

# **Cross-Cultural Risk Perception**

A Survey of Empirical Studies

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## 0 SUMMARY

This study is an attempt to understand attitudes, perceptions, and behaviors with respect to nuclear power and several other technological risk sources. A unique feature of the study is a comparison between public views in the United States, where nuclear energy is resisted, and France, where nuclear energy appears to be embraced (France obtains almost 80% of its electricity from nuclear power).

Although the experiences of France and the U.S. with regard to nuclear energy overlap during the post World War II decades, there are a number of significant differences in timing, motivation toward adopting nuclear power, the economic context, the cultural and political milieu, regulation, and financing of the industry. We would expect these conditions to be associated with significant differences between French and American attitudes and opinions about nuclear power and related issues.

We have used the same survey, between public views in the United States, where nuclear energy is resisted, and public views in France, where nuclear energy appears to be embraced. We found, much to our surprise, that concerns about nuclear power and nuclear waste were high in France and were at least as great there as in the U.S. Thus, even though perception of risk is a strong predictor of attitudes toward nuclear power within both the U.S. and France, it cannot account for the different level of reliance on nuclear energy in the two countries. Further analysis of the survey data uncovered a number of differences that might be central in explaining the difference between France and the U.S. Specifically, the French:

- 0 saw greater need for nuclear power and greater economic benefit from it
- 0 had greater trust in scientists, industry, and government officials who design, build, operate, and regulate nuclear power plants
- 0 were more likely to believe that decision-making authority should reside with the experts and government authorities, rather than with the people.

These findings point to some important differences between the workings of democracy in the U.S. and France and the effects of different "democratic models" on acceptance of risks from technology.

## 1.0 Background and Objectives of the Study

The history of nuclear power is dramatic. Its creation grows out of and reflects the greatest achievements of science and engineering in the 20th century. Its early years demonstrated rapid progress toward the promise of "energy too cheap to meter." By the mid-1970s its progress in the United States came to a halt, and the past two decades have witnessed the growth of strong fear of this technology and opposition to it among many members of the American public. Nuclear scientists and many others in industry and government remain convinced of its safety and efficacy as an energy source, and they express great consternation and antagonism toward a public they view as "ignorant," "radiophobic" or "irrational."

The present study is an attempt to understand attitudes, perceptions, and behaviors that lie at the heart of this conflict. A unique feature of the study is a comparison between public views in the United States, where nuclear energy is resisted, and France, where nuclear energy appears to be embraced (France obtains almost 80% of its electricity from nuclear power).

Although the experiences of France and the U.S. with regard to nuclear energy overlap during the post World War II decades, there are a number of significant differences in timing, motivation toward adopting nuclear power, the economic context, the cultural and political milieu, regulation, and financing of the industry. We would expect these conditions to be associated with significant differences between French and American attitudes and opinions about nuclear power and related issues.

Based on the history of the two programs we have constructed a set of hypotheses about key attitudes and opinions that might differ in France and the U.S.:

- 0 The French will exhibit greater support for nuclear power than the Americans
- 0 The French will assess nuclear power as less risky
- 0 The French will have greater trust and confidence in the nuclear industry
- 0 The French will have greater confidence in science and technology
- 0 The French will be more fatalistic about their ability to influence personal risks or public affairs
- 0 The French will consider nuclear power as economically more necessary
- 0 The French will have more confidence that future risks from nuclear power can be managed adequately.

An extensive survey was designed to evaluate these hypotheses and to assess many different aspects of risk perception and other social, psychological, political, and economic attitudes that we hypothesized might underlie support or opposition to nuclear power in the U.S. and France.

## **2.0 Methodology**

### **2.1 Survey Content**

The survey was designed to assess many different aspects of risk perception and other social, psychological, and economic attitudes that we hypothesized might underlie nuclear power support and opposition. A variety of question formats were used, including word associations, ratings of perceived risk, attitude and opinion questions, and questions about voluntary risk-taking activities in which the respondent has engaged. Question content was based on a general model of the way various factors might influence support for nuclear power. This model was derived from the extensive literature on risk perception and nuclear power. The main components of the survey are outlined in Table 1 and discussed below in approximately the order in which they were presented to the respondents. In this chapter, we shall focus on the results from the survey components marked with an asterisk (\*).

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Insert Table 1 about here

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#### *Word associations*

The study of associations has a long history in psychology, going back to Galton (1880) Wundt (1883) and Freud (1924) More recently, word associations have been found useful in revealing important aspects of the ways people perceive risks (see, e.g., Jenkins-Smith, 1993 Slovic, Kraus, Lappe, Letzel, & Malmfors, 1989; Slovic, Flynn, & Layman, 199; Slovic, Layman, & Flynn, 1991). The first question in the survey asked respondents to indicate the first word or image that came to mind when they heard the words "nuclear power." They were prompted to produce up to three words or images. These associations were elicited at the beginning of the interview so that respondents would not be influenced by the content of other questions. The respondents were then asked to rate the affective quality of their images to nuclear power as very negative, negative, neutral, positive, or very positive.

### *Perceived risk*

In the next segment of the interview, respondents were asked to indicate the degree of health risk they associated with each of the 25 hazards presented to them. These 25 items covered a wide range of hazards, including risks from technology (e.g., nuclear power, high-voltage power lines), lifestyle (e.g., AIDS, suntanning, cigarette smoking), pollution (e.g., indoor air quality, chemical pollution in the environment), common substances (e.g., bacteria in food), and natural hazards (e.g., storms and floods). The array of items was selected to include many of the hazards that have recently been of concern to the public, medical community, or government agencies. In addition to nuclear power, there were five other items pertaining to various forms of radiation risk (e.g., radon, X-rays, food irradiation, suntanning, video display terminals).

Each item was rated in terms of the health risk posed to the American (or French) public as a whole. The possible responses were "almost no health risk," "slight health risk," "moderate health risk," and "high health risk." In addition, for six of the items thought to pose risks to respondents and their families that might be quite different from the risks to the general public (e.g., street drugs), ratings were also obtained for "the health risk to you and your family."

### *Trust in experts, government, and science*

Trust has been found to play a central role in determining public perceptions of risk from nuclear power and public opposition to nuclear facilities. Six items were asked to elicit respondents' level of trust in experts, government, and scientists to manage health and technological risks (e.g., "Decisions about health risks should be left to the experts").

### *Nuclear power*

Five items dealt with support or opposition to nuclear power under differing conditions. Two of these statements asked about attitudes toward building a new nuclear power plant in the face of a shortage of electricity or to avoid importing energy from other countries. Another asked about building new nuclear power plants to reduce health and environmental damage from coal and oil. A third statement asserted we should stop using nuclear power plants because we have no way to safely store the radioactive wastes. The final statement asked for a response to the prospect of a new and safer generation of nuclear power plants.

A second set of questions asked the respondents to rate nuclear power and six other ways to produce electricity. The four-point scale presented to the respondents was from "not at all acceptable" to "slightly acceptable" to "moderately acceptable" and finally to "very

acceptable." The alternative sources of energy production were oil, solar power, natural gas, hydroelectric power, wind power, and coal.

People hold a wide variety of opinions about the characteristics of nuclear power. Some of these characteristics are hypothesized to have an influence on the decision to support or oppose nuclear power. Ten statements were evaluated by respondents on the "strongly disagree" to "strongly agree" scale. These statements presented nuclear power as a technological achievement worthy of pride, as essential to national security and the economy, as a contributor to nuclear-weapons production, as immoral for the risks it imposes on future generations, and as likely to stigmatize host communities. One item asked about whether scientists agree on the acceptability of nuclear-power risks, and another asked whether we should develop options to nuclear power and fossil fuel plants.

The risks from nuclear power have been evaluated in a number of previous studies as being poorly understood (by the public and by scientists), uncontrollable, and catastrophic (Slovic, 1987). The present survey presented four statements asking for evaluations of nuclear power as understood by science and the public, controllable by science, and presenting catastrophic risks. Four similar statements asked for evaluations of coal and oil risks on the same characteristics.

#### *Worldviews*

Over the past decade, evidence has been accumulating regarding the importance of general dispositions or "worldviews" in determining an individual's perceptions of risk (Buss, Craik, & Dake, 1986; Dake, 1991; Jasper, 1990). The survey contained a number of statements designed to measure the following worldviews:

- 0 Fatalism/control (e.g., "It's no use worrying about public affairs; I can't do anything about them anyway")
- 0 Hierarchy (e.g., "We need to pull together and support the energy choices our government has made")
- 0 Egalitarian (e.g., "If people in this country were treated equally, we would have fewer problems")
- 0 Individualism (e.g., "In a fair system people with more ability should earn more")
- 0 Technological enthusiasm/catastrophism (e.g., "A high-technology society is important for improving our health and well-being")
- 0 Conservative/authoritarian (e.g., "I am in favor of capital punishment")



- 0 Future generations (e.g., "Our technologies might impose risks on future generations, but I believe future generations will be able to take care of themselves")
- 0 Economic growth (e.g., "Continued economic growth is necessary to improve our quality of life").

Some of the other items described earlier can also be considered as tapping worldviews. For example, items asking about trust in experts and government officials could be considered measures of the hierarchy worldview.

#### *Personal and demographic characteristics*

The final section of the survey elicited information pertaining to the personal background of the respondent. In addition to standard demographic information (e.g., gender, age, education, income), respondents were asked about their health status, voluntary risk taking, political orientation, their degree of political activism, and their environmental activism (e.g., "Have you purchased a higher priced product because it was better for your health or environmentally friendly in the past year?").

