

SUMMARY OF THE TRANSPORTATION OF SPENT FUEL ATTITUDE SURVEY

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ABSTRACT

The proposed repository at Yucca Mountain, Nevada will increase highway and railway transportation of spent fuel and high level nuclear wastes. The purpose of the survey was to determine the attitudes and differences in attitudes of important actors in the transportation of spent fuel. The three major areas of investigation were 1) perceived risks associated with the transportation of spent fuel, 2) confidence in the government and others responsible for transporting spent fuel, and 3) certain transportation requirements. Response was 34.3% of the original mailing and included: 193 safety personnel, 141 employees of the nuclear industry, 260 government employees, 34 native Americans, and 9 employees of environmental organizations. This paper summarizes overall and group attitudes and opinions for the three areas mentioned above.

INTRODUCTION

Differences in attitudes exist about the risks associated with nuclear wastes between the general public and those involved with the industry (1). Previous surveys have investigated public opinion and attitudes about the transportation of nuclear waste (2). This survey was conducted in order to investigate opinions and attitudes about specific issues in transporting spent fuel held by various groups important to the industry.

METHODOLOGY

The mail-in survey consisted of 41 questions which were divided into 74 items for analysis. A majority of the items (37) focused on the perceived risks associated with transporting spent fuel and high level nuclear wastes. Twelve items were questions about confidence in government agencies and others responsible for ensuring safe transportation of the wastes. Nineteen items solicited attitudes about certain requirements necessary for safe shipping of the spent fuel. The remaining items requested personal information including age, sex, and academic background.

Samples were drawn from five distinct groups that were found to be important in the transportation of spent fuel and high level nuclear wastes. The groups included: safety professionals, government employees, non-government employees of the nuclear industry, employees of environmental organizations and native Americans of various tribes. Mailing lists of safety personnel were obtained from the System Safety Society 1986/1987 Directory of Consultants and American Society of Safety Engineers 1990 Membership Directory. The mailing list for workers in the nuclear power industry were taken from the Waste Management 1991 Attendee List and the remaining lists were taken from Transportation Communication Network Data Base, revised edition, March 31, 1991. Systematic random sampling was applied to each category of lists.

The data analysis consisted of descriptive and non-parametric statistics. Frequencies and percentages of the total sample and individual groups were calculated. Kruskal-Wallis one-way analysis of variance by ranks was used to determine statistically different responses between the groups. Multiple-comparisons-between-treatments tests were applied to identify significantly different groups. Survey

answers of "I Don't Know" could not be transferred to an ordinal scale and therefore were omitted from the analysis.

RESULTS

Survey response totaled 637 (34.3% of the original mailing). Given the considerable length of the instrument (approximately 30 minutes were required to complete it), the response was considered favorable. The samples included: 193 safety professionals, 141 people employed in the nuclear industry, 260 government employees, 34 native American Indians, and 9 employees of environmental organizations.

Perceived Risk in Transporting Spent Fuel and High Level Nuclear Waste on Interstate Highways and Railways

With several exceptions, the risks associated with transporting spent fuel and high level nuclear waste were perceived as low by the employees of the government, safety fields, environmental organizations and nuclear industry. There were, however, great differences in the way the groups rated the magnitude of the risks. Groups responded significantly different ($p < 0.0002$) on every item regarding the risk associated with the transportation of spent fuels. Typically, employees of the nuclear industry perceived the least risk, followed respectively by government employees, safety and environmental personnel, and native Americans. The native Americans usually rated the risks associated with shipping spent fuel as significantly different and much higher than the remaining groups.

Respondents were asked to rate the personal risks of ten health and safety risks (natural disaster, technological disaster, violent crime, transportation of spent fuel, transportation accidents involving spent fuel that could possibly cause a release of radioactive matter, accidents in or around the home, job accidents, chemical pesticides, medical X-rays, motor vehicle accidents and adverse reactions to prescription drug errors) on a scale of one (no risk at all) to ten (great risk). They rated the risks of the transportation of spent fuel and transportation accidents involving spent fuel (including those which involve release radioactive matter) lowest of all risks. Transportation of spent fuel was rated 1 or 2 by 78.6% of the respondents and above 5 by only 4.8% of the respondents. Accidents involving the transportation of spent fuel were rated 1 or 2 by 72.2% and above 5 by 8% of the respondents. The greatest general perceived health and safety risk was

motor vehicle accidents; only 2% of the responses were 1 or 2 and 72% of the responses were above 5. Figure 1 summarizes the ratings of risks associated with the transportation of spent fuel, transportation accidents involving spent fuel, medical X-rays and motor vehicle accidents.

When asked to respond 'agree', 'tend to agree', 'tend to disagree', or 'disagree' to several statements, 93% of the respondents agreed or tended to agree that "Spent fuel can be transported in a way that is acceptably safe" and 87.7% agreed or tended to agree with the statement "I would not hesitate to

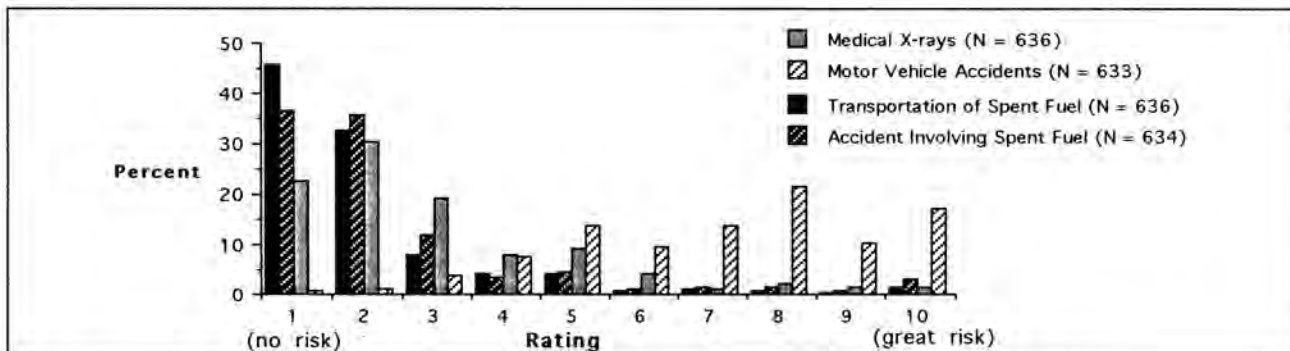


Fig. 1. Overall response to several health and safety risks.

