

Agency Communication, Community Outrage, and Perception of Risk: Three Simulation Experiments

Peter M. Sandman,^{1,5} Paul M. Miller,² Branden B. Johnson,³ and Neil D. Weinstein⁴

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Three experimental studies were conducted employing hypothetical news stories to compare the effects on reader risk perceptions of two situations: when agency communication behavior was reported to be responsive to citizens' risk concerns, vs. when the agency was reported to be unresponsive. In the first two experiments, news stories of public meetings filled with distrust and controversy led to ratings indicating greater perceived risk than news stories reporting no distrust or controversy, even though the risk information was held constant. This effect appeared clearly when the differences in meeting tone were extreme and subjects made their ratings from their recall of the stories, but it was much weaker when the differences were moderate and subjects were allowed to go back over the news stories to help separate risk information from conflict information. In the third experiment, news stories about a spill cleanup systematically varied the seriousness of the spill, the amount of technical information provided in the story, and the agency behavior and resulting community outrage. The outrage manipulation significantly affected affective and cognitive components of perceived risk, but not hypothetical behavioral intentions. Seriousness and technical detail had very little effect on perceived risk.

KEY WORDS: Risk communication; risk perception; outrage.

1. INTRODUCTION

Risk assessment and risk management specialists generally agree that the principal standard for judging and regulating risks should be their relative seriousness—that is, the probability and magnitude of harm.

¹ 54 Gray Cliff Road, Newton Centre, Massachusetts 02159.

² Center for Environmental Communication, 122 Ryders Lane, Cook College, Rutgers University, New Brunswick, New Jersey 08903.

³ Division of Science and Research, New Jersey Department of Environmental Protection and Energy, CN-409, Trenton, New Jersey, 08625.

⁴ Department of Human Ecology, Cook College, Rutgers University, P.O. Box 231, New Brunswick, New Jersey 08903.

⁵ To whom all correspondence should be addressed.

As laypeople have become increasingly involved in risk decision making, however, they have reached very different judgments than the experts as to which risks most merit public concern and regulatory attention.

One explanation for these public-versus-expert risk controversies holds that they are due to the public's failure to understand the scientific data. They can thus be avoided by communicating technical information more effectively, especially via the mass media. This view is widely shared by technical experts, and is tacitly accepted by much research documenting the public's low "science literacy."⁶ But studies of the link between technical knowledge and support for controversial technologies show mixed results.⁽²⁻¹⁴⁾

⁶ See Miller⁽¹⁾, for example.

In stark contrast to the “knowledge breeds support” view is the argument advanced by Mazur that the more technical information the media provide about a risk controversy (e.g., nuclear power), the more concerned the audience will be, even if the information is thought by experts to be reassuring.^(15,16) Merely by mentioning potential problems, the coverage may make those problems seem more likely. A third possibility is that technical information in the mass media might interact with other attributes of the news story to affect risk perceptions. For example, technical detail might make a story more credible, thus heightening the alarm from an alarming story, while confirming the reassurance of a reassuring story. One test of this hypothesis found no such interaction; it also found no direct effect of technical detail on readers’ alarm or reassurance.⁽¹⁷⁾

A competing set of explanations for public-versus-expert risk conflicts holds that the public responds less to the seriousness of a risk (or its knowledge about seriousness as obtained from the media) than to such factors as trust, control, fairness, and courtesy. Sandman,^(18–20) Hance *et al.*,^(21,22) and Sandman *et al.*⁽²³⁾ have proposed the labels “hazard” and “outrage” to refer, respectively, to the technical and the nontechnical aspects of risk. Using different vocabulary, many others have also noted and studied the importance of these nontechnical aspects of risk perception, among them Kasperson,⁽²⁴⁾ Bord,⁽²⁵⁾ Krinsky and Plough,⁽²⁶⁾ Johnson,⁽²⁷⁾ Covello *et al.*,⁽²⁸⁾ Covello and Allen,⁽²⁹⁾ and Slovic.⁽³⁰⁾

In Sandman’s terminology, “hazard” is the product of risk magnitude and probability, while “outrage” is a function of whether people feel the authorities can be trusted, whether control over risk management is shared with affected communities, etc. Supporters of this distinction argue that hazard and outrage are both components of risk deserving attention, and that laypeople have had as little success communicating what they consider significant about risks to the experts as the experts have had communicating to the public. No matter how serious the risk is (in hazard terms), and no matter how much technical detail is used to explain it, this view maintains that the degree of *outrage* is likely to determine much of the public’s response to the risk.