## **2.2 Administration of the Survey**

The survey was administered in both the United States and France. In each country a representative sample of the adult population was interviewed by telephone. Respondents were chosen based on a random-digit dialing process combined with recruiting the person in the household who was 18 years of age or older and had the most recent birth date. The same questionnaire was used in both countries with only slight modifications (e.g., French respondents were asked to rate the risk to the French public; Americans to the American public). The instrument included 155 items, and the average length of the interview was approximately 30 minutes in both countries.

### *France*

Interviews for the French sample were conducted by Brule Ville Associes from November 26 to December 12, 1992; 1550 interviews were completed with a response rate of 49.7%. The sample included 729 (47.0%) men and 821 (53.0%) women with a mean age of 42.2 years.

### *United States*

The U.S. sample consisted of 1512 English-speaking persons. The interviews were conducted by O'Neil Associates between November 21, 1992, and January 16, 1993. The response rate was 50.7%. The sample included 729 men (48.2%) and 783 women (51.8%) with a mean age of 39.7 years.

### 3.0 Results: Univariate Analyses

#### 3.1 Perceptions of Risk and Major National Problems

##### *Risk to the American public*

Figure 1 displays the perceived risk to the American public as a whole for nuclear power, nuclear waste, and 23 other items. Cigarette smoking, street drugs, AIDS, and nuclear waste elicited the greatest percentage of responses in the "high-risk" category, with at least 60% high-risk responses. Other items eliciting over 40% in the high-risk category were stress, chemical pollution, depletion of the ozone, suntanning, and drinking alcohol. Commercial air travel and medical X-rays received the lowest percentage of high-risk responses. One hazard that experts might see as somewhat serious, bacteria in food, was rated moderately low in risk to health.

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Insert Figure 1 about here

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Chemical risks from ozone, street drugs, chemical pollution, pesticides, and alcohol were rated high in risk. Radiation hazards associated with industry (nuclear waste and nuclear power) were seen as more risky than radiation hazards associated with medicine (X-rays). The relatively low perceived risks associated with medical uses of radiation replicates earlier findings in Canada (Slovic, Flynn, Mertz, & Mullican, 1993; Slovic et al., 1989) and elsewhere (Slovic, 1990) and may reflect the influences on risk perceptions of perceived benefits, familiarity, and trust, all of which are higher for medical treatments and the medical establishment than for nuclear power and the nuclear industry.

Perceived risks due to climate change and coal and oil power plants were seen as lower in magnitude compared to risks from chemical pollution of the environment and depletion of ozone. Nuclear waste was seen as a more serious risk than nuclear power, a finding also observed in previous studies (Slovic et al., 1993).

##### *Risk to American respondents and their families*

Figure 2 compares the percentage of high-risk responses when respondents were considering the health risk "to you and your family" with the percentage for the "American public as a whole" for each of the six items. Note that nuclear waste received more high-risk response evaluations than any other items when the reference was to personal or familial risk. Nuclear power ranked second in this respect. In every case, there were more high-risk judgments in reference to the American public although, in some cases, the differences were small (e.g., nuclear power plants, nuclear waste, high-voltage power lines). However, for two

items, AIDS and street drugs, the difference between personal and societal risk perception was quite large.

Drottz-Sjöberg (1993) demonstrated that the difference between personal and societal risk perceptions is linked to perceived personal control over the hazard. It is noteworthy that our respondents judged the risk to themselves and their families from nuclear power to be about as great as the risk to the public as a whole. Slovic et al. (1993) observed the same finding in Canada. All but one of Canada's nuclear power plants are in Ontario, yet people everywhere in Canada, even thousands of miles from the nearest reactor, perceived the risks to themselves and their families to be as great as the risks to the Canadian public.

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Insert Figure 2 about here

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#### *Gender differences: U.S. sample*

Perceived risk to the American public as a whole was examined by gender. Sizable differences were found between perceptions of men and women. These differences are illustrated in Figure 3. Women were more likely to rate a risk as high-risk for all 25 hazards. In many instances, the differences were quite large—almost 20% for stress and suntanning. Other items exhibiting more than a 10% difference in high-risk responses were nuclear waste, nuclear power plants, ozone depletion, AIDS, drinking alcohol, high-voltage power lines, streets drugs, motor vehicle accidents, blood transfusions, and chemical pollution. Items for which women had relatively less excess concern (when compared to men) included video display terminals, commercial air travel, medical X-rays, and genetically engineered bacteria.

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Insert Figure 3 about here

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#### *Age differences: U.S. sample*

Figure 4 displays the difference in high-risk responses between respondents age 30 or less and age 55 or more. In general, older persons are more likely to rate a health risk as high. This tendency was particularly evident for blood transfusions, storms and floods, drinking alcoholic beverages, street drugs, suntanning, and pesticides in food. Younger respondents exhibited slightly higher perceived risk than the older group for nuclear power plants, nuclear waste, and various forms of chemical pollution (including ozone depletion and coal and oil burning power plants). Items for which there were relatively little differences between the older and younger age groups included AIDS, radon in home, genetically engineered bacteria, and outdoor air quality.

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Insert Figure 4 about here

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*Education differences: U.S. sample*

Respondents with high school or less education were consistently more likely than college educated respondents to rate a risk as "high" (see Figure 5). People with less formal education were particularly likely to see blood transfusions as a high risk—with nearly 15% more high-risk responses. There were 14 additional items for which they recorded over 5% more high-risk responses than college educated respondents, including street drugs, various forms of chemical pollution, drinking alcohol, storms and floods, AIDS, nuclear waste, and nuclear power plants. In general, these differences were smaller than gender differences.

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Insert Figure 5 about here

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*Risk to the French public*

Figure 6 shows the perceived risk to the French public as a whole for 25 items. Nuclear waste elicited the greatest percentage of high-risk responses followed by AIDS, street drugs, and cigarette smoking. Other items eliciting more than 40% in the high-risk category were chemical pollution, motor vehicle accidents, ozone depletion, drinking alcoholic beverages, stress, and pesticides in food. Radon in the home elicited the lowest percentage of high-risk responses.

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Insert Figure 6 about here

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Radiation hazards associated with nuclear waste and nuclear power were seen as more risky than radiation hazards associated with medical X-rays. As in the U.S., nuclear waste was seen as more hazardous than nuclear power plants.

*Risk to French respondents and their families*

Figure 7 compares the percentage of high-risk responses when respondents were considering the health risk "to you and your family" with the percentage for the French public as a whole for six items. Nuclear waste, street drugs, and AIDS received more high-risk evaluations than the other items when the reference was to personal or familial risk. There were more high-risk judgments in reference to societal risks than personal risks for

street drugs and AIDS. Virtually no differences were seen between personal and societal risks for the other four items.

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Insert Figure 7 about here

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*Gender differences: French sample*

Perceived risk to the French public as a whole was examined for gender differences. Sizable differences were observed between men and women respondents. As can be seen in Figure 8, women were more likely to rate the risk as high for all but one item—coal and oil burning power plants. The greatest differences were seen for stress and drinking alcohol, 19.7% and 19.5%, respectively. Two other items exhibiting more than a 15% difference were ozone depletion and nuclear power plants.

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Insert Figure 8 about here

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*Age differences: French sample*

Figure 9 portrays the difference in high-risk responses between respondents age 30 or less and age 55 or more. As in the U.S., older respondents were more likely to rate a risk as high. This tendency was particularly evident for street drugs, pesticides in food, food irradiation, storms and floods, AIDS, bacteria in food, genetically engineered bacteria, nuclear power plants (opposite the age trend in the U.S.), and drinking alcohol. Younger persons tended to be somewhat more concerned about climate change and ozone depletion. Very little differences were found for radon in the home, coal and oil burning power plants, and video display terminals.

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Insert Figure 9 about here

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*Education differences: French sample*

College-educated respondents were consistently less likely than respondents with high school or less education to rate a risk as high (see Figure 10). People with less formal education were relatively more concerned about street drugs, ozone depletion, bacteria in food, storms and floods, nuclear waste, food irradiation, blood transfusions, AIDS, and

genetically engineered bacteria. The maximum difference in the high-risk response associated with education was 18.6% for street drugs.

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Insert Figure 10 about here

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*U.S.–France comparison: Risk to the public*

Both the French and American respondents recorded more than 40% high-risk responses for eight items: nuclear waste, AIDS, street drugs, cigarette smoking, chemical pollution, ozone depletion, drinking alcohol, and stress (see Figure 11). Two additional items received more than 40% high-risk responses in France: motor vehicle accidents and pesticides in food. One additional item in the U.S. received over 40% high-risk responses: suntanning.

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Insert Figure 11 about here

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Overall, French respondents tended to rate the items as higher in risk than did the American respondents. The French respondents produced over 20% more high-risk responses than Americans for two items: motor vehicle accidents and genetically engineered bacteria (see Figure 12). In addition, there were seven items for which the French recorded 10% more high-risk responses than Americans: chemical pollution, drinking alcohol, bacteria in food, nuclear waste, pesticides in food, ozone depletion, and food irradiation. There were only two items for which U.S. respondents recorded more than 10% more high-risk responses than the French, coal and oil burning power plants and radon in the home. Of particular interest is the finding that the smallest difference between the two countries was for nuclear power plants.

