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Nuclear Waste: Facts, Fears, and Attitudes¹

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This study examined the effects of a television documentary about the safety of the Sellafield nuclear reprocessing plant in the Northwest of England upon public attitudes. In a study of 805 respondents from four districts in the Southwest of England, we assessed attitudes and beliefs both before and after the documentary about Sellafield. Results indicated a significant attitude change in a more antinuclear direction. Respondents who had seen or heard about the events at Sellafield tended to be more antinuclear after the broadcast. Finally, respondents living close to the existing nuclear power stations in the Southwest of England tended to see the events at Sellafield as less serious than the remaining respondents. Furthermore, this difference in perceived seriousness between respondents living near a nuclear power station and the remaining respondents was much more pronounced in ratings of the environmental risks of the *local* nuclear power stations in Southwest England.

The economic and political significance of energy supplies has increased dramatically since the early seventies. Until then, the debate on nuclear energy had largely centered on "technical arguments about technical issues" (White, 1977, p. 647). Changes in public awareness and involvement have led to the recognition that the future of this technology will be partly determined by public acceptability of nuclear energy.

Over the past decade, public support for nuclear energy has gradually eroded. Recent figures show that the percentage of the U.S.A. public that supports the continued building of nuclear power plants in the United States is, on average, 5% to 10% more than the percentage of the public that opposes such construction (Rankin, Melber, Overcast, & Nealy, 1981).

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The above trends are also apparent in Europe. For instance, opinion polls in the Netherlands and the United Kingdom have shown a slow but steady increase in public opposition to building more nuclear power stations. Recent opinion polls in both countries show a majority of the general public opposing further expansion of the number of nuclear power stations (see Thomas & Baillie, 1982). EEC surveys indicate that, averaged over the 10 member states, 38% of the public favors expansion of nuclear energy with 37% opposing further development.

In the present study, we investigate the impact of information concerning the effects of nuclear waste on public attitudes toward this technology. The recent past has shown that major nuclear accidents can have a marked impact upon public attitudes. Immediately following the Three Mile Island accident in 1979, support in the U.S.A. decreased, uncertainty about taking a stand on nuclear power decreased, and opposition toward nuclear energy increased. Although there has been some rebound toward pre-Three Mile Island levels of support and opposition, the return has not been complete (Rankin et al., 1981). Furthermore, a majority of the U.S. public believes that more such accidents are likely to happen, and a large majority now says that it is concerned about waste management issues (Kasperson, Berk, Pijawka, Sharaf, & Wood, 1980). It has been argued that because of the importance of safety aspects in the public's acceptance of nuclear energy, it seems more likely for attitudes to become more anti because of a major accident or a series of minor accidents than it would be for nuclear attitudes to become more pronuclear as a longer term result of a period of safe operations (Van der Pligt & Eiser, 1985).

The present research is part of a larger scale project on public attitudes toward nuclear energy. All subjects participating in the present study had been approached in October 1982 as part of a study of attitudes to proposals for a new nuclear power station in Southwest England. After data from that study had been collected, considerable public concern arose over the safety of the nuclear reprocessing plant at Sellafield in Northwest England. (The Sellafield site used to be called Windscale before recent expansion; cf. Eiser & Van der Pligt, 1979.) Whereas the plant had had a major fire in 1957, and had a history of subsequent minor incidents, the nature of the debate was changed dramatically by a television documentary broadcast nationally in November 1983. According to that program, plutonium and other radioactive material was discovered in houses near the Sellafield plant. The program also claimed that the incidence of leukemia among children in Seascale, the nearest village to the plant, was about ten times the national average. British Nuclear Fuels Ltd., which runs the Sellafield plant, denies that radioactive discharges from the plant present any serious danger.

Attribution of the geographical distribution of excess deaths to radioactive pollution, rather than to chance variation or to unknown factors, remains controversial (Black, 1984; Craft, Openshaw, & Birch, 1984). While it is undeniable that there have been accidental radioactive discharges from Sellafield, there is room for considerable divergence of opinion regarding whether these have had serious consequences.