The predominant strategy in much research on risk perception has been to ask people to rate the riskiness of an assortment of hazards, and then to rate the same hazards on several other attributes thought by the investigators to be related to risk perception. Factor analysis or other statistical analysis of the ratings then reveals relationships between risk perception and the hazard at-

tributes under investigation. This methodology omits the social context in which risk judgments are made, although we know that judgments about risk in the abstract can be very different from judgments about specific, personally relevant risk situations.^(5,31,32) Furthermore, when large numbers of risk ratings are factor-analyzed much can be learned about the sources of risk perception, but the imputation of causality is unjustified. Finally, some factors in risk perception, including important outrage variables, are so tied to situations that they simply cannot be studied from lists of hazards. Anecdotal discussions of agency–community and company–community interactions usually focus on such factors as trust, power-sharing, respect for community concerns, openness to community suggestions, and promptness and completeness in releasing risk information.⁷ Because they are not characteristics of the hazard itself, but rather of an agency’s or company’s approach to managing the hazard, most of these factors have been difficult to study via the riskiness-ratings methodology.

There are legitimate reasons, of course, why most studies of risk perception have not been experimental. (There are exceptions, of course; see Slovic.⁽³³⁾) We cannot experimentally manipulate the attributes of existing hazardous substances, activities, and technologies. Ethics and logistics prevent exposing people to hazards varied systematically by attribute—nor do the environmental problems facing communities cooperate by differing one attribute at a time.

Simulation is one way to take advantage of the inferential power provided by experimental research to study situational variables. In the three studies reported here, an effort was made to create hypothetical hazard situations realistic enough to elicit risk judgments like those that would occur with actual hazards. All three studies examine the same central hypothesis, that manipulation of the reported behavior (in a hypothetical news story) of the organization managing a risk controversy will lead to variations in subjects’ outrage, and therefore to variations in the perceived seriousness of the risk.⁸ In the third study, moreover, the outrage effect is experimentally compared with the effects of manipulating hazard

⁷ See for example Refs. 19–22.

⁸ Note that the term “outrage,” used strictly, should refer to the public’s *response* to a risk or to the behavior of risk managers; it should not refer to characteristics of the risk or the management behavior themselves. Nonetheless, throughout this paper the variations in reported agency behavior (open vs. secret, compassionate vs. contemptuous, etc.) will be referred to as the outrage manipulation.

seriousness and amount of technical information provided in the story.⁹

2. STUDY ONE¹⁰

2.1. Method

Two mock newspaper stories were written, each with two versions. One story dealt with barrels of chemicals discovered in a community; the other dealt with plans to build a hazardous waste incinerator. In each case a government agency (the state Department of Environmental Protection), rather than a corporation, was responsible for dealing with the issue. In one version of each story, the agency representative willingly shared information, encouraged community residents to form their own opinions, and acknowledged that there was some small risk. In the other version, the agency representative was unwilling to release some types of information, released other facts only after repeated questioning, and suggested that residents were silly to be concerned. Both versions of each story had the same information about the risk itself. The stories were presented in narrow (2 1/2-inch) newspaper columns, two columns to a page. The "barrels" stories were 72 lines long; the "incinerator" stories were 102 lines long.

The study questionnaire asked for judgments about the seriousness of the risk on a 6-point scale (1 = no risk at all; 6 = very serious risk). Next, it asked how trustworthy the agency spokesman seemed (1 = very trustworthy; 4 = not trustworthy at all) and whether the spokesman appeared to be withholding important information (1 = definitely is; 4 = definitely not). The fourth question presented a list of words describing how someone might feel if he or she lived in the community described: angry, helpless, frightened, safe, alarmed, relieved, concerned, pleased, confused, and annoyed. Subjects could choose as many items as they liked to describe how they

thought they would feel. Finally, the "incinerator" story questionnaire asked whether the facility should be built (1 = definitely yes; 4 = definitely not). Each questionnaire concluded with demographic items. Extensive pilot testing with college students and nonstudents ensured that none of the situations was viewed as presenting risks so high or so low that ceiling or floor effects would make it impossible to observe differences between versions.

Subjects were a cluster sample of adult residents of single-family homes in East Brunswick, New Jersey, a middle-income to upper-middle-income suburban community. Research assistants went door-to-door to recruit individuals. Only adults at least 18 years of age (one person per household) were eligible to participate. People who agreed were given two news stories, one on the "barrels" and one on the "incinerator," and a stamped envelope addressed to the "Environmental Information Project" at Rutgers University. All four combinations of the outrage manipulation were used: high on the first story and high on the second, high-low, low-high, and low-low. The two stories appeared in random order. Subjects were asked to read the stories and send back the questionnaire in the next day or two. In order to lower refusal rates, subjects' names and addresses were not requested. This meant, however, that reminders could not be used to increase response rates from those who agreed to take part.