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Insert Figure 12 about here

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*U.S.–France comparison: Risk to respondents and their families*

For both U.S. and French respondents, there tended to be somewhat more high-risk judgments in reference to societal risk than personal risk. However, the differences between the two types of risk perception were small except for AIDS and street drugs. For these two items, the magnitude of the differences was much larger in the U.S. than France; for the

French the differences between societal and personal risk for AIDS and street drugs was 10.3% and 15.2%, respectively, compared to 33.6% and 35.0% in the U.S. The percentage of high-risk ratings for nuclear power in reference to self and family was about equal in both countries (28.8% in the U.S. vs. 30.8% in France). For nuclear waste, the percentage of high-risk responses to self and family was greater in France (70.8% vs. 55.1% in the U.S.).

#### *U.S.-France comparison: Gender analyses*

Women in both samples gave more high-risk judgments than men. In the U.S. sample, women were higher on all 25 items compared to 24 in France. In France, the only item for which men recorded more high-risk responses than women was coal and oil burning power plants. In particular, women in both countries rated stress as a much greater risk than did men.

### **3.2 Word Associations**

#### *Affective ratings*

The American respondents provided a total of 3546 associations to the stimulus "nuclear power." The average number of associations per respondent was 2.3. When asked to rate their associations, 46.7% of the respondents gave a positive or very positive rating; 40.6% were negative or very negative, and 12.1% were rated as neutral. There tended to be more extremely negative ratings than extremely positive ones (17.1% versus 10.1%).

French respondents gave a total of 3768 associations to the stimulus "nuclear power" for an average of 2.4 per respondent. The distribution of ratings assigned to these associations by the French respondents was remarkably similar to that of the Americans. Nearly half (49.3%) of the associations were rated as positive or very positive; 10.4% were rated as neutral, and 39.1% as negative or very negative. There were more extreme responses on the negative side than on the positive (19.4% very negative vs. 11.5% very positive).

Within the U.S. sample, men gave more positive ratings to their associations than women (52.5% vs. 40.9%) and people under 30 years of age gave fewer positive ratings than people over 55 (39.2% vs. 60.4%). Similar patterns were found in the French data. French men gave more positive ratings (51.6% vs. 47.3% for women) and younger people gave fewer positive ratings than older persons (43.9% vs. 60.8%).

The affective ratings that respondents made for every image they produced were found to be highly correlated with many of the other responses in the survey, including

attitudes of support or opposition to nuclear power. The relationships between affect ratings and other survey variables are presented elsewhere (see Peters & Slovic, in press).

### *Content analysis*

The images were categorized into 11 content categories as shown in Tables 2 and 3. There was one large category containing negative associations.<sup>1</sup> For the American sample (Table 2), this category accounted for 41.1% of the associations and included such responses as bombs, death, killing, nuclear waste, accidents, dangerous, risky, hazardous, toxic, and so forth. About one-quarter (26.5%) of the American associations fell into a generally positive category. The positive content category included such associations as electricity, energy, light, economical, good, clean, efficient, necessary, and so forth. In addition, one-third of the images fell into categories that were neither clearly negative nor positive by content, such as specific locations or facilities (e.g., TMI, Hanford), components of nuclear plants (e.g., tower, dome), or physical states (e.g., radiation, heat, fission).

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Insert Table 2 about here

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The frequency distribution of content categories in the French data is shown in Table 3. About one-third (35.5%) of the French associations fell in the negative category. Positive associations accounted for 23.4% of the responses.

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Insert Table 3 about here

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The historical link between nuclear power and nuclear weapons was noted by Smith (1988), who observed, "nuclear energy was conceived in secrecy, born in war, and first revealed to the world in horror. No matter how much proponents try to separate the peaceful from the weapons atom, the connection is firmly embedded in the minds of the public" (p. 1606). In light of this link, it is of interest to examine the degree to which the word associations reflect that link. The evidence is clear. The category labeled "A-bombs, bombs, atomic weapons" was the second largest in both countries, behind only the category "Energy, power, electricity, light." The A-bomb category, combined with the category "War, annihilation, end of world, holocaust," totaled 12.4% of the U.S. associations and 14.7% of

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<sup>1</sup> Labeling of these associations as negative in content was done by the research team and should not be confused with the negative affective ratings given by the respondents themselves.



the French associations. Frequent associations to destruction and death may also be related to the weapons connection.

Comparing the U.S. and French content distributions shows a basically similar pattern, except that negative associations were slightly more frequent in the U.S. sample. There were also more ecological references in the French data (3.5%) than in the American data (1.5%). The same held true for science and technology associations (5.8% in France vs. 1.5% in the U.S.).

An earlier survey by Slovic, Flynn, and Layman (1991) asked a representative sample of Americans to associate to the stimulus prompt "underground nuclear waste repository." Negative concepts and consequences clearly dominated the nuclear waste imagery and accounted for 56.2% of the responses. This was considerably higher than the 41.1% negative content to the stimulus "nuclear power" in the present U.S. survey.

In the U.S. survey, women were somewhat more likely than men to give images that fell in the clearly negative content categories (44.9% vs. 37.2%). No such differences were found in France. In the U.S., older respondents (age 55 or more) were more likely to provide positive images (34.3%) compared to respondents under age 30 (20.8% positive). A similar, but weaker pattern was found in France, where 27.3% of those age 55 or older produced positive images compared to 23.2% of those age 30 or younger.

### 3.3 Support for Nuclear Power

#### *U.S.: Nuclear power*

A number of statements were posed to assess respondents' support for nuclear power and attitudes about various aspects of nuclear power. U.S. respondents were divided in their support. Even if their community was faced with a potential shortage of electricity, only 46.7% agreed that a new nuclear power plant should be built to supply that electricity (see Table 4).<sup>2</sup> The level of agreement was similar (45.6%) when asked, "In light of health concerns about acid rain, damage to the ozone layer, and climate change associated with the burning of coal and oil, America should rely more heavily on nuclear power to meet its future electricity needs." Again, fewer than half (46.6%) of the respondents agreed that America should rely more heavily on nuclear power to avoid importing energy from other countries to meet our future electricity needs. However, nearly two-thirds of the U.S. respondents agreed

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<sup>2</sup> Table 4 illustrates a characteristic difference between French and American respondents. The French more frequently used the extreme response categories, "strongly disagree" and "strongly agree." This occurred with almost every attitudinal item. This may be due to a response bias, rather than to any greater bipolarity in French attitudes. On the assumption that this is a response bias, we shall combine "strongly disagree" with "disagree" responses and "strongly agree" with "agree" responses when repeating the results in the text.

with the statement "The nuclear power industry says that it is now possible to build a new generation of nuclear power plants that will be safer than existing plants. Assuming the nuclear power industry is correct, I would support such new generation nuclear power plants to supply the country's future electricity needs."

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Insert Table 4 about here

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Respondents were presented with seven ways to produce electricity and asked how acceptable each of these ways is to them for meeting the nation's future energy needs. An overwhelming majority (92.5%) considered solar power moderately or very acceptable (see Table 5). Solar power was followed by hydroelectric power, wind power, and natural gas, with 86.8 to 88.5% of the respondents indicating these were acceptable ways to produce electricity. Nuclear power was the least acceptable method, with only 52.9% moderately acceptable or very acceptable responses.

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Insert Table 5 about here

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A majority of the U.S. respondents (80.5%) thought other options for providing electricity should be developed instead of building more nuclear power and fossil fuel plants (see Q80 in Table 6). More than two-thirds of the respondents agreed that "Having a nuclear power plant nearby makes other people think that a community is a less attractive place" (Q86). Two-thirds of the respondents felt that nuclear power was a technological achievement of which our nation can be proud (Q69). However, respondents were divided over whether nuclear power is essential to our nation's security (Q73) or economic well-being (Q76), with 51.4% and 53.1% agreement, respectively. Only one-third of the respondents thought the nuclear industry is capable of managing its wastes safely (Q78).

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Insert Table 6 about here

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Respondents were divided over whether most scientists agree that the risks of nuclear power are acceptable (55.6% agreement in Q84). Similarly, only 52.1% agreed that differences of opinion about the risks of nuclear power can be resolved by scientific data and analysis (Q90). About half (51.6%) thought that "Nuclear power is immoral because it imposes risks on future generations without their consent" (Q85).

Eight items were included to compare nuclear power risks to those of coal and oil on four characteristics: whether the risks were well understood or not well understood by

science, well understood or not well understood by the public, controllable or not controllable by science, and catastrophic or not catastrophic. Table 7 displays the results. Nuclear power risks were perceived as less well understood by both science and the public than coal and oil risks, less controllable, and more catastrophic than coal and oil risks.

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Insert Table 7 about here

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*Gender differences: U.S. sample*

Men tended to be more supportive of nuclear power than women. Men recorded 12-13% more agree responses in support of nuclear power if faced with electricity shortages, to avoid importing energy from other countries, and in light of health concerns about acid rain, damage to the ozone layer, and climate change. Men were also more likely to support a new generation of nuclear power plants, with 8.4% more agree responses. Women were more likely to believe we should stop using nuclear power plants because we do not know how to store radioactive wastes safely, with 11.7% more agree responses than men. Men were more likely to indicate that nuclear power was an acceptable method of producing electricity than women, with 13.5% more acceptable responses.

Women were more likely to indicate that nuclear power was immoral because of the risks it imposes on future generations, with 13.4% more agreement with this statement than men. They also were more likely than men to agree that a nuclear power plant makes the nearby area unattractive. Men were more likely to indicate that most scientists agree that the risks of nuclear power are acceptable and that nuclear power is a technological achievement of which our nation can be proud. In addition, men were more likely than women to believe that nuclear power was essential to our national economy and security.