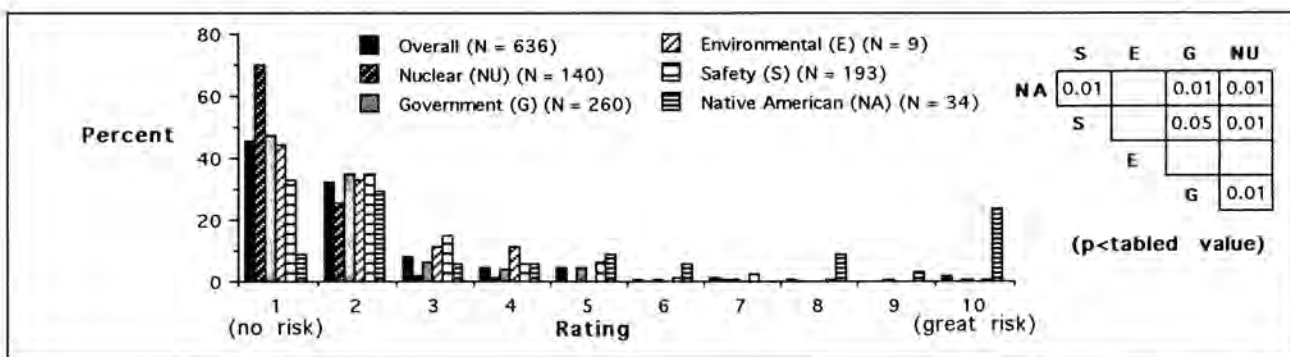


Fig. 2. Responses to the risk associated with the transportation of spent fuel. For example, the difference in response between the nuclear employees (NU) and native Americans (NA) is significant ($p < 0.01$). This value is in the upper right corner of the table. If there is no tabled value, the groups were not significantly different.

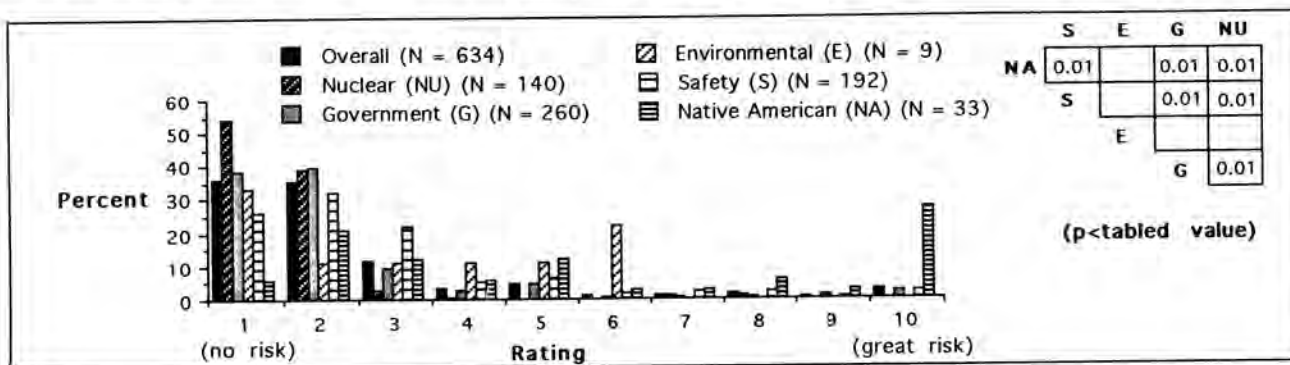


Fig. 3. Risk associated with transportation accidents involving spent fuel. Significant differences between groups are tabled.

Although there were no significant differences in how groups rated natural disasters, accidents in and around the home, job accidents, medical X-rays, and motor vehicle accidents, there were significant differences ($p < 0.0001$) in how the risks associated with the transportation of spent fuel and spent fuel transportation accidents were rated by the groups. The distributions of the ratings and significant group rating differences are shown in Figs. 2 and 3.

purchase food produced in an area through which spent fuel is trucked". Additionally, 91.9% of the respondents disagreed or tended to disagree with the statement "I would change my travel route to avoid a highway used to transport spent fuel even if it added miles to my trip" and 90.4% disagreed or tended to disagree with the statement "I would not take a vacation in an area through which spent fuel is trucked". There were, however, significantly different group responses to each

statement ($p < 0.0001$). Consistently, employees of the nuclear industry tended to show the least perceived risk and native Americans indicated the highest perceived risk. The distributions of responses indicate that native Americans were ambivalent in each case. The overall and group distributions as well as the significant group differences of ratings for each statement are shown in Figs. 4, 5, 6, and 7.

railways. Figures 9 and 10 illustrate the overall distributions of ratings for the 5 potential causes surveyed.