2.2. Results

A volunteer was found in 83% of the houses visited where an eligible respondent was at home; 71% of these volunteers actually returned their questionnaires, yielding a net response rate of 59%. Nearly all of the 86 respondents (93%) owned their home. The sample was 57% male, 63% had completed a four-year college, and 12% belonged to an environmental group. The mean age was 44.2.¹¹

Analyses of variance in the data on seriousness, trustworthiness, and secrecy were done for each story separately, using the variables outrage (high or low) and story reading order (first or second). Emotion checklists were compared by Fisher's exact test. Story reading order showed no main effects or interactions with outrage, and is not discussed further. Table I shows the outrage manipulation results.

⁹ Both the notion that technical information in the media affects audience risk perception and the notion that media "outrage information" affects risk perception share a focus on how journalists approach risk controversies. The research literature on media coverage of risk is beyond the scope of this article. For a "manual" on how sources attempt to influence risk coverage, see Sandman *et al.* (34)

¹⁰ This study was conducted by Neil D. Weinstein and Peter M. Sandman. The assistance of Hannah Vo Dinh and Katherine Curcio in collecting the data is gratefully acknowledged. For a more complete analysis and copies of the materials and instrument, see Weinstein. (35)

¹¹ The study reported here was conducted simultaneously with a study assessing the effects on risk perception of individual vs. societal responsibility for a hazard and of existing vs. newly proposed hazards. Subjects received either one set of materials or the other at random. The data on response rate and demographics apply to the combined samples for the two studies.

Table I. Effect of Outrage Manipulation on Perceived Risk (Study One) ($N = 86$)

Response	Low outrage	High outrage	Significance ^a
“Barrels” Story			
Seriousness ^b	4.18	4.59	.08
Trust ^c	2.48	3.26	.0001
Secrecy ^d	2.41	1.48	.0001
Emotion checklist:			
Angry	42.5%	84.8%	.0001
Relieved	2.5%	0.0%	NS
Frightened	37.5%	52.2%	NS
Safe	0.0%	2.2%	NS
Alarmed	47.5%	65.2%	NS
Helpless	27.5%	43.5%	NS
Concerned	72.5%	67.4%	NS
Pleased	2.5%	0.0%	NS
Confused	10.0%	30.4%	.04
Annoyed	32.5%	58.7%	.02
“Incinerator” Story			
Seriousness ^b	3.19	3.44	NS
Trust ^c	2.02	2.54	.03
Secrecy ^d	2.46	2.37	NS
Build decision ^e	2.72	2.82	NS
Emotion checklist:			
Angry	19.0%	50.0%	.004
Relieved	14.3%	25.0%	NS
Frightened	26.2%	34.1%	NS
Safe	9.5%	9.1%	NS
Alarmed	33.3%	54.5%	.06
Helpless	7.1%	0.0%	NS
Concerned	81.0%	65.9%	NS
Pleased	4.8%	2.3%	NS
Confused	19.0%	18.2%	NS
Annoyed	19.0%	38.6%	.06

^a Probabilities are based on analysis of variance tests for means and on Fisher’s exact test for percentages.

^b 1 = No risk at all; 6 = very serious risk.

^c 1 = Very trustworthy; 4 = not trustworthy at all.

^d 1 = Definitely is withholding information; 4 = definitely is not.

^e 1 = Definitely should build; 4 = definitely should not.

The two “barrels” stories produced significantly different perceptions of agency trustworthiness and secrecy, as intended, as well as significant differences in anger, confusion, and annoyance. However, the perceived seriousness of the risk was only marginally greater in the high-outrage condition ($P < .08^{12}$). The “incinerator” stories were less successful in producing different ratings for trust, secrecy, and emotional responses, and yielded no significant difference in perceived seriousness.

Correlations between trust and perceived seriousness were .61 and .62 for the “barrels” and “incinerator” stories, respectively (P 's $< .0001$). Correlations between perceived agency secrecy and perceived seri-

ousness were .53 and .63 for the two stories (P 's $< .0001$). These high correlations suggest (but do not demonstrate) that a stronger manipulation of trust and secrecy might have had more impact on risk perception.

3. STUDY TWO¹³

The lack of a strong effect on risk perceptions in Study One was a surprise. Pilot tests had shown large differences in responses to the two story versions. Also, the strong correlations of perceived trustworthiness and secrecy with risk judgments suggested that agency (or corporate) actions that successfully build trust and show openness should strongly affect community risk perception. One likely explanation for the Study One results is that the experimental outrage manipulation—the difference between the two hypothetical news stories—was too small to show this impact clearly. Another possibility is that subjects adopted an atypically rational orientation to the task, looking back at the articles and noting only those sentences directly relevant to the risk. Both of these possibilities were addressed by the design used in Study Two.