In addition, men were more likely to believe nuclear power risks are well understood and controllable by science than women. Women were more likely to characterize nuclear power risks as catastrophic. Gender differences in the characterization of risks from coal and oil were small.

*Age differences: U.S. sample*

There appeared to be little difference between older and younger respondents in terms of support for nuclear power. Respondents age 55 or more were somewhat more likely to agree with the statement that to avoid importing energy from other countries Americans should rely more on nuclear power. Older respondents (age 55 and older) tended to indicate that oil and nuclear power were more acceptable ways of producing electricity than younger respondents (age 30 or younger), with about eight percent more acceptable responses.

Older respondents were more likely than younger respondents to indicate that nuclear power is essential to our national economy and to our national security and that nuclear power is a technological achievement of which to be proud, with 12–14% more agreement. They also were somewhat more likely to think the nuclear industry is capable of managing nuclear wastes safely. Younger respondents were somewhat more likely to believe nuclear power is immoral because it imposes risks on future generations and that a nuclear power plant nearby makes a place unattractive. Younger respondents were more likely to indicate that nuclear power and coal and oil risks are catastrophic.

*Education differences: U.S. sample*

There were no large educational differences on the nuclear power support questions; high school educated respondents were somewhat more likely than the college educated respondents to indicate that coal and oil were acceptable ways to produce electricity. College-educated respondents were somewhat more likely to indicate that nuclear power was an acceptable method of producing electricity. They also were more likely to feel nuclear power risks were controllable by science.

Those with a high school education produced 16.1% more agree responses than those with a college education when asked whether nuclear power was immoral because it imposes risks on future generations. They also were more likely to agree that nuclear power contributes to the production of nuclear weapons, with 12% more agreement than college educated respondents.

*France: Nuclear power*

Generally, the French were divided in their support for nuclear power. About 49% expressed support for new nuclear power plants if their community was faced with a potential shortage of electricity (see Table 4). Similarly, 51.1% supported nuclear power in light of health concerns about acid rain, damage to the ozone layer, and climate change associated with burning of coal and oil. Only 43% wanted to rely more heavily on nuclear power to avoid importing energy from other countries. However, three-quarters of the respondents would support a new generation of nuclear plants if they could be assured that the plants were safer than existing plants. Nearly 60% of the French respondents agreed that "We should stop using nuclear power plants because we do not know how to store radioactive wastes safely."

An overwhelming majority of the French respondents indicated that solar power, hydroelectric power, natural gas, and wind power would be moderately acceptable or very acceptable ways to produce electricity (see Table 5). Nuclear power was found to be the least

acceptable method; however, 63.6% still found it a moderately or very acceptable way to produce electricity.

Most of the respondents (85.6%) agreed that "We should develop other options for providing electricity instead of building more nuclear power and fossil fuel plants (see Table 6). While nearly three-quarters indicated that having a nuclear power plant nearby "makes other people think that a community is a less attractive place," a majority (70.6%) also thought nuclear power was a "technological achievement of which our nation can be proud." Two-thirds of the respondents thought nuclear power is essential to the national economic well-being; however, only 48.9% thought it was essential to national security. Respondents were divided about whether the production of nuclear power contributes to the production of nuclear weapons (50.5% agreement; 44.0% disagreement).

Nearly 60% of the French sample agreed that nuclear power was immoral because it imposed risks on future generations without their consent. Just over half (54.2%) thought that most scientists agree that the risks of nuclear power are acceptable. Even more (62.9%) thought that scientific data and analysis could resolve differences of opinion about the risks of nuclear power. However, only 26.6% agreed that the nuclear industry was capable of managing its wastes safely.

In addition, the French thought nuclear power risks were less well understood by both science and the public, less controllable, and more catastrophic than coal and oil risks (see Table 7).

#### *Gender differences: French sample*

French men were more likely to be supportive of nuclear power than women. Twelve percent more men than women expressed support for new nuclear plants if their community was faced with electricity shortages. Men also expressed somewhat more support for nuclear power in light of acid rain, damage to the ozone layer, climate change, and to avoid importing energy. Women were more likely to agree that we should stop using nuclear power plants because we don't know how to store wastes safely (14.6% more agreement than men). Male support for nuclear power was also seen in the responses to the acceptability of various forms of producing electricity. Men recorded 12.8% more moderately acceptable or very acceptable responses than women with respect to nuclear power. There were no other sizable gender differences in regard to the acceptability of other forms of producing electricity.

Women were more likely to indicate that nuclear power is immoral because of the risks it imposes on future generations; women produced 14.1% more agree responses to this statement. They also were more likely to believe that a nuclear power plant makes a community less attractive. Men were more likely to think that nuclear power is a

"technological achievement of which our nation can be proud," with 15.7% more agree responses than women. Men also were more likely to think that nuclear power is essential to the national economy and to national security and to indicate that most scientists agree that the risks of nuclear power are acceptable. Men also tended to be more likely to believe that nuclear power risks were well understood and controllable by science.

*Age differences: French sample*

Age differences in support for nuclear power were rather small. Respondents age 55 or over were somewhat more likely to indicate that nuclear power was an acceptable way of producing electricity, with 8.9% more acceptable responses than respondents under age 30. Older respondents were also more likely to agree that nuclear power was essential to the national security with 9.3% more agreement than younger respondents. Older respondents tended to be more likely than younger respondents to think the nuclear power industry could manage radioactive wastes safely.

There were few age differences in how characteristics of nuclear power risks were seen. However, younger respondents were much more likely to see coal and oil risks as catastrophic and well understood by science.

*Education differences: French sample*

There was a greater tendency for those with a high school education or less to think that we should stop using nuclear power because we do not know how to store the wastes safely. They also were slightly more likely to believe we should rely more on nuclear power in light of acid rain, ozone depletion, and climate change. No other educational differences in support for nuclear power were found. Educational background did not appear to have much influence in attitudes regarding the acceptability of various forms of producing electricity.

Respondents with a high school education were more likely than those with a college education to indicate that nuclear power was immoral because it imposes risks on future generations without their consent, with 12.8% more agree responses. College educated respondents were somewhat more likely to believe that scientists agree that the risks of nuclear power are acceptable. Those with higher education levels were more likely to think nuclear power risks and coal and oil burning risks were well understood by science.

*U.S.-France comparison: Support for nuclear power*

French respondents were slightly more likely to express support for nuclear power than U.S. respondents (see Tables 4 and 8). In particular, French respondents gave 10.4% more agree responses than Americans when asked if they would support a new generation of

nuclear power plants if they could be assured that the plants would be safer than the existing plants.

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Insert Table 8 about here

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French respondents were much more likely to consider coal an acceptable way to produce electricity, with 29.7% more acceptable responses than American respondents (see Table 9). The French were also more likely than Americans to find oil and nuclear power moderately or very acceptable.

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Insert Table 9 about here

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When asked if nuclear power was essential to their national economy, French respondents recorded 13.2% more agree responses than U.S. respondents (see Table 10). They were also more likely than Americans to believe that science can resolve differences of opinions about nuclear power risks and that nuclear power is immoral because it imposes risks on future generations.

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Insert Table 10 about here

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### **3.4 Trust in Experts, Government, and Science**

#### *U.S.: Trust in experts, government, and science*

Trust in the government, experts, and science was the focus of seven questions (see Table 11). Disagreement that government and industry can be trusted to make proper decisions to manage technological risks was indicated by 64.7% of the U.S. respondents (Q119). Lack of trust was further indicated by three-quarters of the respondents who disagreed that decisions about health risks should be left to the experts (Q64). In addition, a vast majority (84.2%) lacked confidence in the ability of public health officials to take care of really serious health problems (Q55). When risks involved nuclear power, respondents were divided. Just over half (54.3%) of the respondents lacked trust in the experts and engineers who build, operate, and regulate nuclear power plants (Q88). Slightly under half (46.5%) lacked confidence in experts and scientists to make accurate estimates of the risks from nuclear power (Q50). In response to Q90, respondents were also divided about whether differences of opinion about the risks of nuclear power can be resolved by scientific data and analysis (45.0% disagreed; 52.1% agreed). Another question was included to gauge one's trust in the use of animal studies to determine a chemical's risk to humans (Q54). There was a sizable level of trust expressed when asked "If an animal study produces evidence that a

chemical causes cancer in animals, then we can be reasonably sure that the substance will cause cancer in humans" (63.2% agreement).

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Insert Table 11 about here

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In general, men exhibited somewhat more trust in experts, government, and science than did women. Men were more likely to agree that experts and engineers can be trusted to build, operate, and regulate nuclear power plants and that government and industry can be trusted to make proper decisions about risks from technology. Differences on the other trust items were minor.

*France: Trust in experts, government, and science*

The French respondents exhibited moderately high levels of trust in experts, government, and science. Approximately two-thirds of the respondents agreed that decisions about health risks should be left to the experts and that experts and engineers who build, operate, and regulate nuclear power plants could be trusted (see Table 11). Similarly, 62.9% of the French agreed that differences of opinion about the risks of nuclear power can be resolved by scientific data and analysis. Respondents were more divided about whether experts and/or scientists are able to make accurate estimates of the risks from nuclear power (55.2% agreement). Less confidence was demonstrated about the ability of the government and industry to make proper decisions to manage risks from technology (39.6% agreement). Trust in certain kinds of scientific studies was demonstrated by two-thirds of the respondents who agreed that if an animal study that produces evidence that a substance causes cancer in animals then we can be reasonably sure the substance will cause cancer in humans.