Survey recipients were asked to classify the safety of special trains (which are restricted to a maximum speed of 35 mph, and when passing or being passed by another train, one train comes to a complete stop) and dedicated trains (which are 10 car trains that carry only radioactive wastes) for trans-

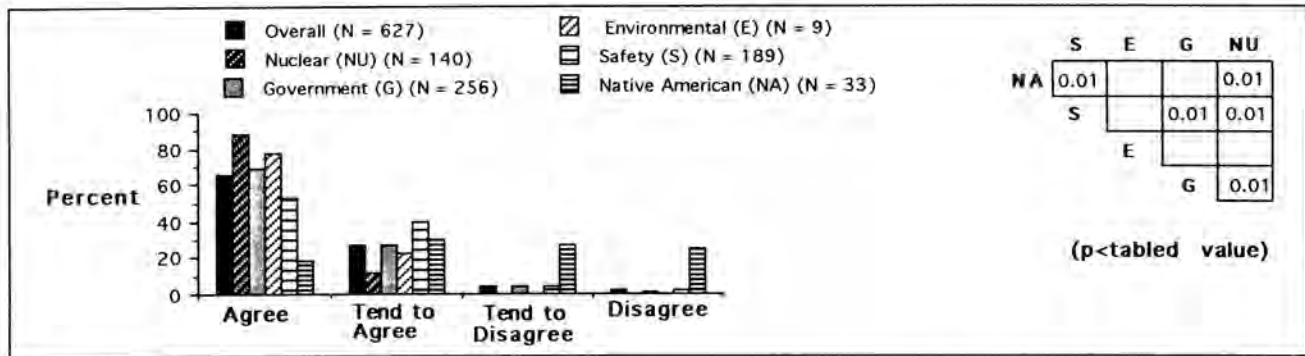


Fig. 4. Responses to the statement "Spent fuel can be transported in a way that is acceptably safe".

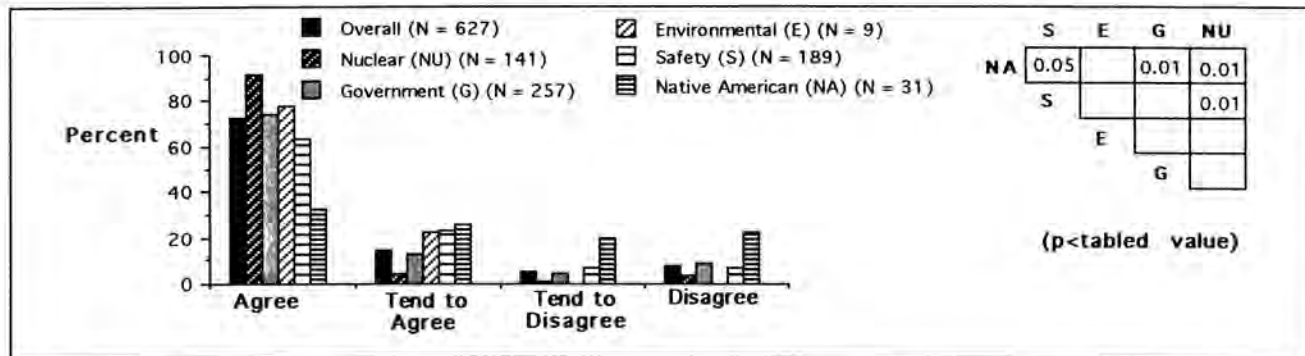


Fig. 5. Responses to the statement "I would not hesitate to purchase food produced in an area through which spent fuel is trucked".

Respondents were asked to rate the likelihood of human error, mechanical error, breakdown, transportation accident, and container rupture to cause any release of radiation during the transportation of spent fuel. Again, group ratings differed significantly ($p < 0.0001$) for each of the five causes. Nuclear industry workers generally rated the lowest risk and the native Americans rated the highest risk. Group differences in rating the likelihood of mechanical error to cause a release of radiation during the interstate highway transportation of spent fuel provide a typical example of the overall and group responses (See Fig. 8).

Respondents found human error the most likely cause of a radiation release during both the interstate highway and railway transportation of spent fuel. On a scale of 1 (very low likelihood) to 5 (very high likelihood), 51.8% of the respondents reported a high or very high likelihood for human error to cause a release of radiation on interstate highways and 41.9% found human error to be as likely a cause on railways.

Response indicated container rupture to be the least likely cause of a release of radiation. Only 11.3% of the respondents found container rupture to have a high or very high likelihood of causing a radiation release on interstate highways and only 12% indicated the same likelihood on

porting spent fuel as 'not safe', 'somewhat safe', 'moderately safe' or 'very safe'. Although both types of trains were considered relatively safe for transporting spent fuel, respondents tended to rate special trains as being safer. Special trains were rated very safe or moderately safe by 86.1% of the respondents and dedicated trains were rated similarly 79.9% of the time. However, significantly different group responses ($p < 0.0001$) regarding the safety of both types of trains were found. The distributions and significant group differences concerning the safety of special trains is shown in Fig. 11.

The overall response ('very safe', 'moderately safe', 'somewhat safe' or 'not safe') to the safety of legal weight and overweight trucks for transporting spent fuel, indicated that legal weight trucking is perceived as less dangerous than overweight trucking of spent fuel. The use of legal weight trucks was considered moderately safe or very safe by 79.7% and not safe by 4.2% of the respondents. In contrast, only 44.8% found overweight trucking moderately safe or very safe and 29.9% of the respondents found the use of overweight trucks not safe. Group responses to both the legal weight and overweight trucking of spent fuel differed significantly ($p < 0.0001$) (See Figs. 12 and 13).