3.1. Method

Subjects in Study Two were a cluster sample of 156 New Jersey residents who lived in Edison Township and in adjacent areas of Metuchen Borough and Woodbridge Township. These were primarily areas of single-family houses. If more than one person per household offered to take part when visited by a researcher, they were given different versions of the news story.

Only one story was used, a revision of the one dealing with barrels of chemical waste. This story was selected because it had been much more successful in creating different perceptions of trust and openness than the story about the incinerator.

The questions on perceived risk seriousness, agency trustworthiness, and withholding of information were unchanged from Study One. The checklist of emotions retained only the choices of angry, frightened, safe, concerned, annoyed, and alarmed.

The key change in procedure is that study participants were not permitted to review the story when answering the questions. Subjects were also asked to

¹² All statistical analyses reported in this paper were two-tailed.

¹³ This study was carried out by Patrick H. Bivona, David P. Cho, John D’Angelo, and Christine D. Garcia under the direction of Peter M. Sandman. For a more complete analysis and copies of the materials and instrument, see Ref. 35.

complete the questionnaire immediately instead of returning it by mail.

The story was revised to increase the differences between the two versions. In Study One, the two versions did not diverge until the third paragraph, and even then the differences required careful reading. In the excerpts in Display 1, the low-outrage condition is on the left.

The two versions used for Study Two (Display 2), by contrast, show their differences earlier and more obviously. Once again, the low-outrage condition is on the left.

Note that in Study One, “outrage” was operationalized solely in terms of agency communication behavior thought likely to generate an outraged response. In Study

Display 1.

State Says Hazwaste Barrels Not Health Risk

CANTERVILLE—Several hundred barrels of hazardous waste stored near Mill Road in Canterville pose little threat to public health, officials from the state Department of Environmental Protection said yesterday.

Although some of the barrels are leaking, DEP spokesperson Thomas Nicholas said the leaking materials would not contaminate nearby wells. The area where the leaking barrels are located has dense clay soil, Nicholas explained.

Nicholas spoke at a meeting of local citizens, organized by DEP to explain to the community about the contents of the barrels, the likely health effects, and the plans for cleaning up the site. . .

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DEP uncovered the barrels two years ago outside a plant abandoned in 1986 by its former owner, the ARC Chemical Company. But DEP did not announce its discovery at that time. The problem finally became public last week, when Councilwoman Gladys Smith told reporters about the leaking barrels. . .

Display 2.

DEP Helps Council Understand Problems of Waste Site

NEW FALLS, NJ—In a meeting organized by the Department of Environmental Protection and New Falls residents, a DEP official said that there was no serious danger from the leaking barrels found in the abandoned hazardous waste site near Main Street.

At the meeting, citizens were able to ask DEP what was going on at the site in an open forum format. Spokesperson Frank Doll started the meeting by assuring the residents that the leaking materials were safe.

“We have analyzed the chemicals and have found them to be a variety of industrial solvents and intermediate chemical products,” said Doll. “Most of them are similar to everyday laundry detergents and are safe.”

Doll passed out a list which contained the names of all the chemicals present. He also gave out a pamphlet which would help people understand what each chemical was used for.

Residents Still Uncertain About Status of Waste Site

NEW FALLS, NJ—Townpeople who attended last night’s council meeting left angry and confused even after a Department of Environmental Protection official said that there was no serious danger from the leaking barrels found in the hazardous waste site near Main Street.

Outraged citizens continuously asked spokesperson Frank Doll to release information about the barrels. He offered no definitive answers however, stating that they were no serious health threat and need not be worried about. The exact chemical composition of the materials inside the barrels is still unknown.

“We have analyzed the chemicals and have found them to be a variety of industrial solvents and intermediate chemical products,” said Doll. “Most of them are similar to everyday laundry detergents and are safe. We are not going to make the chemicals known because you probably wouldn’t understand them anyway.”

Two, by contrast, the high-outrage version also presented subjects with an explicitly outraged community, while the low-outrage version showed the community to be calm and cooperative. Study Two stories thus included two kinds of reported behavior: of the agency spokesperson and of neighborhood residents. (Such “person in the street” reactions to government statements are typical of news stories on environmental issues.) These two sets of behaviors may have joint, separate, or even offsetting effects on risk perception—but it is useful to determine whether outrage in general affects risk perception before designing studies to tease apart its constituents.