The television program received widespread attention in the other media, both before and after the broadcast. Later in the same month that the program was broadcast, an unplanned discharge of radioactive waste into the sea led to contamination of Cumbrian beaches and temporary closure of these beaches to the public. As a consequence of these events, Sellafield is being placed under increasing pressure, both in the U.K. and elsewhere, to "clean up." In April 1984, the nations at a meeting of the international Paris Commission, which controls European discharges into the sea, accepted a resolution calling for the emissions from Sellafield to be kept as low as is technically achievable. The next meeting of the Paris Commission accepted a resolution from five Nordic countries demanding zero discharges from all reprocessing plants. A similar resolution was accepted at the meeting of European nations in Oslo in June 1984, demanding that the best available technology should be employed to stop radioactivity being pumped into the sea. In December 1984, British Nuclear Fuels (BNFL) announced its intention to spend 150 million pounds on a new plant to reduce its discharges of radioactive waste into the Irish Sea from the reprocessing plant at Sellafield. BNFL made clear that the extra investment was effectively a "public relations" gesture, designed to make Sellafield "publicly acceptable" and not justified by strict cost benefit analysis. BNFL is still under pressure from other European countries, the main issue being the timetable for the stopping of the discharges.

The present study, therefore, looked at the attitudinal effects of the television program among residents of a different part of the country, some of whom lived near a nuclear power station and some of whom did not. Specifically, we compared those who had viewed the program with those who had only heard or read about it, and those who had no knowledge of it. The possible effects we considered were (a) an overall persuasion effect in the direction of a generalized antinuclear position; (b) a polarization of those with opposed viewpoints; (c) a "self-defensive" attitude, particularly among those living nearest to nuclear facilities.

Regarding an overall persuasion effect, it was predicted that greater exposure to an unambiguously antinuclear communication would produce greater attitude shifts toward the anti-extreme. Since those who only heard about the program at second hand would probably not have received so

much information (and what they did receive would have been less vividly presented), we expected that this group would show intermediate levels of change, that is, less than viewers but greater than unaware nonviewers. On the basis of Tesser's (1978) work on self-generated attitude change, one would expect the broadcast and the debate between opponents and proponents which followed the documentary to lead to increased polarization of attitudes for both opponents and proponents. This would be a function of thought producing changes in the direction of greater consistency.

The sample of respondents included a number of people living near two existing nuclear power stations. A number of studies have investigated the effects of living near a nuclear power station on attitudes and beliefs about nuclear energy. There is limited support for the idea that familiarity leads to greater acceptance of a nuclear power station in one's community (Thomas & Baillie, 1982). The effect of familiarity must be interpreted with caution since communities initially more favorable are more likely to be chosen as sites. Further complications are caused by the fact that people with strong anti-attitudes that left the area or decided not to move there in the first place will not be included in studies of local opinion. Finally, local opinion is likely to be due in part to direct economic benefits to the community. Although the effects of familiarity upon acceptance of a new nuclear power station in one's community and nuclear energy in general are not clear-cut (see, e.g., Hughey, Lounsbury, Sundstrom, & Matingly, 1983; Thomas & Baillie, 1982; Warren, 1981), a number of studies have shown effects of familiarity upon the perception of the risks of nuclear energy. Ester, Mindell, Van der Linden, and Van der Pligt (1983) found that people living near a nuclear power station rated the environmental and public health risks as less serious than those living further away. Our own research in the Southwest is in accordance with these findings (Van der Pligt, Eiser, & Spears, 1986), and showed a relative underestimation of the risks by those living close to a nuclear reactor. Summarizing, the purpose of the present study is:

- (a) to test the effect of different levels of knowledge about the television program concerning Sellafield upon attitudes and attitude polarization, and
- (b) to investigate the effect of living near a nuclear power station upon beliefs both about the specific events at Sellafield and about the extent to which similar risks could apply to the Southwest.

The geographical location of this study allows us to look at how individuals may make generalized inferences concerning the acceptability and/or safety of the nuclear industry as a function of incidents by which they are *not* personally affected.

It is important to give some information regarding the timing of our study. The questionnaire was sent out in the first half of November 1983, shortly after the television broadcast, and focused on the allegations made in this broadcast. The television program presented a large quantity of evidence pointing to (but not yet proving) a link between radioactive discharges from the plant at Sellafield and the abnormal levels of cancers in neighboring parishes. The program also traced the paths taken by radioactive materials discharged into the Irish Sea to places as far away as Greenland, and for the first time uncovered traces of plutonium and other radioactive elements in household dust in the coastal villages.

