probability sample of 366 residents near the Oyster Creek Nuclear Station in Barnegut Bay, New Jersey, were personally interviewed to determine the impact of thermal pollution. The study was part of an impact assessment for a proposed additional plant. Respondents included long-time residents, recreational businessmen, fishermen, and politicians. Attitudes toward the environment and recreation were compared with those toward the nuclear plant. Assessment was made during a time of considerable publicity about the energy crisis. The researchers suggest that results were affected by such publicity. E-I-O

Pilgrim, Massachusetts

Becker (Pilgrim 76/3)

Becker Research Corporation. Survey of Plymouth, MA. Boston, March 1976.

Anticipating the referendum on construction of a second nuclear power plant at the Pilgrim site, 150 randomly selected voters likely to vote in the election were interviewed by telephone about their voting opinions, awareness of the referendum, reasons for their attitudes toward the proposal, and the strength of their attitudes. S-A

St. Francisville, Louisiana

Central (St. Francisville 72)

Central Surveys, Inc. Plant site survey, St. Francisville, LA. Shenandoah, IA, 1972.

Attitudes toward a proposed nuclear power plant were assessed in personal interviews with 360 residents living within 20 miles of the site. Questions covered favorability toward the plant, knowledge of the proposal, willingness to live nearby a plant, and the plant's expected effect on pollution, wildlife, tourism, recreation, and business. S-A-O-U

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