3.2. Results

Table II shows the Study Two results. The two versions produced almost totally different reactions. As desired, and as in Study One, the agency spokespeople were judged to be very different in trustworthiness and secrecy. Subjects were also more likely to express anger in the high-outrage condition than the low-outrage condition. More importantly, and unlike Study One, the manipulation had a powerful impact on subjects’ risk perceptions as well. When the agency was depicted as untrustworthy and secretive and the community was depicted as outraged, subjects rated the risk as much more serious and their responses to the risk as much more frightened and less safe. When the agency and community were depicted as mutually respectful and cooperative, on the other hand, subjects saw the risk as much less serious, and described their own reactions as con-

cerned rather than frightened or unsafe. Despite identical technical information about the risk, “outrageous” agency behavior and an outraged community strongly influenced perceived risk.¹⁴

4. STUDY THREE¹⁵

To clarify the impact of the outrage manipulation, Study Three manipulated three experimental variables: outrage, the seriousness of the risk itself, and the amount of technical detail provided in the news story. This article focuses on the results for the outrage manipulation; results for the technical detail manipulation are reported elsewhere.⁽³⁷⁾ Because Study Three was more elaborate than the two earlier studies, with a bigger sample and a more complex design, it will be discussed in more detail. To aid in the discussion, variable names appear in capital letters.

4.1. Method

4.1.1. Manipulations

The hypothetical news stories developed for this study focused on a spill of perchloroethylene (PERC) and the resulting response by the state Department of Environmental Protection. The story versions were developed in consultation with substantive specialists at the New Jersey Department of Environmental Protection. Care was taken to assure that the differences between the “low” and “high” treatments were great enough to

Table II. Effect of Outrage Manipulation on Perceived Risk (Study Two) (*N* = 156)

Response	Low outrage	High outrage	Significance ^a
Seriousness ^b	2.65	4.96	.0001
Trust ^c	1.77	3.22	.0001
Secrecy ^d	3.06	1.64	.0001
Emotion checklist:			
Angry	1.2%	68.0%	.0001
Frightened	2.6%	39.7%	.0001
Safe	24.4%	1.2%	.0002
Alarmed	2.6%	10.0%	NS
Concerned	69.2%	39.7%	.0004
Annoyed	20.5%	23.1%	NS

^a Probabilities are based on analysis of variance tests for means and on Fisher’s exact test for percentages.

^b 1 = No risk at all; 6 = very serious risk.

^c 1 = Very trustworthy; 4 = not trustworthy at all.

^d 1 = Definitely is withholding information; 4 = definitely is not.

¹⁴ It is of course possible that in the high-outrage condition readers were less inclined than in the low-outrage condition to believe the technical information provided by the agency. This replicates a familiar pattern in risk controversies, where the key technical information often comes from sources who are also managing the risk, and whose courtesy, compassion, openness, and the like may determine whether the technical information is accepted. A study in which the risk information came from neutral third parties would be useful.

¹⁵ This study was carried out by Peter M. Sandman, Paul M. Miller, and Branden B. Johnson. Grateful acknowledgement is made to: Caron Chess and Kandice L. Salomone, who provided critical assistance in the development of the news stories and the design and interpretation of two pilot studies; JoAnn M. Valenti, who assisted in the development of the news stories; Neil D. Weinstein, who advised on the development of the instruments; and Jennifer Field, who coordinated the data collection and data entry. An advisory committee at the New Jersey Department of Environmental Protection provided counsel on technical accuracy and realism in the depiction of agency behavior. For a more complete analysis and copies of the materials and instruments used, see Sandman and Miller.⁽³⁶⁾

fairly test the impact of each variable, but not so great as to be unrealistic in their simulation of agency, journalistic, or chemical behavior.

The seriousness manipulation varied the estimated toxicity of perchloroethylene, the estimated exposures resulting from the spill, and the number of people exposed. It is appropriate to multiply these sources of variation to get the overall difference in seriousness (not necessarily perceived seriousness) between the two treatments: The high-seriousness condition was about five orders of magnitude (a hundred thousand times) worse than the low-seriousness condition. The technical detail manipulation consisted of several additional paragraphs of information on exposure pathways and toxicological studies, absent in the low-technical detail condition and present in the high-technical detail condition.

The outrage manipulation was more extreme than in Study One, but much less extreme than in Study Two, with its arguably unrealistic depiction of agency behavior in the high-outrage condition. As in Study Two, reported community outrage, not just the agency spokesperson's behavior, was manipulated, but the manipulations were less extreme. Four typical paragraphs appear below; the low-outrage condition is on the left.