After our questionnaire was sent out, Greenpeace divers took silt samples near the Sellafield pipeline in the Irish Sea and were contaminated by a high dose of radioactivity. This larger than usual discharge of radioactivity through the pipeline took place between November 10 and 14, 1983, when storage tanks were being washed out. Clearly, these events further increased the anxiety about Sellafield. By that time, a substantial number of questionnaires had been returned. Around November 22, radioactive waste from the Sellafield plant drifted ashore and contaminated a 200-yard stretch of beach. By the time the Department of the Environment warned the public to stay away from the coastline near the Sellafield plant after clumps of radioactive seaweed had been washed upon beaches, over 90% of the questionnaires had been returned. Although the present study is concerned primarily with the effects of the television program and respondents' perception of the claims made in the program, subsequent events may have influenced the study.

Method

The present study was part of a larger scale, longitudinal study of public attitudes and beliefs concerning the possible construction of a nuclear power station in the Southwest of England. In February 1981, the Central Electricity Generating Board (CEGB) announced the names of five sites to be considered as possible locations for a new nuclear power station. In February 1982, the CEGB ruled out two of these five sites on geological grounds. The CEGB made its final announcement on August 25th, 1982,

and stated that instead of any of these last three sites it had selected Hinkley Point in Somerset (the site of two existing nuclear power stations) as the location for a new nuclear power station. One of the original five sites (Winfrith in Dorset) is regarded as a possible site for the next new station after Hinkley Point. The present study took place near the five possible locations, and near Hinkley Point, and also included a number of communities in the Southwest that were not regarded possible locations for the next nuclear power station.

Sample

Respondents who participated in various stages of the above longitudinal study served as subjects in the present investigation. The respondents were drawn from the electoral registers for a number of districts in Southwest England. The above respondents ($n = 1085$) returned a questionnaire on the issue of nuclear energy in October 1982. After the events at the Sellafield nuclear reprocessing plant in November 1983, subjects were approached again. All respondents received a questionnaire by mail. Two weeks later, the nonrespondents received a reminder and a copy of the questionnaire. Of this sample, 98 respondents had moved from the area, and 811 persons agreed to participate in the study (a response rate of 82%). Six respondents who returned questionnaires without their name and address were excluded from the analyses. Of this sample, 433 respondents were male; the average age was 47.8 years.

Questionnaire

Subjects received a closed-ended questionnaire. First, respondents were asked whether they had seen the television broadcast "Windscale: The Nuclear Laundry." Responses were given in terms of four categories: "I saw all/most of it," "part of it," "no, but I heard about it through the news," and "no, not at all." Next, subjects who had seen the program were asked to give their opinion on the broadcast in terms of eight rating scales (sensationalist, scientific, trustworthy, biased, objective, extremist, balanced, and politically-motivated). For each term, it was indicated whether it applied to the broadcast on a 9-point scale ranging from "not at all" (1) to "extremely" (9). Respondents were then asked a number of questions concerning the Sellafield nuclear reprocessing plant issue. First, they were asked whether they believed that the Sellafield reprocessing plant had caused cases of leukemia and other cancers. Next, whether they believed that the incidence of cancers was higher around Sellafield than in the rest of the country, and whether they believed that the plant had caused cases of leukemia and other