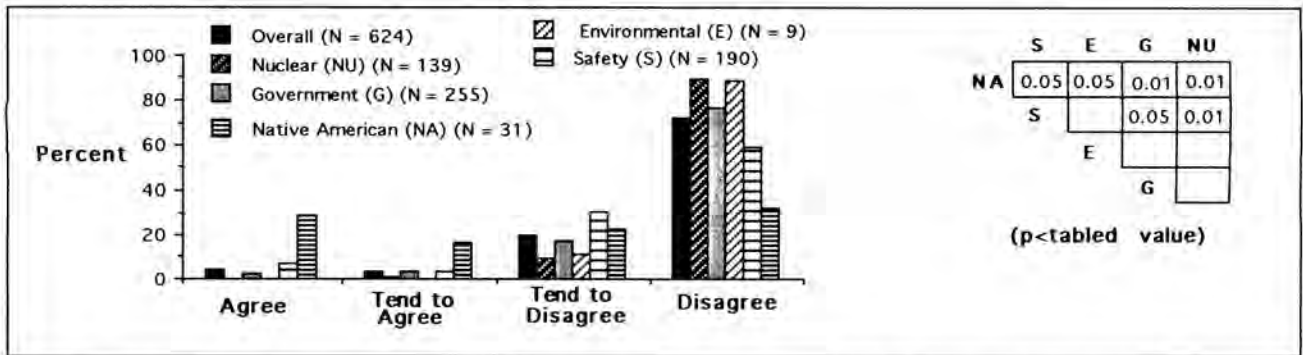


Fig. 6. Response to the statement "I would change my travel route to avoid a highway used to transport spent fuel".

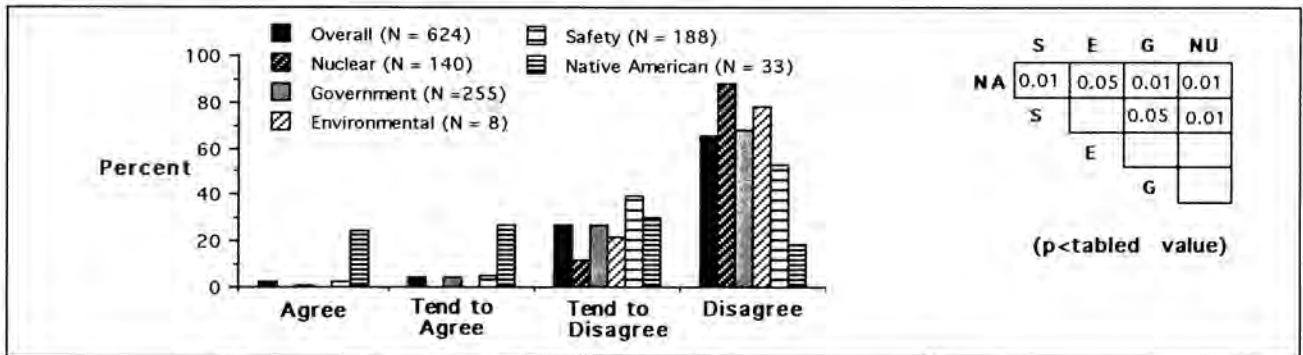


Fig. 7. Responses to the statement "I would not take a vacation in an area through which spent fuel is trucked".

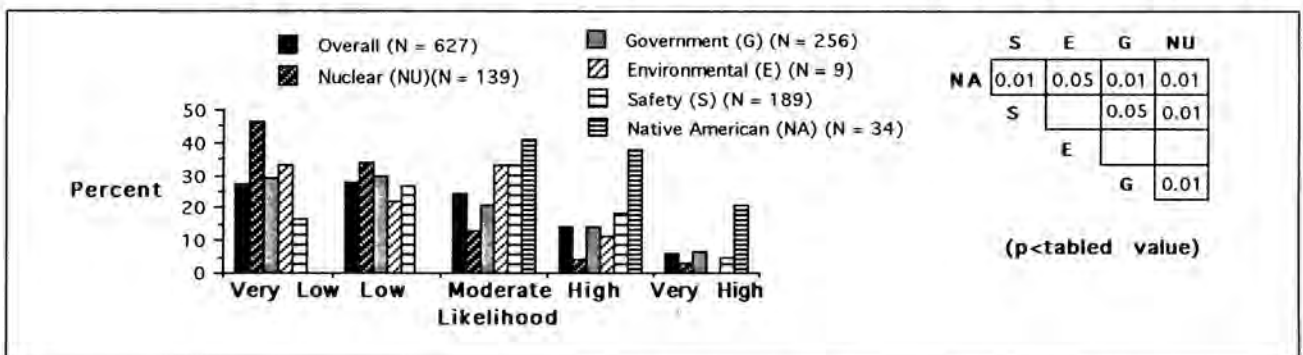


Fig. 8. Response to mechanical error as the possible cause of a release of radiation on the interstate highway transportation of spent fuel exemplifies the typical response by different groups.

Confidence in the Government in Transporting Spent Fuel

When asked to rate personal confidence that the federal, state and local governments will work to make the transportation of spent nuclear fuel safe, respondents generally reported highest confidence in the federal government and lowest in the local government. On a scale of 1 (no confidence) to 10 (complete confidence), 45.6% of the respondents rated the federal government above 7, 35.3% rated the state government above 7 and 22% rated the local government above 7.

The confidence rating of the federal government differed significantly between groups (p<0.0001). Distributions of responses of the nuclear industry employees and native Americans showed opposite trends. Those working in nuclear power reported complete confidence in the federal government 20.3% of the time and no confidence only 3.1% of the time. In contrast, none of the native American Indians reported complete confidence in the federal government and

38.2% reported 'no confidence' in the federal government. Group distributions for the ratings of confidence in the federal and state governments are illustrated in Figs. 14 and 15.

All groups tended to have little confidence in the local government's ability to work to make the transportation of spent fuel safe. Unlike the confidence ratings of the federal and state governments, there were no significantly different ratings for the local government (See Fig. 16).