In general, men were somewhat more likely to express trust in experts, government, and science. Men recorded 14.5% more agree responses to the statement "We can trust experts and engineers who build, operate, and regulate nuclear power plants." Men also tended to express more trust in science to resolve differences of opinion about nuclear power risks and that government and industry could be trusted to manage technological risks.

*U.S.-France comparison: Trust in experts, government, and science*

Overall, the French respondents expressed much higher levels of trust in experts, government, and science to manage risks. The French produced 44.7% more agree responses when asked if decisions about health risks should be left to the experts (see Table 12). The French were much more likely to trust health care officials to manage serious health problems, with 26% more agree responses than American respondents. The French



respondents also produced 23.0% more agree responses when asked if the experts and engineers could be trusted to manage nuclear power plants.

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Insert Table 12 about here

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### 3.5 Worldviews

#### *U.S.: Worldviews*

Response distributions for questions pertaining to worldviews are shown in Table 13. Three questions assessed the fatalism worldview. American respondents tended not to hold fatalistic views. Only one-third of the respondents felt that they had very little control over risks to their health (Q63). Even fewer, 18.3%, agreed with the statement "It's no use worrying about public affairs; I can't do anything about them anyway" (Q122). In addition, a vast majority (83.9%) agreed with the statement in Q48 that "People can offset health risks from pollution by improving their individual lifestyles, such as exercising and eating properly."

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Insert Table 13 about here

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Four questions were designed to assess the hierarchy worldview. Little support was indicated for this view by the American respondents. Only 14.1% of the respondents disagreed that "People in positions of authority tend to abuse their power" (Q110). Similar disagreement (14.0%) was found in responses to the statement "Those in power often withhold information about things that are harmful to us" (Q126). Some support (58.9%) was shown for "the need to pull together and support the energy choices our government has made" (Q114).

Considerable support was indicated for the egalitarian worldview. Over three-quarters of the respondents agreed that "If people in this country were treated more equally we would have few problems" (Q113). Two-thirds expressed agreement that "what this world needs is a more equal distribution of wealth" (Q121). Moreover, two-thirds also disagreed that "We have gone too far in pushing equal rights in this country" (Q123).

A view known as individualism was measured in three questions. Strong support for this view was found in all three items. A vast majority of the American respondents (85.3%) agreed that "In a fair system people with more ability should earn more" (Q111). Nearly three-quarters (72.6%) indicated agreement with the statement "Government has no right to regulate people's personal risk-taking activities such as smoking, mountain climbing, hang gliding, etc." (Q112). Finally, there was almost complete agreement (92.6%) with the

statement "I admire those who attempt to be independent and self-sufficient by growing their own food and adopting resource-conserving lifestyles" (Q116).

Two questions assessed the technological enthusiasm worldview (based on Jasper, 1990). A vast majority of the respondents (86.1%) thought that "A high-technology society is important for improving our health and social well-being" (Q108). However, 61.2% also agreed that "Technological development is destroying nature" (Q117).

An authoritarian/conservative worldview was assessed by two questions. Nearly three-quarters of the respondents were in favor of capital punishment (Q109). However, only 35.6% thought the police should have the right to listen to private phone calls to investigate a crime (Q125). Responses to a question designed to explore attitudes toward future generations were mixed. Respondents were divided over the statement in Q118, "Our technologies might impose risks upon future generations, but I believe future generations will be able to take care of themselves;" 49.6% agreed, 49.1% disagreed, and 1.4% were undecided.

Two questions examined attitudes toward economic growth. A large majority (80.2%) agreed that "Continued economic growth is necessary to improve our quality of life" (Q115). However, 43.8% also thought "continued economic growth can only lead to pollution and depletion of natural resources" (Q124).

#### *France: Worldviews*

French responses to the fatalism questions were mixed. Nearly 80% felt that they had very little control over risks to their health. However, a vast majority (87.5%) agreed that "People can offset health risks from pollution by improving their individual lifestyles, such as exercising and eating properly" (see Table 13). Only one-quarter indicated agreement to the statement "It's no use worrying about public affairs; I can't do anything about them anyway."

An overwhelming majority of the French respondents agreed with two of the hierarchical worldviews. There was almost complete agreement (89.5%) that people in positions of authority tend to abuse their power. Similar agreement was found in responses to the statement "Those in power often withhold information about things that are harmful to us." Over two-thirds of respondents agreed with the "need to pull together and support the energy choices our government has made."

French respondents tended to hold egalitarian worldviews. A majority of the French (81.6%) thought that "If people in this country were treated more equally we would have fewer problems." However, support was lower for the other two egalitarian measures. Only slightly more than half (53.6%) agreed that the world needs a more equal distribution of

wealth. However, 55.0% disagreed that "We have gone too far in pushing equal rights in this country." General agreement with the individualistic view was found in all three questions. Three-quarters of the French respondents agreed that "In a fair system people with more ability should earn more." Similar agreement was found when respondents were asked whether they admired those with independent and resource-conserving lifestyles. Sixty percent felt that the government had no right to regulate people's personal risk-taking activities.

The French respondents expressed awareness of both the risks and benefits of technology. There was almost complete agreement (88.5%) that "A high-technology society is important for improving our health and social well-being." On the other hand, three-quarters of the respondents also agreed that "technological development is destroying nature." French responses to the conservative/authoritarian worldview questions were mixed. Respondents were divided over support for capital punishment; 53.9% were in favor of it and 45.3% were not in favor. Forty-seven percent agreed the police should have the right to listen to private phone calls to investigate a crime (52.6% disagreed).

Nearly three-quarters of the French respondents thought that although our technologies might impose risks on future generations, they believed future generations will be able to take care of themselves. A majority of the respondents agreed that "Continued economic growth is necessary to improve our quality of life." But the French also tended to believe that continued economic growth will lead to pollution and depletion of natural resources (68.4% disagreement).

#### *U.S.-France comparison: Worldviews*

Table 14 displays the differences in responses between France and the U.S. Americans tended to express more agreement with individualistic worldviews. For example, U.S. respondents recorded 10.0% more agreement to the statement "In a fair system people with more ability should earn more." U.S. respondents were more likely to think government has no right to regulate personal risk-taking activities, with 12.3% more agree responses than the French. Americans were also more likely to admire independent, resource-conserving lifestyles; they produced 17.0% more agree responses to this statement than the French. The item on which Americans had the greatest increase in agreement compared to the French was one endorsing capital punishment (a 19.2% difference).

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Insert Table 14 about here

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French respondents were more likely to hold fatalistic views. In particular, French respondents recorded 44.6% more agree responses to the statement "I feel that I have very

little control over risks to my health." The French were also more likely to believe the police had the right to listen to private phone conversations and that people should support their governments energy choices.

The French were less likely to express support for egalitarian worldviews. They were more likely to think their country had gone too far in pushing equal rights and were less likely to think that a more equal distribution of wealth was necessary. In addition, the French were more likely to feel that continued economic growth will lead to pollution and that technological development was destroying nature. They also were less likely to be concerned about future generations.

### **3.6 Personal and Demographic Characteristics**

The final section of the survey asked questions about personal characteristics of the respondents, including social, economic, and behavioral information. This information is summarized below and related to ratings of risks.

#### *U.S.: Personal and demographic characteristics*

As mentioned above, the U.S. sample included 729 (48.2%) males and 783 (51.8%) females, with an average age of 39.7. Fifty-one percent of the respondents had two years of college or more; 40.8% had completed high school. Nearly 9.0% of the sample had not finished high school. The respondents were primarily white (84.3%), and most (81.9%) reported their personal health was good or excellent. Nearly half (47.6%) reported their annual household income as less than \$35,000; 46.4% reported incomes over \$35,000. In terms of political orientation, 29.7% considered themselves as liberal or very liberal; 33.4% thought they were middle of the road; and 35.3% indicated they were conservative or very conservative.

One about one-third of the U.S. respondents reported that they voluntarily participate in an activity that others consider a risk to their health or safety. When asked what activities they voluntarily participated in a range of activities were mentioned. Many of the activities were sports-related, such as skiing, scuba diving, hang gliding, bungee jumping, flying airplanes, and motorcycling. In addition, other types of voluntary risk-taking activities included drinking alcohol, smoking, and driving.

Four questions measured respondents' environmental activism during the past year. About three-quarters of the U.S. respondents reported that they had avoided using certain products that harm the environment (see Q147 in Table 15). Seventy percent indicated that they had purchased a higher priced product because it was better for their health or

environmentally friendly (Q150). Only about half the respondents said they had voted or worked for candidates because of their positions on environmental issues (Q149). Less than one-quarter (22.2%) of the respondents indicated that they had been active in a group or that works to protect the environment (Q148).

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Insert Table 15 about here

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*France: Personal and demographic characteristics*

As mentioned above, the French sample included 729 (47.0%) men and 821 (53.0%) women, with an overall age of 42.2. Nearly two-thirds (63.6%) of the French respondents report monthly household incomes under 13,000 francs (which corresponds to about 31,200 U.S. dollars per year).

Two-thirds of the respondents reported their personal health to be good or excellent. In terms of political orientation, 30.6% of the respondents considered themselves left or far left, 18.1% middle of the road, and 24.9% right or far right. Only 21.5% of the French respondents reported voluntarily participating in activities that were risky to their health or safety. The most common type of voluntary activity included some type of sport; other types of activities included smoking, political activism, and going to demonstrations.