cancers in Western Scotland and the Hebrides. Answers were indicated on a 5-point scale ranging from "yes, definitely" (scored as 1) to "definitely not" (scored as 5). Next, subjects were asked to indicate to what extent a number of factors had contributed to the cases of leukemia and other cancers in the area around Sellafield. These factors were natural background radiation, routine discharge of radioactive waste into the sea, accidents at the plant, and other unknown factors. Subjects were then asked whether they thought the nuclear reprocessing plant had discharged plutonium into the sea, and whether the plant creates radioactive pollution to the local environment. Similar questions were asked concerning the nuclear power stations at Hinkley Point in Somerset. Answers were indicated in terms of four categories ranging from "none at all" (scored as 1) to "enough to represent a serious danger" (scored as 4), with "don't know" as a fifth category. Next, subjects' attitudes toward building a new nuclear power station in the Southwest of England were assessed in terms of seven categories ranging from "very strongly opposed" to "very strongly in favor." Respondents were then presented with a list of eight general beliefs about nuclear energy (e.g., "nuclear energy is the only practical source of energy for the future"; "Britain should abandon all plans to build any more nuclear power stations"). These statements were rated on a 7-point scale ranging from "very strongly disagree" to "very strongly agree." The questionnaire also included a single scale measure of attitude toward nuclear energy. Responses to the question "How would you describe your attitude toward nuclear energy?" were given in terms of seven categories ranging from "very strongly opposed" to "very strongly in favor." The single scale attitude measure and the eight statements on the issue of nuclear energy were included at both stages of the present study.

Results

Table 1 shows the mean attitude scores before and after the television broadcast. We computed an attitude index score based on the eight general statements concerning nuclear energy. This scale proved reliable and consistent as indicated by a Cronbach's alpha of 0.86 for both measurements. Table 1 shows the mean attitude scores for three groups: those who had seen all or part of the program ($n = 131$),² those who had not seen the program but heard about it through the news ($n = 227$), and those who had neither seen the broadcast nor heard about it ($n = 383$).

²The percentage of respondents in our sample that had seen the program (17%) is in accordance with national viewing figures.

Table 1

Attitudes Toward Nuclear Energy for the Three Subject Groups

Subject group	(n)	October 1982		November 1983		Difference
		M	SD	M	SD	
Single scale measure						
Seen the program	(131)	3.6	1.7	3.3	2.2	+0.3
Heard about it	(277)	3.9	1.7	3.7	2.1	+0.2
Neither	(383)	3.8	1.6	4.0	2.0	-0.2
Attitude index ^b						
Seen the program	(131)	28.9	9.6	27.4	9.9	+1.6
Heard about it	(277)	30.5	8.8	29.9	8.8	+0.6
Neither	(383)	31.1	8.7	31.1	8.3	0.0

^aPossible range of scores from 1 (very strongly opposed) to 7 (very strongly in favor). ^bPossible range of scores from 8 to 56; lower scores indicate a more anti-nuclear attitude.

Analyses showed no significant differences in attitude *before* the broadcast. Mean scores for the three groups on the single scale attitude measure were 3.6 for those who had seen the program, 3.9 for those who had heard about it, and 3.8 for the remaining respondents ($F(1,767) = 1.62, ns$). Attitude index scores *before* the broadcast were 28.9, 30.5, and 31.1 respectively. The overall F value was nonsignificant ($F(2,764) = 2.85$); however, these mean scores yielded a significant linear term ($F_{lin}(1,764) = 5.19, p < .05$), suggesting that more antinuclear subjects were more likely to watch the program.

Attitude scores *after* the broadcast were most unfavorable for the people who had seen the program and least unfavorable for the people who had not seen or heard about the program. Both the single-scale scores and the attitude index yielded a significant linear term $F_{lin}(1,788) = 11.43, p < .001$, and $F_{lin}(1,784) = 16.39, p < .001$, respectively. We next computed difference-scores for each subject (attitude at time 1 — attitude at time 2).

in order to test whether subjects' attitude changed over time. A positive score would indicate a less favorable attitude at time 2. Means for the differences in the attitude index scores were +1.6 for the respondents who had seen the broadcast, +0.6 for those who had heard about it, and 0.0 for those who did not know about it, yielding a significant linear term; $F_{lin}(1,750) = 6.05, p < .05$. The single scale attitude scores revealed similar differences. Means were +0.3 for those who had seen the broadcast, +0.2 for those who had heard about it, and -0.2 for those who did not know about it; $F_{lin}(1,759) = 11.73, p < .001$. Thus, both attitude measures showed a change of attitude in a less favorable direction for those who had seen the program, a marginal change for those who had heard about it, and no change for those who did not know about it.³