Lack of confidence in the local officials was evident in overall response to the question, "If there was an accident involving the release of spent fuel in your area, and local officials called for the evacuation of a 5-mile radius of the accident site, would you evacuate at < 1, 1 to 5, 6 to 10, 11 to 15, 16 to 20 or > 25 miles?" Over 46% of the respondents reported that they would evacuate when further than 5 miles from the accident. Group responses were significantly different (p<0.0001) and the least confidence in the local

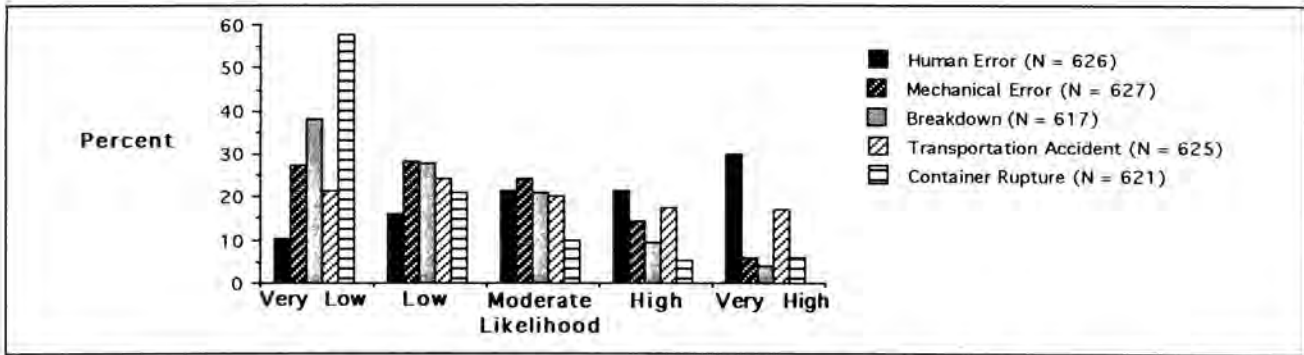


Fig. 9. Overall response to the likelihood that each will cause any release of radiation during the highway transportation of spent fuel.

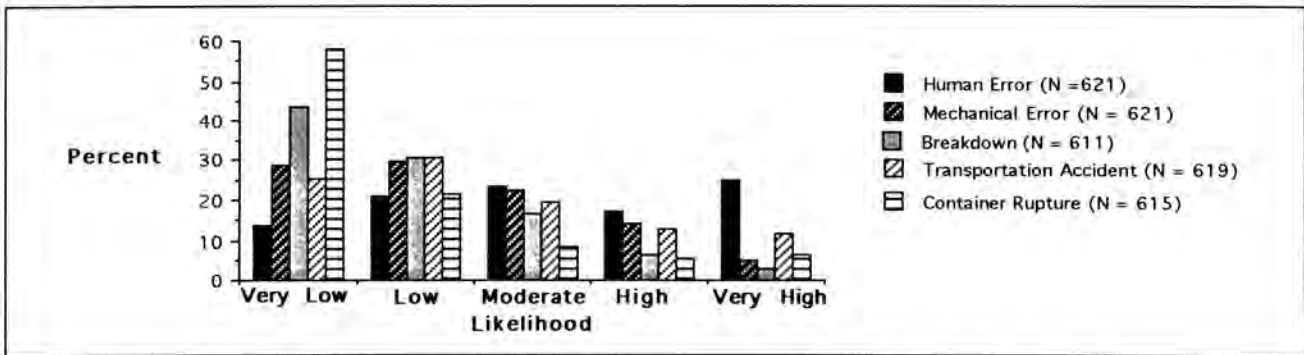


Fig. 10. Overall response to the likelihood that each will cause any release of radiation during the railway transportation of spent fuel.

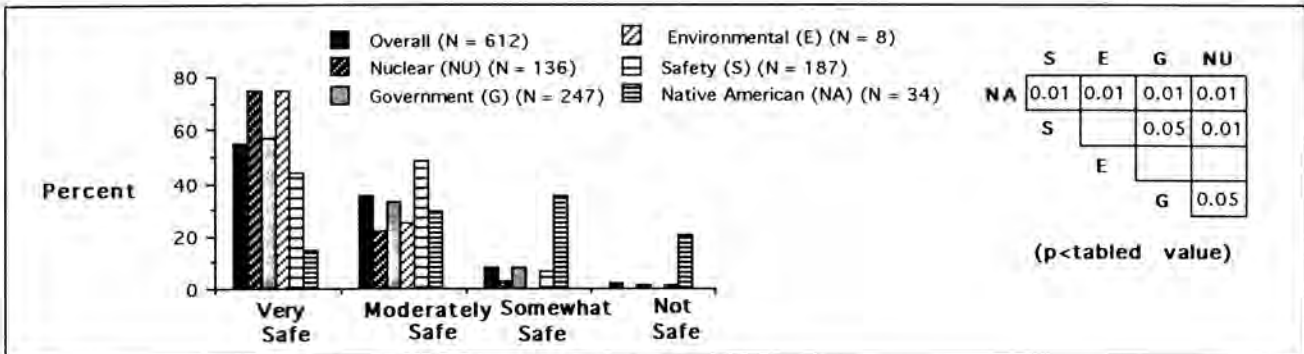


Fig. 11. Responses regarding the safety of special trains for shipping spent fuel.

government was demonstrated by the native Americans. Over 44% of the native American's reported that they would evacuate when further than 25 miles from the accident (See Fig. 17).