The study focused on two questions: the extent to which agency behavior and community outrage increase people's risk perception of low-risk events, and the extent to which technical detail decreases people's risk perception of low-risk events. The outrage and technical detail manipulations were presented at both low and high levels, in a 2 × 2 design, with seriousness kept low. In addition, a fifth high-seriousness condition was included (with outrage and technical detail both kept low) to as-

sess the magnitude of outrage and technical detail effects compared to seriousness effects.

4.1.2. Instrument

The instrument included 13 questions.¹⁶ One manipulation check was used for each of the three experimental variables. All were 6-point Likert-type items, with a seventh option of "no opinion." For SERIOUS RISK (the check on the seriousness manipulation), subjects were asked: "What is your impression of how serious this situation is?" For PERCEIVED DETAIL (the check on the technical detail manipulation), they were asked: "How detailed was the information in the story about the health effects of the PERC spill and the ways people might get exposed?" For PERCEIVED APPROPRIATENESS (the check on the outrage manipulation), they were asked, "How appropriate was DEP's handling of the PERC spill?"

Three response measures were used to assess perceived risk—one affective, one cognitive, and one behavioral. Once again, 6-point Likert-type scales were used, with a "no opinion" option as well. Subjects were asked: "If you lived in the area, how worried would you be about the risk from the PERC spill?" (WORRY);

¹⁶ Two pilot studies were conducted, using student subjects and only two versions of the story (high-high-high and low-low-low). Results of the pilot studies led to changes in the text of the story, in the conceptualization of the independent variables, and in the measurement of both independent and dependent variables. For a complete discussion of the pilot study methods and findings, see Ref. 36, pp. 15-41.

Display 3.

"We will certainly want to take another look at the regulations," Chester said. "Perhaps the agency should consider tougher standards for lightning protection."

Chester said DEP would be developing plans to test area wells for PERC. "At this point I wouldn't really expect any wells to be seriously contaminated," Chester said. "But we still want to test to be sure."

Clara Stevenson, whose home is the closest one to the site of the spill, said she was "impressed" by DEP's promise to test her well. "I'm much less upset now that I have talked to the DEP people," she said.

"Soon after I woke up there was a DEP person at my door explaining what happened and what the clean-up crews were doing," said Maple Ridge resident Alex Sands.

"It looks like a fluke to me," Chester said. "As far as I know, DEP has no plans to re-examine the regulations. You can't cover every conceivable event."

Chester said DEP had no plans to test area wells for PERC. "At this point I wouldn't really expect any wells to be seriously contaminated," Chester said. "People who want to be sure will have to make their own arrangements."

Clara Stevenson, whose home is the closest one to the site of the spill, said she was "furious" about DEP's unwillingness to test her well. "My whole family is upset and the DEP people just don't seem to care," she said.

"I have no idea what happened or what they're doing about it, and nobody from DEP is taking the time to tell me," said Maple Ridge resident Alex Sands.

“How important do you consider the risk posed by this situation?” (IMPORTANT RISK); and “If you lived in the area, how willing would you be to spend \$500 to have your water tested for PERC after the spill?” (INTENTION TO TEST).

WORRY and IMPORTANT RISK correlated + .72, but the correlations between WORRY and INTENTION TO TEST and between IMPORTANT RISK and INTENTION TO TEST were both only + .21, statistically significant but small. Although SERIOUS RISK was originally conceived as a check on the seriousness manipulation, correlations between SERIOUS RISK and WORRY and between SERIOUS RISK and IMPORTANT RISK were + .65 and + .67, respectively. WORRY, IMPORTANT RISK, and SERIOUS RISK were therefore collapsed into a single index variable called PERCEIVED RISK, with INTENTION TO TEST, the behavioral measure, kept separate. Combining WORRY, IMPORTANT RISK, and SERIOUS RISK into a composite index provided a more reliable (coefficient $\alpha = .78$) and therefore more sensitive response measure.

Two pilot studies for Study Three (using university student subjects and just the high-high-high and low-low-low treatments) had shown that a general measure of risk aversion was significantly related to the risk perception response measures, and that use of risk aversion as a covariate improved the sensitivity of the analysis. Four items developed by Weinstein^(31,38) were therefore included to assess subjects' risk aversion. Each item consisted of a statement about environmental risk with which subjects were asked to rate their agreement or disagreement on 7-point Likert-type scales. Choices ranged from very strongly disagree to very strongly agree; statements were phrased so that low ratings indicated acceptance of risks and high ratings indicated risk aversion.