Not surprisingly, the results concerning the questions about the incidence of leukemia and other cancers were in accordance with the above findings. Table 2 summarizes these findings. Thus, the respondents who had seen the broadcast were more inclined to believe that the reprocessing plant had caused cases of leukemia and other cancers. Similarly, the respondents who had seen the broadcast tended to believe that the incidence of leukemia and other cancers was higher around Sellafield than in the rest of the country, while those who had heard about the program were less certain about it, with the remaining respondents being least certain. Respondents who had seen the broadcast also tended to believe that the reprocessing plant had caused cases of leukemia and other cancers in Western Scotland. Respondents' perceptions of the contributions of various factors to the reported cases of leukemia and other cancers revealed clear-cut effects due to whether one had seen the broadcast or not (see Table 2). The three groups did not differ in their estimation of the contribution of natural background radiation; the overall mean score was 3.1 on a 9-point scale ranging from "no effect at all" (scored as 1) to "extremely strong effect" (scored as 9). Respondents who had seen the broadcast had the highest score concerning the effects of routine discharge into the sea, followed by those who had heard about the program and those who had not. Mean scores were 6.0, 5.1, and 4.6 respectively, a significant linear effect $F_{lin}(1,728) = 29.11, p < .001$. Similar differences were obtained for the effects of accidents at the nuclear plant and other unknown factors.

Since the three groups showed marginal differences in their attitude index scores *before* the broadcast, one could argue that the above differences are due to differences in the initial attitudes of the three subject groups. In order to test this possibility, we repeated all the above analyses in an

³A total of 521 subjects also received questionnaires in early/mid 1982. Inspection of their attitudes and attitude polarization scores revealed no significant change in either of these variables between mid and late 1982, confirming the results presently obtained for those who

Table 2

Beliefs About the Reprocessing Plant as a Function of Having Seen the Program

	Seen the program		Heard about it		Neither		<i>F_{lin}</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
	(<i>n</i> = 131)		(<i>n</i> = 277)		(<i>n</i> = 383)		
Beliefs ^a							
Plant caused cases of leukaemia and other cancers	2.1	0.9	2.4	0.9	2.7	0.8	47.83*
Incidence of cancers higher around Sellafield than elsewhere	2.2	1.0	2.5	0.9	2.8	0.9	31.10**
Plant caused cases of leukaemia in Scotland and the Hebrides	2.6	1.0	2.9	0.9	3.0	0.8	20.93**
Causes ^b							
Natural background radiation	3.2	2.4	3.3	2.1	2.9	1.9	3.38
Routine discharge of radioactive waste	6.0	2.8	5.1	2.4	4.6	2.5	29.11**
Accidents at the plant	6.1	2.6	5.1	2.6	4.8	2.6	19.23**
Other unknown factors	4.7	2.4	4.2	2.3	4.0	2.2	8.15**

* $p < .001$. ** $p < .005$.

^aScores could range from 1 (yes definitely) to 5 (definitely not). ^bScores could range from 1 (no effect at all) to 9 (extremely strong effect).

Table 3

Attitude Polarization: The Effect of Having Seen the Program

Subject group	<i>(n)</i>	Polarization ^a			
		Single scale		Attitude index	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Seen the program	(131)	-0.7	0.9	0.9	4.3
Heard about it	(277)	-0.6	1.0	0.0	4.0
Neither	(383)	+0.5	1.0	+0.1	4.4
		<i>F_{lin}</i> (1,759) = 6.38*		<i>F_{lin}</i> (1,750) = 4.21*	

* $p < .05$.

^aA positive score indicates less polarization after the broadcast, a negative score indicates more polarization.

analysis of covariance design with the initial attitude index score as a covariate and whether one had seen the program, heard about it, or neither, as an independent variable. These analyses confirmed our findings; in all cases, the ANCOVA's yielded significant effects due to the independent variable over and above the effects of initial attitude.