Attitudes Regarding Requirements for Shipping Spent Fuel

Although group attitudes toward the magnitude of risk and the confidence in government associated with the transportation of spent fuel often differed significantly, groups usually agreed about the requirements for the safe transportation of spent fuel presented in the survey. When asked to respond 'agree', 'tend to agree', 'tend to disagree' or 'disagree' to a number of statements about the requirements of the system, 81.5% of the respondents agreed that training should be offered to all local, state and federal employees that might

respond to a mishap; 85.2% agreed or tended to agree that drivers of spent fuel shipments should be paid a relatively high salary (rather than be paid by the shipment) to prevent the incentive to break motor vehicle laws; 96.5% agreed or tended to agree that drivers of spent fuel shipments should have access to information identifying hazardous areas along the route from state and regional agencies; and 74% agreed or tended to agree that a national safety program governing the movement of spent fuel would be better than regional or state wide programs (See Fig. 18). There were no significant differences between groups for any of the responses.

Survey recipients were also asked to respond 'agree', 'tend to agree', 'tend to disagree' or 'disagree' to several proposed requirements of casks containing spent fuel; respondents generally agreed that casks should be rigorously

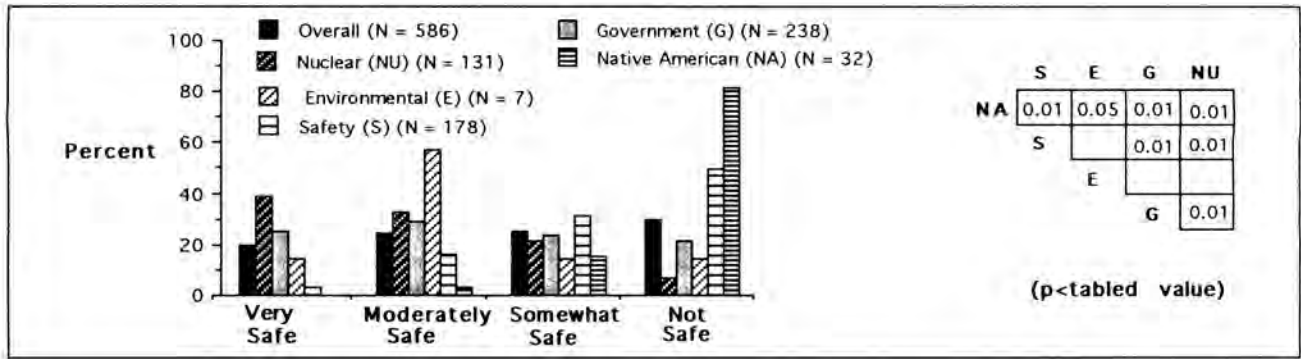


Fig. 12. Responses regarding the safety of overweight trucks for shipping spent fuel.

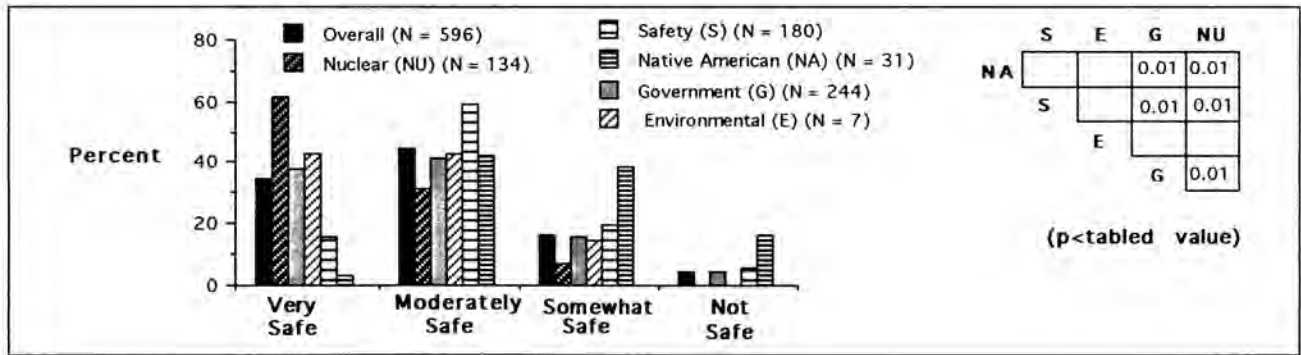


Fig. 13. Responses regarding the safety of legal weight trucks for shipping spent fuel.

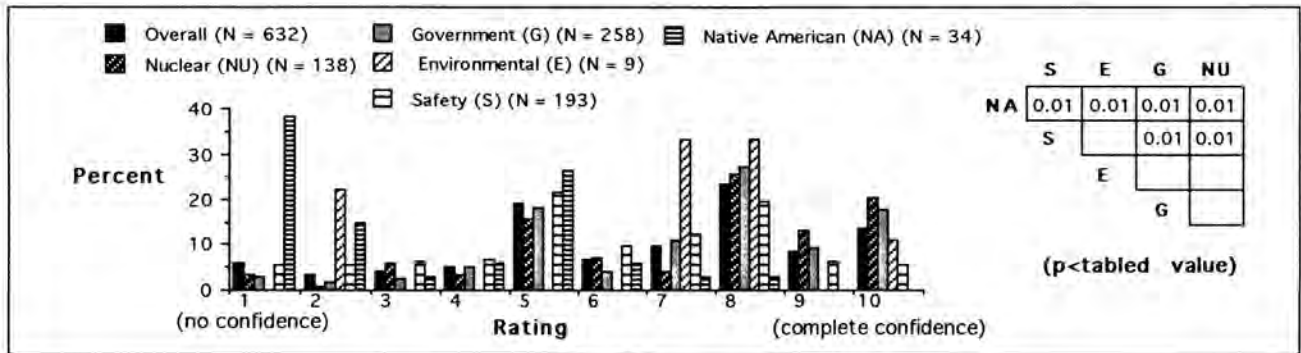


Fig. 14. Confidence that the Federal government will work to make the transportation of spent fuel safe.