As in Weinstein's studies,^(31,38) two dimensions of risk aversion—SOCIAL RISK AVERSION and PERSONAL RISK AVERSION—were assessed, using two items each. A risk aversion score was derived for each dimension by adding the ratings for the two items measuring that dimension. The SOCIAL RISK AVERSION items asked subjects about their agreement with two statements: “The public has the right to demand zero pollution from industry” and “An industry that pollutes should not be allowed to stay open, no matter how little pollution it produces.” The PERSONAL RISK AVERSION items measured people's agreement with two statements: “If there was even the slightest amount of asbestos in my home, I would remove it” and “I try to avoid all food additives and preservatives.” Although the two risk aversion variables turned out to have a + .54 correlation, their correlations with other variables in the

study had quite different patterns, justifying the decision to keep them separate.

Data on three demographic variables, SEX, AGE, and EDUCATION, were also collected.

4.1.3. Subjects and Procedures

Subjects were 595 New Jersey residents over 18 years old from middle-income residential areas in Middlesex county. An additional 81 questionnaires were unusable because of incomplete responses on the dependent measures.

Using a prepared script, trained interviewers obtained a cluster sample, canvassing every home in an identified area. To make sure the sample was balanced by age and sex, interviewers alternated the type of subject asked for at the door between oldest/youngest (over 18) and male/female. Half of the subjects received the story, then the six-item survey instrument, and finally the risk aversion/demographic questionnaire; the other half received the risk aversion/demographic questionnaire first, then the story, then the survey instrument. No order effects were found, and this variable will not be discussed further. All subjects were asked to return the story before receiving the survey, to prevent them from rereading the story in search of the “right” answers.

4.2. Results

4.2.1. Effects of Outrage

Table III shows results for the outrage variable. The outrage manipulation was successful. Subjects who read high-outrage news stories saw agency behavior as much less appropriate than subjects who read low-outrage stories; the difference was more than a scale point on the 6-point scale, significant at $P < .0001$.¹⁷ OUTRAGE correlated with PERCEIVED APPROPRIATENESS at .41 ($P < .0001$).

As predicted, outrage had a significant, if small, effect on PERCEIVED RISK ($P < .01$).¹⁸ Subjects who

¹⁷ Cohen⁽³⁹⁾ and Cohen and Cohen⁽⁴⁰⁾ note that the size of an effect can be measured by dividing the difference between the means by the standard deviation; they suggest the convention that a quotient of .2 represents a small effect, .5 is a medium effect, and .8 is a large effect. By this standard, the effect of the outrage manipulation on PERCEIVED APPROPRIATENESS is large.

¹⁸ By the standard suggested by Cohen⁽³⁹⁾ and Cohen and Cohen⁽⁴⁰⁾ (described in the previous note), this effect is small.

Table III. Response Measure Means, Standard Deviations, and Significance Tests for Mean Differences Between Outrage Conditions (Study Three)

Variable	Outrage		Mean difference	F-value significance
	Low	High		
Perceived risk				
(Mean)	13.42	14.18	0.76	F(1,495) = 6.99
(SD)	3.30	3.06		—**
(N)	254	245		
Intention to test				
(Mean)	3.16	3.36	0.20	F(1,469) = 1.51
(SD)	1.77	1.81		NS
(N)	240	233		
Perceived appropriateness				
(Mean)	3.71	2.50	-1.21	F(1,495) = 99.79
(SD)	1.28	1.42		—****
(N)	254	245		
Perceived detail				
(Mean)	3.69	3.30	-0.39	F(1,495) = 10.61
(SD)	1.25	1.39		—**
(N)	254	245		

* $P < .05$; ** $P < .01$; *** $P < .001$; **** $P < .0001$.

read high-outrage stories saw the risk as more important, serious, and worrisome than did those who read low-outrage stories. Outrage did not significantly affect INTENTION TO TEST, however.

An interesting and unexpected finding was the small but significant effect of outrage on PERCEIVED DETAIL.¹⁹ Subjects who read high-outrage stories judged that they had significantly less technical detail than subjects who read low-outrage stories ($P < .01$). As we shall see, the *actual* amount of technical detail in the stories had no significant effect on PERCEIVED DETAIL. This suggests that if an agency or company behaves satisfactorily otherwise, people tend to judge that it is providing enough information as well, while if its behavior is improper or offensive the information given is more likely to be thought insufficient. Perhaps “outrageous” agency behavior makes people distrust the technical detail coming from the agency, or distracts them from the detail actually present, or makes them require more detail than they would have required had agency behavior been more responsive.