With respect to personal environmental activism, 70.7% of the French indicated that they had purchased a higher priced product because it was better for their health or environmentally friendly (see Table 15). Nearly two-thirds also reported that they had avoided certain environmentally harmful products. Only about one-quarter of the respondents had voted or worked for candidates because of their positions on environmental issues. Few French respondents (9.1%) reported being active in an environmental group or organization.

*U.S.-France comparison: Personal and demographic characteristics*

American respondents were more likely to report voluntary participation in risky activities, with 35.4% of U.S. respondents reporting that they participate in such activities compared to 21.6% of French respondents. American respondents were also more likely to report voting for an environmental candidate in the past year, with 23.1% more "have done" responses than the French (see Table 16). In addition, Americans were more likely to report being active in an environmental group or organization.

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Insert Table 16 about here

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### 3.7 Summary

Many strong differences in attitudes and opinions of the French and American respondents were found. These differences center around issues of trust in government, science, and industry, and around certain worldviews such as egalitarianism and fatalism and not around perceptions of risk from nuclear power or nuclear waste. If anything, the French expressed more concern about risk from nuclear power and nuclear waste than did the Americans.

Across the entire set of hazards, the French were generally more likely than the Americans to call something a high risk. Nuclear power plants produced the smallest difference between the two countries in this regard. Americans were relatively more concerned about coal and oil burning power plants. Nuclear waste evoked much greater percentages of high-risk responses than did nuclear power and, in fact, France exceeded the U.S. in this regard.

There were also large differences between the French and Americans for the attitudinal statements. Trust stands out as a strong variable differentiating American and French respondents. Over two-thirds (67.9%) of the French respondents agreed that "decisions about health risks should be left to the experts," whereas only 23.2% of the Americans agreed with this statement, a difference of 44.7%. Higher trust levels in France were born out in other survey questions as well. Another large difference occurred in regard to the statement "I feel that I have very little control over risks to my health;" 79.3% of the French agreed compared to 34.7% agreement among the Americans.

The French were also much more likely than Americans to agree that:

- 0 When there is a really serious health problem, the public health officials will take care of it.
- 0 Our technologies might impose risks on future generations, but I believe future generations will be able to take care of themselves.
- 0 We can trust the experts and engineers who build, operate, and regulate nuclear power plants.
- 0 We need to pull together and support the energy choices our government has made.

Our results portray the French (relative to the Americans) as a people who believe that nuclear power has high risks but feel it is necessary for maintaining their economy and their standard of living. Although they believe they have little control over risks, they trust the experts and appear content to put their fate in the hands of the authorities.

In contrast, Americans are more likely to admire independence, respect individuality, dislike government intervention in personal risk-taking, and favor more equal distribution of wealth. Americans are also more likely to want public involvement in decision making. A surprising finding is that Americans were slightly more likely to agree that "the nuclear industry is capable of managing its wastes safely," although the degree of agreement was low in both countries (32.5% agreement in the U.S. vs. 26.6% in France).

Higher support was found in France for a new generation of nuclear power plants to supply the country's future electricity needs; 77.3% of the French respondents indicated support compared to 63.1% of the U.S. respondents. While there are high levels of support for nuclear reactors, the question is framed in such a way that support is contingent on the public's trust or confidence in the nuclear industry. The respondent is asked to assume the nuclear industry is correct that these new plants are safer.

In addition, as expected, many demographic effects were found in each country. Women in both countries tended to be more concerned than men not only about risks from nuclear power and chemicals but other types of risks as well (e.g., stress, AIDS, drinking alcoholic beverages, motor vehicle accidents). Women also tended to exhibit more concern about global and local environmental problems and were more likely to choose protecting the environment over ensuring an adequate supply of electricity. Men were more likely than women to support the building of new nuclear power plants than women and to trust experts and the government.

In general, older persons were more likely to rate a health risk as high, especially for non-nuclear types of risks (e.g., street drugs, storms and floods). Less-educated respondents were more likely to rate a health risk as high for all 25 hazards than college educated respondents.

#### **4.0 Conclusions**

The surveys described in this chapter have attempted to understand attitudes, perceptions, and behaviors that lie at the heart of public acceptance or rejection of nuclear power. The data from the two surveys clearly showed the greater concern and opposition to nuclear power among women. Similar results have been obtained in other studies as well (Flynn, Slovic, & Mertz, 1994). By examining the interaction between this gender effect and the racial composition of the respondents in the U.S. survey, Flynn, Slovic, and Mertz (1994) were able to gain insights into why women tend to be more anti-nuclear than men. They found no strong differences among nonwhite males, nonwhite females, and white females. Only white males stood apart from the others in having low perceptions of risk from all

hazards and stronger support for nuclear power. Probing further, they found that 30% of the white males had extremely low perceptions of risk from nuclear power and other hazards. These low-risk-perception white males differed in having higher incomes and education (though these did not explain why they differed in their perceptions). More importantly, they also held highly authoritarian and anti-egalitarian attitudes. They believed more than others that decisions about nuclear power should be made by experts, and they were more likely than others to trust experts.

The U.S. and French surveys also demonstrated the strong influence of worldviews on perception and acceptance of nuclear power. Using this same survey data, Peters and Slovic (in press) found that persons endorsing individualistic attitudes or attitudes depicting a hierarchical social system tended to be pro-nuclear. Those favoring a more egalitarian society, in which power and wealth are more evenly distributed, tended to be anti-nuclear.

These worldview and race/gender results point toward a dramatic conclusion. Attitudes toward nuclear power are conditioned by the interplay of psychological, social, cultural, historical, and political factors that will not easily be changed by public information or educational campaigns. Our support or opposition to nuclear power is part of who we are and how we feel about society and our place in it. In the U.S., white males of conservative ideology tend to see nuclear power as safe and acceptable. Those of egalitarian persuasion and those who feel disenfranchised and alienated from society see nuclear power as dangerous and unacceptable. Our experiences, sometimes filtered through worldviews, contain an affective quality that also conditions our reactions to nuclear power.

A unique feature of the present study has been a comparison, using the same survey, between public views in the United States, where nuclear energy is resisted, and public views in France, where nuclear energy appears to be embraced. We found, much to our surprise, that concerns about nuclear power and nuclear waste were high in France and were at least as great there as in the U.S. Thus, even though perception of risk is a strong predictor of attitudes toward nuclear power within both the U.S. and France, it cannot account for the different level of reliance on nuclear energy in the two countries. Further analysis of the survey data uncovered a number of differences that might be central in explaining the difference between France and the U.S. Specifically, the French:

- 0 saw greater need for nuclear power and greater economic benefit from it
- 0 had greater trust in scientists, industry, and government officials who design, build, operate, and regulate nuclear power plants
- 0 were more likely to believe that decision-making authority should reside with the experts and government authorities, rather than with the people.



These findings point to some important differences between the workings of democracy in the U.S. and France and the effects of different "democratic models" on acceptance of risks from technology. The French model involves less public participation and more centralized control. Political scientists have recognized that, in a climate of strong distrust, the French approach, in which policy formation and implementation is not accessible to public intervention, is expedient (Morone & Woodhouse, 1989). Campbell (1988) for example, argues that formal democratic institutions providing political access to nuclear critics may be fundamentally incompatible with commercial success of nuclear power.

What works in France, however, is unlikely to be achievable in the U.S. The French nuclear power program is run by the state, not private industry. ElectricitÈ de France has long had a strong reputation for being competent and putting service above profits. The French have a tradition of looking to a scientific elite for guidance in policy matters. Jasper (1990, noting that the word as well as the image of a "technocrat" arose in France, observed that "perhaps no other political system provides as large a role for people to exercise power on the basis of technical training and certification" (p. 83).

America, since Thomas Jefferson, has had a different approach to democracy, and it is not surprising that attempts to restrict citizens' rights to intervene directly in national risk-management policies have been vigorously opposed. One example is the unsuccessful attempt in Congress to strip the state of Nevada of its rights to issue environmental and safety permits for nuclear waste studies at Yucca Mountain (Batt, 1992).

Given that the French approach is not likely to be acceptable in the U.S., restoration of trust there may require a degree of openness and involvement with the public that goes far beyond public relations and "two-way communication" to encompass levels of power sharing and public participation in decision making that have rarely been attempted (Flynn, Kasperson, Kunreuther, & Slovic, 1992; Kunreuther, Fitzgerald, & Aarts 1993). Even this, however, is no guarantee of success (Bord, 1988; Nelkin & Pollak, 1979). In many situations, we may have to recognize that relationships are so poisoned that trust and conflict resolution cannot realistically be achieved in the short run. The bitter conflict over the proposed nuclear waste repository in Nevada is a prime example of such a situation. To preserve the form of democracy Americans value so highly, they will need to develop new ways to manage risks and work constructively in situations where they cannot assume that trust is attainable (Kasperson, Golding, & Tuler, 1992; National Research Council, 1996; Kasperson, Golding, & Tuler, 1992).

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Footnote for Table 4

Table 4 illustrates a characteristic difference between French and American respondents. The French more frequently used the extreme response categories, "strongly disagree" and

"strongly agree." This occurred with almost every attitudinal item. This may be due to a response bias, rather than to any greater bipolarity in French attitudes. On the assumption that this is a response bias, we shall combine "strongly disagree" with "disagree" responses and "strongly agree" with "agree" responses when repeating the results in the text.