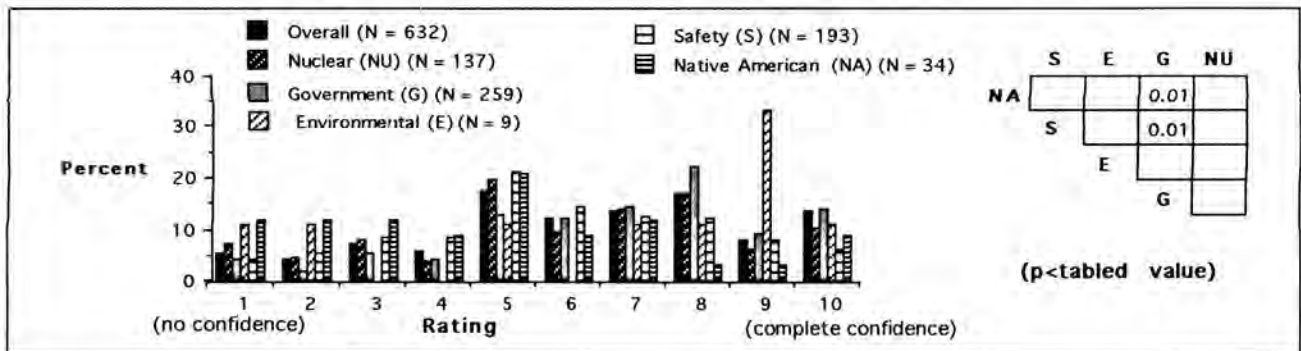


Fig. 15. Confidence that the State government will work to make the transportation of spent fuel safe.

tested. Eighty percent of the respondents agreed or tended to agree that all appropriate nondestructive testing techniques should be performed on cask features which are designed to prevent radioactive releases. Additionally, 70.9% of the respondents disagreed or tended to disagree with the statement that computer models are acceptable substitutions for destructive tests. The distribution of responses for both items are shown in Figs. 19 and 20.

CONCLUSIONS

Respondents generally found the perceived risks associated with the transportation of spent fuel to be relatively low but indicated low confidence in the government's ability to

reduce the risk of transportation of spent fuel. Respondents' lack of confidence was most evident in items regarding local governments. Additionally, group responses were often significantly different. Nuclear industry respondents usually rated the lowest perceived risk and the highest confidence in the government; native Americans rated the highest perceived risk and showed the least confidence in the government. However, the five groups generally agreed on the items about certain requirements for the safe transportation of spent fuel.

Other findings seem to have indicated that: human error is perceived to be a likely cause of a release of radiation during the transportation of spent fuel, legal weight trucks are perceived as being safer than non-legal weight trucks, special

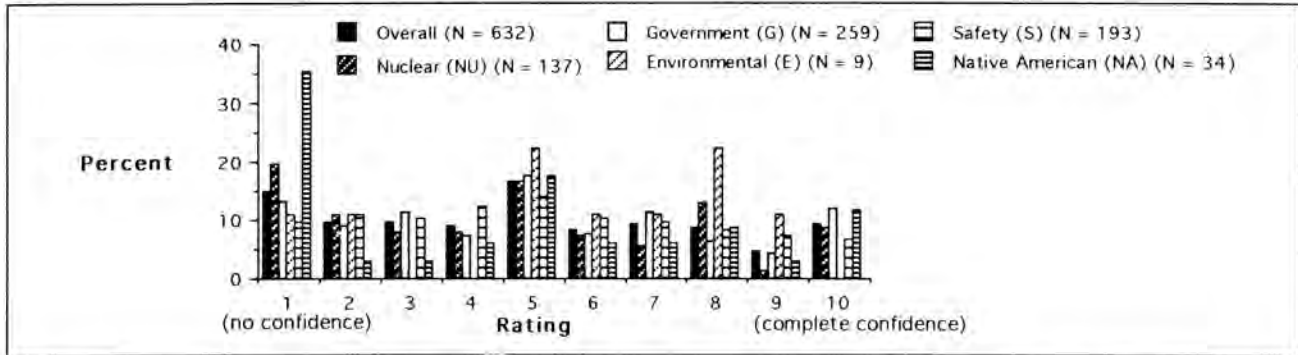
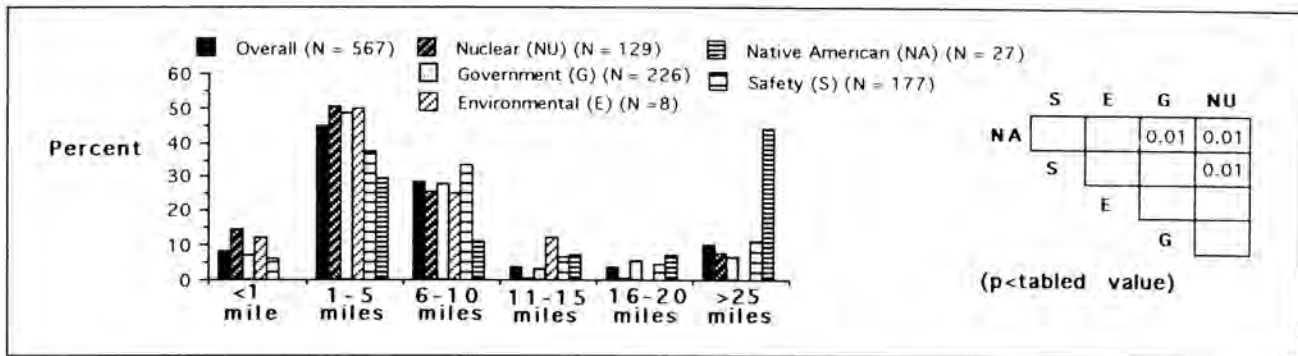


Fig. 16. Confidence that the local government will work to make the transportation of spent fuel safe (there were no significant group differences).