Attitudes and Polarization

In order to test whether the broadcast had a polarizing effect on respondents' attitudes, we computed two polarization scores. First, polarization on the single scale attitude measures. For this measure we simply calculated the absolute difference from midpoint (4) of the attitude scale. Polarization on the eight-item attitude scale was calculated as the deviation from midpoint (4) of the agreement/disagreement scale, for each statement, summed over the eight statements. We next calculated the difference in polarization before and after the broadcast. A *positive* score would indicate *less* polarization after the broadcast; a *negative* score *more* polarization after the broadcast. Table 3 shows that respondents who had seen the broadcast had a more polarized attitude index score after the

Table 4

Changes in Polarization and Attitude as a Function of Initial Attitudes

Initial attitude	(n)	Single-scale ^a				Attitude-index ^b			
		Change in polarization		Change in attitude		Change in polarization		Change in attitude	
		M	SD	M	SD	M	SD	M	SD
Extremely anti	(118)	-0.5	1.0	+0.2	1.6	+0.2	4.3	-1.2	5.9
Moderately anti	(93)	-0.9	1.0	+0.6	1.6	-1.2	4.2	+0.5	6.0
Moderately pro	(92)	-0.9	0.8	+0.1	1.5	-0.9	4.3	+1.7	5.5
Extremely pro	(89)	-0.4	0.9	-0.1	1.5	+0.7	3.6	+3.3	6.1

^aA positive score indicates less polarization after the broadcast, a negative score indicates more polarization. ^bA positive score indicates a change in an anti-nuclear direction after the broadcast, a negative score a change in a pro-nuclear direction.

program, respondents who had heard about the program had a difference score of 0.0, while the remaining group showed less polarization. Polarization scores on the single scale attitude measure showed a similar pattern, more polarization for those who had seen the broadcast and less so for the two remaining groups. Those who had heard about the program also showed increased polarization but to a lesser extent than those who had seen the program.

In order to investigate which people showed an increase of polarization, we conducted a number of further analyses on a subset of the respondents, that is, those who had seen or heard about the broadcast. First these subjects were split into four groups on the basis of their attitude index score before the broadcast: one group of subjects with an extremely antinuclear attitude, one group with a relatively moderate antinuclear attitude, a group with a moderately pronuclear attitude, and finally a group with a clear-cut pronuclear attitude. As shown in Table 4, the moderate groups showed the most marked increase in polarization on both attitude measures. The two extreme attitude groups did not show increased levels of polarization on the attitude index scores (scores of +0.2 for extreme anti's and +0.7 for extreme pro's). The moderate groups, however, showed increased polarization (difference scores of -1.2 and -0.9, respectively). A planned comparison between the moderate and extreme attitude groups yielded a significant *t* value; $t(388) = 3.6, p < .001$. Similarly, the moderate attitude groups showed more polarization on the single scale measure (-0.9 for both groups), while the extreme attitude groups' scores were -0.5 and -0.4. A planned comparison yielded a *t* value of 4.56, $p < .001$. Closer inspection of the mean attitude scores after the broadcast for the four attitude groups did not confirm the prediction that the two moderate groups would shift to a more extreme position in line with their previous attitude. Mean scores on the single scale attitude measure showed a shift in the anti direction for three of the four attitude groups. Mean difference scores were +0.2 (for extreme anti's), +0.6 (moderate anti's), +0.1 (moderate pro's), and -0.1 (extreme pro's). Although the extreme pro's showed a slight shift into the pro-direction (suggesting a hardening of their position), the differences did not vary significantly between the four groups. Similarly, differences on the attitude index scores did not confirm the polarization hypothesis. All groups, with the exception of the extreme anti's, showed a more anti-attitude after the broadcast. The mean difference scores were -1.2 (extreme anti's), +0.5 (moderately anti's), +1.7 (moderately pro's), and +3.3 (extremely pro's), a highly significant linear effect; $F_{lin}(1,388) = 31.77, p < .001$. Summarizing, these results show that the broadcast led to more polarized attitude scores, especially for the relatively moderate attitude groups. Inspection of the differences in mean attitude scores, however,

revealed that this increase in polarization is asymmetrical. The increase in polarization seems due to a shift in the anti-direction only. Overall, the attitude changes for the various groups fail to support the notion that attitudinal changes should be in line with previous attitudes.