Table 1. Outline of the Content of the French and American Survey

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\*1. Word associations

Associations to "nuclear power" and ratings of these associations on a positive/negative scale

\*2. Perceived risk

- a. Risk to the public as a whole from each of 25 hazards, including nuclear power and other radiation hazards (e.g., radon, X-rays, food irradiation, suntanning, video-display terminals)
- b. Risk to you and your family on a subset of these 25 items

3. National problems

Risk from nuclear power versus other social/political/economic problems

4. Health and environmental problems

5. Intuitive toxicology

\*6. Trust in experts/government/science

7. Risk/benefit tradeoffs

8. Knowledge

\*9. Nuclear power

- a. Support versus opposition
- b. Acceptability compared to other sources of energy
- c. Attitudes/opinions/characteristics
- d. Comparison between characteristics of nuclear power risks and risks from oil and coal

10. Equity and fairness: Nuclear power and societal decisions

11. Demand, scarcity, and conservation of electricity

\*12. Worldviews

- a. Fatalism
- b. Hierarchy
- c. Egalitarian view
- d. Individualism
- e. Technological enthusiasm/catastrophism
- f. Conservative/authoritarian ideology
- g. Concern for future generations
- h. Economic growth

\*13. Personal data

a. Gender

b. Age

c. Children under 18

d. Education

e. Voluntary risk taking

f. Personal health

g. Race

h. Environmental activism

i. Income

j. Actual distance to nearest nuclear power plant

k. Perceived distance to nearest nuclear power plant

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Note. Results from survey sections marked with an asterisk (\*) are presented and discussed in the present chapter.

Table 2. Nuclear Power Images: U.S. Data

Tables 2 and 3 are on a document created 6-27-96 by Melanie, called asscat.doc. Revised 7-10-96.

Table 3. Nuclear Power Images: French Data

See note on previous page (Table 2).



**Table 4. Support for Nuclear Power**

		Strongly disagree	Disagree	Agree	Strongly agree	Don't know/ no answer
Q5 If your community was faced with a potential shortage of electricity, do you strongly agree that a new nuclear power plant should be built to supply that electricity	U.S.	18.7%	31.5%	38.8	7.9%	3.1%
	France	29.7	20.7	35.5	13.2	.8
Q65 In light of health concerns about acid rain, damage to the ozone layer, and climate change associated with the burning of coal and oil, America [France] should rely more heavily upon nuclear power to meet its future electricity needs	U.S.	6.2	43.5	42.5	3.1	4.8
	France	19.5	28.0	31.2	19.9	1.5
Q68 In order to avoid importing energy from other countries to meet our future electricity needs America [France] should rely more heavily upon nuclear power	U.S.	4.4	46.0	43.4	3.2	3.0
	France	22.3	33.3	26.2	16.8	1.5

Q77 The nuclear power industry says that it is now possible to build a new generation of nuclear power plants that will be safer than existing plants. Assuming the nuclear power industry is correct, I would support such a new generation of nuclear plants to supply the country's future electricity needs	U.S.	4.3	27.6	59.5	6.3	2.2
	France	10.5	12.6	40.3	35.9	.6

		Not acceptabl e	Slightly acceptabl e	Moderate ly acceptabl e	Very acceptabl e	Don't know/ no answer
Q104 Nuclear power	U.S.	25.8	20.6	34.8	18.1	.7
	Franc e	21.9	14.4	44.5	19.1	.1

Note. The four response categories to these five items were coded 1 (strongly disagree; not acceptable) to 4 (strongly agree; very acceptable) and averaged for each respondent. The mean response was labeled the nuclear support index. The reliability of this index, as measured by Cronbach's alpha, was .84.

**Table 5. Acceptability of Alternative Ways to Produce Electricity**

		Not acceptabl e	Slightly acceptabl e	Moderate ly acceptabl e	Very acceptabl e	Don't know/ no answer
Q101 Oil	U.S.	10.3%	21.5%	47.8%	19.8%	.5%
	France	4.1	8.1	57.8	29.2	.7
Q102 Solar power	U.S.	1.5	5.1	20.7	71.8	.9
	France	1.5	2.6	13.4	82.3	.1
Q103 Natural gas	U.S.	3.7	9.2	43.3	43.5	.3
	France	1.9	3.1	39.7	54.9	.3
Q104 Nuclear power	U.S.	25.8	20.6	34.8	18.1	.7
	France	21.9	14.4	44.5	19.1	.1
Q105 Hydroelectric power	U.S.	3.1	7.3	28.8	59.7	1.1
	France	1.6	2.7	23.0	72.5	.1
Q106 Wind power	U.S.	3.4	8.2	19.9	68.0	.5
	France	3.8	4.6	15.9	75.5	.3
Q107 Coal	U.S.	18.4	25.5	43.2	12.4	.5
	France	5.5	9.1	53.3	32.0	.1

**Table 6. Characteristics of Nuclear Power**

		Strongly disagree	Disagree	Agree	Strongly agree	Don't know/ no answer
Q69 Nuclear power is a technological achievement of which our nation can be proud	U.S.	2.8%	28.5%	60.8	4.6%	3.2%
	France	11.6	17.1	36.7	33.9	.7
Q71 We should stop using nuclear power plants because we do not know how to store radioactive wastes safely	U.S.	2.1	39.4	44.4	10.6	3.5
	France	12.6	27.3	26.2	33.1	.8
Q73 Nuclear power is essential to our nation's security	U.S.	4.0	40.5	48.0	3.4	4.2
	France	20.6	28.5	26.8	22.1	2.1
Q76 Nuclear power is essential to our nation's economic well-being	U.S.	3.2	39.2	50.3	2.8	4.4
	France	9.9	22.3	38.3	28.0	1.5
Q78 The nuclear industry is capable of managing its wastes safely	U.S.	9.9	54.5	31.1	1.5	3.0
	France	32.6	39.6	16.5	10.1	1.2
Q80 We should develop other options for providing electricity instead of building more nuclear power and fossil fuel plants	U.S.	.4	17.4	63.4	17.1	1.7
	France	4.1	9.4	31.7	53.9	.9
Q82 The production of nuclear power contributes to the production of nuclear weapons	U.S.	2.4	46.0	44.2	2.8	4.6
	France	22.3	21.7	23.2	27.3	5.4
Q84 Most scientists agree that the risks of nuclear power are acceptable	U.S.	2.4	33.7	54.0	1.6	8.2
	France	18.2	25.7	34.6	19.6	1.8

Q85 Nuclear power is immoral because it imposes risks upon future generations without their consent	U.S.	3.1	42.6	45.3	6.3	2.6
	Franc e	14.5	24.6	23.5	36.2	1.2
Q86 Having a nuclear power plant nearby makes other people think that a community is a less attractive place	U.S.	1.3	27.8	62.9	6.2	1.9
	Franc e	9.8	16.1	27.1	46.5	.5
Q90 Differences of opinion about the risks of nuclear power can be resolved by scientific data and analysis	U.S.	2.8	42.2	49.9	2.2	2.8
	Franc e	10.5	23.4	40.2	22.7	3.2

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Table 7. Characteristics of Nuclear Power and Coal and Oil Risks

		Nuclear power	Coal and oil
Well understood by science	U.S.	55.1%	81.9%
	France	60.6	80.0
Well understood by public	U.S.	8.1	39.4
	France	13.9	49.0
Controllable by science	U.S.	53.0	67.8
	France	50.3	78.8
Catastrophic	U.S.	68.8	37.5
	France	80.3	45.4

Table 8. Nuclear Power Support: U.S.–France Comparison

	Differenc e
Q104 Nuclear power	10.7%
Q77 The nuclear power industry says that it is now possible to build a new generation of nuclear power plants that will be safer than existing plants. Assuming the nuclear power industry is correct, I would support such a new generation of nuclear power plants to supply the country's future electricity needs	10.39
Q65 In light of health concerns about acid rain, damage to the ozone layer, and climate change associated with the burning of coal and oil, Americans [French] should rely more heavily upon nuclear power to meet its future electricity needs	5.40
Q5 If your community was faced with a potential shortage of electricity, do you strongly agree . . . that a new nuclear power plant should be built to supply that electricity	2.08
Q68 In order to avoid importing energy from other countries to meet our future electricity needs America [France] should rely more heavily upon nuclear power	-3.59

Note. Values shown are differences in percent agree responses for France minus percent agree responses in the U.S. except for Q104 where the difference is in terms of percent saying "moderately acceptable" or "very acceptable."

Table 9. Acceptability of Alternative Ways to Produce Electricity: U.S.–France Comparison

	Difference
Q107 Coal	29.7%
Q101 Oil	19.4
Q104 Nuclear power	10.7
Q103 Natural gas	7.8
Q105 Hydroelectric power	7.0
Q106 Wind power	3.5
Q102 Solar power	3.2

Note. Values shown are differences in percent agree responses for France minus percent agree responses in the U.S. except for Q104 where the difference is in terms of percent saying "moderately acceptable" or "very acceptable."



Table 10. Characteristics of Nuclear Power: U.S.–France Comparison

	Difference
Q76 Nuclear power is essential to our nation's economic well-being	13.21%
Q90 Differences of opinion about the risks of nuclear power can be resolved by scientific data and analysis	10.79
Q85 Nuclear power is immoral because it imposes risks upon future generations without their consent	8.09
Q69 Nuclear power is a technological achievement of which our nation can be proud	5.17
Q80 We should develop other options for providing electricity instead of building more nuclear power and fossil fuel plants	5.06
Q86 Having a nuclear power plant nearby makes other people think that a community is a less attractive place	4.50
Q71 We should stop using nuclear power plants because we do not know how to store radioactive wastes safely	4.26
Q82 The production of nuclear power contributes to the production of nuclear weapons	3.49
Q84 Most scientists agree that the risks of nuclear power are acceptable	-1.36
Q73 Nuclear power is essential to our nation's security	-2.55
Q78 The nuclear industry is capable of managing its wastes safely	-9.96

Note. Values shown are differences in percent agree responses for France minus percent agree responses in the U.S.