	S	E	G	NU
NA			0.01	0.01
S				0.01
E				
G				

(p < tabled value)

Fig. 17. Responses indicating the distance from a spent fuel accident that respondents would evacuate, given that local officials called for the evacuation of a five mile radius from the accident.

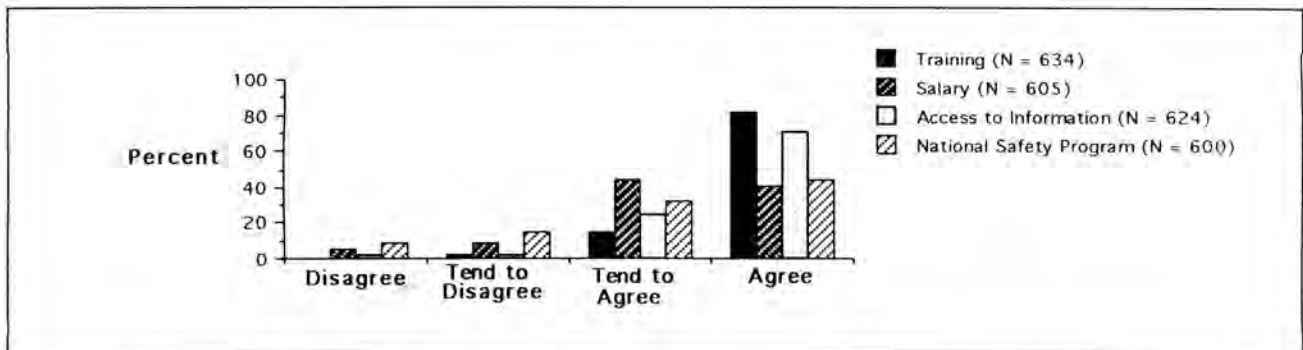


Fig. 18. Overall response to statements regarding the training of government groups, payment of drivers, access to information along spent fuel routes, and the development of a national safety program to govern the movement of spent fuel.

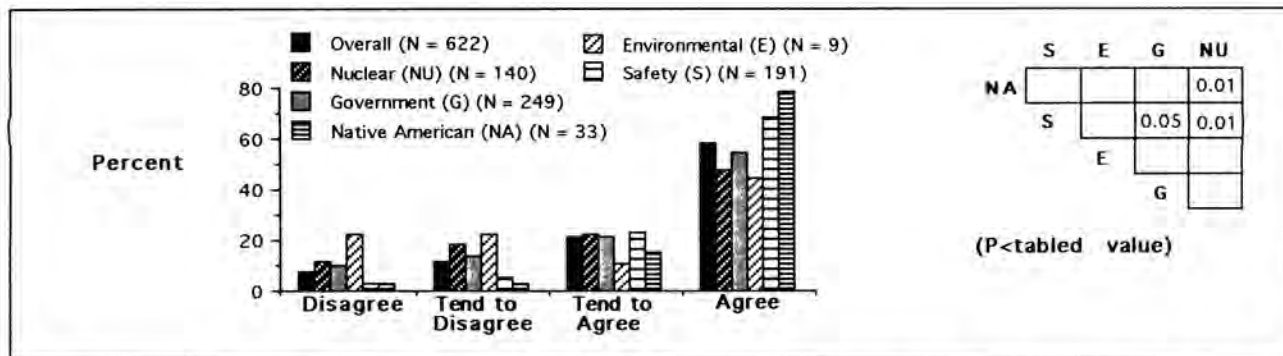


Fig. 19. Response to the statement "Before each shipment of spent fuels, all appropriate non-destructive techniques should be performed on cask features which are designed to prevent radioactive releases".

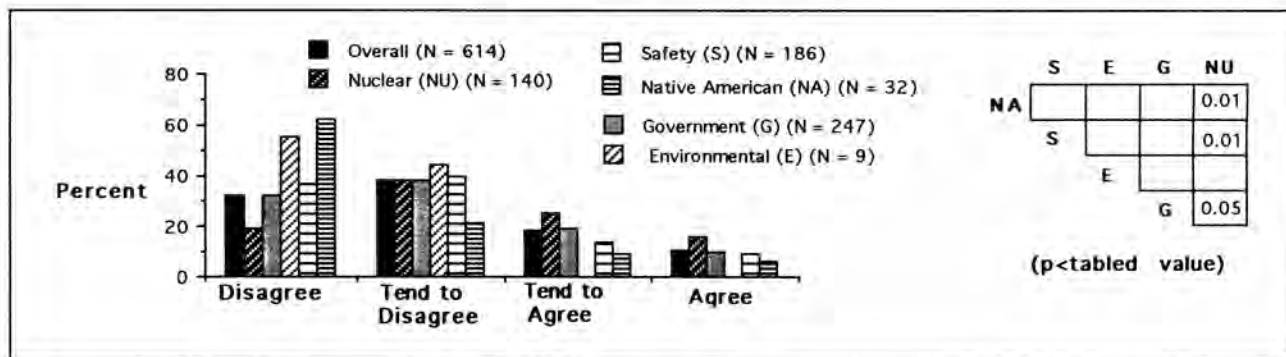


Fig. 20. Response to the statement "Destructive testing of casks should no longer be necessary, and computer models of these tests are acceptable substitutions for destructive tests".

trains are perceived as being safer than dedicated trains, the perceived risks of highway vs. railway transportation of spent fuel are approximately the same, and destructive cask testing is favored over computer modeling of cask testing.

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