Attitudes and Familiarity

Finally, we compared subjects' perceptions of the events at Sellafield and their beliefs about the safety of the nuclear power plants in the Southwest of England as a function of "familiarity," that is, living near the nuclear power stations in the Southwest. In order to investigate this issue, subjects were split into two groups: those who lived near the nuclear power stations at Hinkley Point in Somerset (within 5 miles of the plants, $n = 141$), and the remaining subjects living further away from these power stations. Analyses were carried out by casting the data in a 2×3 analysis of variance design with familiarity and whether one had seen the broadcast, heard about it, or did not know about it as independent variables. All the effects of familiarity to be reported were assessed *after* controlling for the effects of having seen the program. Results indicated a more favorable attitude toward nuclear energy in the communities close to the existing nuclear power stations in the Southwest. The index score was 31.8 in the communities near Hinkley Point and 29.6 in the rest of the Southwest $F(1,765) = 9.15, p < .005$. Similarly, the single scale attitude scores were 4.4 and 3.6, respectively; $F(1,765) = 19.56, p < .001$. Results concerning attitude change after the program showed no effect due to familiarity over and above the effects of having seen the program. The only exception was a marginally significant effect for familiarity on the single scale attitude measure. The respondents living near Hinkley Point showed a slight shift in the pro-direction (-0.2), while the remaining respondents revealed a difference score of $+0.1$. The difference between the two groups yielded an F value of $3.63, p < .06, df = 717$.

Next we compared the two groups with respect to their responses to questions concerning the extent of the pollution caused by the Sellafield nuclear plant and by the nuclear power stations at Hinkley Point. In these analyses, we excluded the respondents who ticked the "don't know" response category. The effects of familiarity were again assessed after controlling for the effects of having seen the broadcast. Not surprisingly, the percentage of subjects who ticked the "don't know" category was highest for those who had neither seen nor heard about the broadcast, but did not vary as a function of familiarity. Results indicated that the two groups did not differ in their beliefs about how much plutonium was being discharged by the Sellafield nuclear plant. Mean scores were 2.9 and 3.0 for the Hinkley Point sample and the remaining respondents, respectively ($F(1,544) = 2.51,$

ns). The groups showed a small but significant difference in their beliefs about the extent of radioactive pollution created by Sellafield in other ways than routine discharge into the sea. Mean scores on the 4-point scale ranging from 1 (none at all) to 4 (enough to represent a serious danger) were 2.7 and 2.9, indicating that the Hinkley Point sample believed the pollution was less serious ($F(1,588) = 6.42, p < .05$). The same two questions were asked concerning the nuclear power stations at Hinkley Point. Results indicated very strong effects due to familiarity, and unlike the previous two questions, results revealed a much stronger effect due to familiarity than to whether respondents had seen the program. The question concerning plutonium discharges resulted in mean scores of 2.2 (Hinkley Point sample) and 2.7 (remaining subjects), yielding a highly significant F value; $F(1,497) = 23.76, p < .001$. It needs to be noted that it is technically impossible for plutonium to be discharged by nuclear power stations of the type at Hinkley Point. Respondents at Hinkley Point also believed the radioactive pollution at Hinkley Point to be less serious than the remaining subjects. Mean scores were 2.2 and 2.6; $F(1,566) = 20.34, p < .001$. Finally, respondents near Hinkley Point were generally more in favor of building a new nuclear power station in the Southwest—3.7 vs. 3.1 on a 7-point scale ranging from "very strongly opposed" (scored as 1) to "very strongly in favor" (scored as 7). This difference yielded an $F(1,793)$ of 50.05, $p < .001$. However, even within the Hinkley Point sample those who had seen the program were less favorable toward the building of a new nuclear power station than those who had only heard about it or did not know about it. Mean scores were 3.2, 3.7, and 4.0 respectively. The effect of having seen the program was significant $F(1,793) = 5.70, p < .005$, but this effect was much weaker than that of familiarity. Overall, these findings show that familiarity does have some effect on respondents' beliefs concerning the Sellafield nuclear reprocessing plant. The effect of familiarity is much more marked, however, when the questions refer to the nuclear power stations in the Southwest. Results show that people living near the nuclear power stations in the Southwest have a more favorable attitude toward building a new nuclear power station and are less pessimistic about possible radioactive pollution in the Southwest than the respondents who live further away from these nuclear power stations.