Table 11. Trust in Experts, Government, and Science

		Strongly disagree	Disagree	Agree	Strongly agree	Don't know/no answer
Q50 Experts/scientists are able to make accurate estimates of the risks from nuclear power	U.S.	6.2%	40.3%	46.6%	4.9%	2.0%
	France	17.1	26.9	27.7	27.5	.8
Q54 If a scientific study produces evidence that a substance causes cancer in animals, then we can be reasonably sure that the substance will cause cancer in humans	U.S.	2.0	32.9	56.9	6.3	1.9
	France	10.2	23.3	36.1	28.5	1.9
Q55 When there is a really serious health problem, the public health officials will take care of it. Until they alert me about a specific problem, I don't really have to worry	U.S.	20.8	63.4	14.0	1.4	.5
	France	29.5	28.4	22.8	18.5	.8
Q64 Decisions about health risks should be left to the experts	U.S.	9.8	66.4	21.8	1.5	.6
	France	14.4	17.3	25.9	42.0	.4
Q88 We can trust the experts and engineers who build, operate, and regulate nuclear power plants	U.S.	7.0	47.3	41.4	2.0	2.3
	France	11.4	21.7	39.7	26.7	.5
Q90 Differences of opinion about the risks of nuclear power can be resolved by scientific data and analysis	U.S.	2.8	42.2	49.9	2.2	2.8
	France	10.5	23.4	40.2	22.7	3.2

Q119	Our government and industry can be trusted with making the proper decisions to manage the risks from technology	U.S.	10.3	54.4	32.9	1.1	1.4
		France	21.0	38.2	28.0	11.6	1.2

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Table 12. Trust in Experts, Government, and Science: U.S.–France Comparison

	Difference
Q64 Decisions about health risks should be left to the experts	44.72%
Q55 When there is a really serious health problem, the public health officials will take care of it. Until they alert me about a specific problem, I don't really have to worry	25.95
Q88 We can trust the experts and engineers who build, operate, and regulate nuclear power plants	23.00
Q90 Differences of opinion about the risks of nuclear power can be resolved by scientific data and analysis	10.79
Q119 Our government and industry can be trusted with making the proper decisions to manage the risks from technology	5.62
Q50 Experts/scientists are able to make accurate estimates of the risks from nuclear power	3.70
Q54 If a scientific study produces evidence that a substance causes cancer in animals, then we can be reasonably sure that the substance will cause cancer in humans	1.35

Note. Values shown are differences in percent agree responses for France minus percent agree responses in the U.S.

Table 13. Worldviews

		Strongly disagree	Disagree	Agree	Strongly agree	Don't know/ no answer
<u>Technological enthusiasm</u>						
Q108 A high-technology society is important for improving our health and social well-being	U.S.	.8	12.4	58.7	27.4	.7
	France	3.4	7.6	29.0	59.5	.5
Q117 Technological development is destroying nature	U.S.	2.8	33.9	53.7	7.5	2.1
	France	5.5	19.4	31.9	42.8	.4
<u>Conservative/authoritarian</u>						
Q109 I am in favor of capital punishment	U.S.	5.0	20.5	47.8	25.3	1.5
	France	31.8	13.5	18.9	35.0	.8
Q125 The police should have the right to listen to private phone calls to investigate a crime	U.S.	15.5	47.6	31.9	3.7	1.4
	France	34.1	18.5	20.8	26.2	.4
<u>Future generations</u>						
Q118 Our technologies might impose risks upon future generations, but I believe future generations will be able to take care of themselves	U.S.	5.6	43.5	46.2	3.4	1.4
	France	7.4	18.1	36.8	36.4	1.4
<u>Economic growth</u>						
Q115 Continued economic growth can only lead to pollution and depletion of natural resources	U.S.	5.1	49.2	39.0	4.8	2.0
	France	8.5	21.9	27.9	40.5	1.0
Q124 Continued economic growth is necessary to improve our quality of life	U.S.	1.4	17.7	70.7	9.5	.8
	France	6.3	13.2	36.6	43.3	.6

Fatalism/control

Q48 People can offset health risks from pollution by improving their individual lifestyles, such as exercising and eating properly	U.S.	1.9	13.6	55.0	28.9	.7
	Franc	5.8	6.7	31.0	56.5	0.0
	e					
Q63 I feel that I have very little control over risks to my health	U.S.	6.6	58.3	31.0	3.7	.3
	Franc	7.9	12.5	31.0	48.3	.4
	e					
Q122 It's no use worrying about public affairs; I can't do anything about them anyway	U.S.	17.9	63.4	15.7	2.6	.4
	Franc	42.4	31.4	11.2	14.6	.5
	e					

Hierarchy

Q110 People in positions of authority tend to abuse their power	U.S.	.5	13.6	58.5	26.7	.7
	Franc	4.0	6.5	24.1	65.4	.1
	e					

		Strongly disagree	Disagree	Agree	Strongly agree	Don't know/ no answer
Q114 We need to pull together and support the energy choices our government has made	U.S. Franc e	3.1 8.6	36.0 20.4	51.5 27.7	7.4 42.1	2.1 1.2
Q126 Those in power often withhold information about things that are harmful to us	U.S. Franc e	1.0 3.2	13.0 6.6	65.1 30.0	20.0 59.2	.9 1.0
<u>Egalitarian view</u>						
Q113 If people in this country were treated equally we would have fewer problems	U.S. Franc e	1.3 6.2	19.8 11.2	58.9 23.4	19.7 58.2	.3 1.0
Q121 What this world needs is a more equal distribution of wealth	U.S. Franc e	3.0 20.3	30.0 24.9	55.4 24.8	10.4 28.8	1.3 1.3
Q123 We have gone too far in pushing equal rights in this country	U.S. Franc e	12.4 24.7	53.2 30.3	28.0 18.2	4.8 24.9	1.6 1.9
<u>Individualism</u>						
Q116 I admire those who attempt to be independent and self-sufficient by growing their own food and adopting resource-conserving lifestyles	U.S. Franc e	.3% 7.0	6.5% 16.9	67.7% 29.7	24.9% 45.9	.6% .5
Q111 In a fair system people with more ability should earn more	U.S. Franc e	1.1 8.6	12.6 15.6	69.0 30.6	16.3 44.7	1.0 .5
Q112 Government has no right to regulate people's personal risk-taking activities such as smoking, mountain climbing, hang gliding, etc.	U.S. Franc e	2.6 16.1	23.9 22.8	53.4 18.6	19.2 41.7	1.0 .9

Table 14. Worldviews: U.S.-France Comparison

	Difference
Q63 I feel that I have very little control over risks to my health	44.6%
Q115 Continued economic growth can only lead to pollution and depletion of natural resources	24.6
Q118 Our technologies might impose risks upon future generations, but I believe future generations will be able to take care of themselves	23.6
Q117 Technological development is destroying nature	13.5
Q125 The police should have the right to listen to private phone calls to investigate a crime	11.4
Q114 We need to pull together and support the energy choices our government has made	10.9
Q123 We have gone too far in pushing equal rights in this country	10.2
Q122 It's no use worrying about public affairs; I can't do anything about them anyway	7.5
Q110 People in positions of authority tend to abuse their power	4.2
Q126 Those in power often withhold information about things that are harmful to us	4.0
Q48 People can offset health risks from pollution by improving their individual lifestyles, such as exercising and eating properly	3.6
Q113 If people in this country were treated equally we would have fewer problems	3.0
Q108 A high-technology society is important for improving our health and social well-being	2.5
Q124 Continued economic growth is necessary to improve our quality of life	-.3
Q111 In a fair system people with more ability should earn more	-10.0
Q121 What this world needs is a more equal distribution of wealth	-12.2
Q112 Government has no right to regulate people's personal risk-taking activities such as smoking, mountain climbing, handgliding, etc.	-12.3



Q116 I admire those who attempt to be independent and self-sufficient -17.0  
by growing their own food and adopting resource-conserving  
lifestyles

Q109 I am in favor of capital punishment -19.2

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Note. Values shown are differences in percent agree responses for France minus percent agree responses in the U.S.

Table 15. Environmental Activism

Have you done any of the following things in the past year?		Have done	Have not done	Can't remember	Don't know/ no answer
Q147 Avoided using certain products that harm the environment	U.S. Franc e	74.4% 64.7	23.3% 33.9	2.0% .9	.3% .5
Q148 Been active in a group or organization that works to protect the environment	U.S. Franc e	22.2 9.1	77.1 90.9	.5 0.0	.3 0.0
Q149 Voted or worked for candidates because of their positions on environmental issues	U.S. Franc e	49.5 26.5	49.7 72.8	.3 .1	.4 .6
Q150 Purchased a higher priced product because it was better for your health or environmentally friendly	U.S. Franc e	69.8 70.7	28.0 28.3	2.0 .6	.3 .3

Table 16. Environmental Activism: U.S.-France Comparison

	Difference
Q150 Purchased a higher priced product because it was better for your health or environmentally friendly	.9%
Q147 Avoided using certain products that harm the environment	-9.7
Q148 Been active in a group or organization that works to protect the environment	-13.1
Q149 Voted or worked for candidates because of their positions on environmental issues	-23.1

Note. Values shown are differences in percent agree responses for France minus percent agree responses in the U.S.