Discussion

Results of the present study show that alleged effects of nuclear waste have a significant impact on public attitudes toward nuclear energy in general and toward the building of more nuclear power stations. Present results suggest that the more information one had received about the

incidents at the Sellafield nuclear reprocessing plant the more significant the influence on attitudes. People who had seen the television broadcast on the issue showed more attitude change than those who had only heard about the issue through the news, while those who had not heard about it did not show any attitude change. The present study was conducted about 2 weeks after the television broadcast and one should allow for some rebound to previous levels of support and opposition. Although the present study cannot answer the question of long-term attitude change, our results suggest that less serious events than the Three Mile Island incident do have a significant influence on public attitudes and beliefs about nuclear energy. On a practical level, the implication is that the recurrence of this type of incident is bound to have more long-term effects on public acceptance. Since the television program in question, two further accidents have been reported and recently (April, 1984) the Sellafield area was revisited by television to report on another case of leukemia in Seascale. The broadcast further alleged that there are cancer rates four times the national average in young people at Maryport, a village up the coast in the same area. The impact of the incidents is obviously not shortlived. In December 1984, a large Victorian house overlooking the estuary near the Sellafield reprocessing plant was sold for about 30,000 pounds below its market value. Potential buyers withdrew their offer after the beaches around Sellafield were closed and the owners sold their house eventually by auction for 35,000 pounds (estimated value was 65,000 pounds).

Results of the present study do not confirm Tesser's (1978) polarization hypothesis. We did not find increased polarization in both the pro and antinuclear direction; inspection of the attitude change scores showed that this increase in polarization was the result of both the moderately pronuclear and moderately antinuclear respondents becoming more anti. Although the television program was followed by a debate in which both sides presented their case, the overall impact of the broadcast was for attitudes to become more anti. It seems, therefore, that the broadcast's claims concerning the environmental and health risks of the Sellafield plant had a significant impact on respondents' attitudes. This is in accordance with numerous studies showing that these safety aspects play a crucial role in the public's acceptance of nuclear energy (see, e.g., Fischhoff, Lichtenstein, Slovic, Derby, & Keeney, 1981).

Finally, present results show that people who live near a nuclear power station tend to see nuclear incidents as less serious than those with no direct experience of living near a nuclear power station. More importantly, the effect of familiarity had much more marked effects on respondents' perception of the environmental risks of the nuclear power stations in their locality than on their perceptions of the Sellafield issue. The fact that the

discrepancy between the two groups is greater when rating the risks of nuclear power stations on one's doorstep suggests that not only personal experience but also dissonance reducing mechanisms (Festinger, 1957) influence people's perception of these issues.

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Perceptions of Controllability and Attitudes Toward Cancer and Cancer Patients¹

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This study explored the possibility that widely held beliefs that cancer is uncontrollable underlie the public's negative attitudes toward this disease. One-hundred-and-sixty undergraduates read a paragraph describing a disease that was labelled either as cancer or as "Haltmar's Disease," a fictitious disease. The descriptions were designed to manipulate subjects' perceptions regarding both the degree to which the disease could be controlled through preventive behaviors (disease preventability) and the likelihood that it could be controlled through treatment (disease treatability). Subjects then completed a questionnaire on which they indicated their attitudes toward the described disease as well as toward a patient with that disease. Results generally supported the hypothesis that when a disease is perceived as controllable it is evaluated less negatively than when it is perceived as uncontrollable. Perceptions of control also influenced attitudes toward patients with the fictitious disease. As predicted by the Just World hypothesis, attitudes toward patients with the fictitious disease were more negative when the disease was described as uncontrollable. Attitudes toward cancer patients, however, were positive regardless of level of control. Overall, cancer was described significantly more negatively than the fictitious disease and cancer (vs. Haltmar's) patients were described significantly more positively.

Both laypersons and medical professionals hold strongly negative attitudes toward cancer. In a nationwide survey of 1,553 adults (Lieberman Research Inc., 1979), half of all respondents agreed with the statement, "The word cancer itself scares me." Further, over a third reported that having cancer would be "the worst thing that could happen to a person." Elkind (1982) asked 785 nurses which of several serious diseases they perceived to be the "most alarming" and, paralleling findings obtained for the lay public, cancer was chosen most frequently. Research with medical students has yielded similar results (Cassileth & Egan, 1979).

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