4.2.2. Effects of Technical Detail

No significant effects of the technical detail manipulation were found for any dependent measure. (Indeed,

¹⁹ This effect, too, would be considered small by the standard of the two previous notes.

technical detail had no significant correlations with any other variable in the study.) Even the manipulation check, PERCEIVED DETAIL, showed no effect. This is consistent with the findings of the two pilot studies, where subjects saw some individual paragraphs as more detailed in the “high” condition than in the “low” condition, but saw no differences in detail, clarity, or informativeness between the overall news stories.

The technical detail manipulation was intentionally kept within the range of journalistic possibility. More extreme variations might be more visible to readers, and have more impact on their risk perceptions. (And more extreme variations are feasible in other formats, such as brochures or interpersonal interactions.) But within the range tested, variation in technical detail had no effect on PERCEIVED RISK, INTENTION TO TEST, or even PERCEIVED DETAIL.²⁰

4.2.3. Effects of Seriousness

In four of the five cells in this study, the “objective” level of risk seriousness was quite low. To test whether subjects had greater PERCEIVED RISK and greater INTENTION TO TEST when objective risk was greater, a fifth cell was included with low outrage and low technical detail, but much higher seriousness. Analysis of this fifth cell compared it to the low-outrage, low-technical detail, low-seriousness cell.

Mean ratings for SERIOUS RISK were marginally higher in the high-seriousness condition than in the low-seriousness condition (the difference between the means was less than a third of a standard deviation, $P < .05$).²¹ The manipulation worked, in other words, but just barely; subjects who read a news story reporting a substantially more serious risk perceived it to be slightly more serious than those who read the low-risk news story. Note that subjects in the two pilot studies accurately reported exposure, toxicity, and related factors to be higher when they were in fact higher (P 's $< .0001$). Thus, the small effect of manipulated seriousness on perceived seriousness probably is not due to any failure to detect the manipulation. Rather, people apparently see the seriousness of a risk as more than the outcome of such factors as exposure and toxicity. The high correlations of SERIOUS RISK with WORRY and IMPORTANT RISK, which led to its inclusion in the PERCEIVED RISK composite index variable, underscore the point. The se-

²⁰ See Ref. 37 for a fuller discussion of alternative hypotheses and research topics on technical detail.

²¹ See note 17.

riousness manipulation had no effect on WORRY, IMPORTANT RISK, or PERCEIVED RISK, nor on INTENTION TO TEST.

Mean ratings of PERCEIVED APPROPRIATENESS were somewhat lower in the high-seriousness than in the low-seriousness condition, a result also significant at $P < .05$. In other words, when the risk reported was more serious, subjects saw the agency's behavior as less appropriate than when the risk was lower. Though this finding was not predicted, it is not surprising that people should expect more from the agency when the risk is more serious, and thus find the same agency behavior less acceptable in the high-seriousness condition.²² The objective risk, in short, has less effect on the public's perception of risk than it has on the public's perception of agency response.

4.2.4. Regression Analyses of the Response Variables

Regression analyses were run for PERCEIVED RISK and INTENTION TO TEST, using data from the 2×2 study (excluding the fifth cell testing the SERIOUSNESS manipulation). Results of both analyses appear in Table IV.

Both models found significant multiple correlations between response measures and predictor variables, with the strongest relationship for PERCEIVED RISK (adjusted $R^2 = .25$, $P < .0001$). This is not a strong relationship; clearly many factors other than those measured in this study affect PERCEIVED RISK. The relationship for INTENTION TO TEST was still weaker (adjusted $R^2 = .14$, $P < .0001$).

The patterns of prediction were substantially different. For PERCEIVED RISK, the strongest predictor in terms of uniquely contributed variance was SOCIETAL RISK AVERSION (about 7% of the variance, $P < .001$), followed by PERCEIVED APPROPRIATENESS (4% of the variance, $P < .001$).²³ The higher the SOCIETAL RISK AVERSION and perceived outrage (lower PERCEIVED APPROPRIATENESS of the agency

response), the higher was the PERCEIVED RISK. In addition, higher PERCEIVED RISK was associated with significantly higher PERCEIVED DETAIL, lower EDUCATION, and female rather than male subjects.

Neither OUTRAGE nor TECHNICAL DETAIL made a significant unique contribution to the variance in PERCEIVED RISK, although their respective manipulation checks, PERCEIVED APPROPRIATENESS and PERCEIVED DETAIL, did. When the two manipulation checks were dropped from the regression analysis, TECHNICAL DETAIL still had no significant unique effect on PERCEIVED RISK. But OUTRAGE then was a significant predictor ($P < .05$), with a regression coefficient of .10, accounting uniquely for just under 1% of the variance.

For the INTENTION TO TEST variable, only three predictors made significant unique contributions: EDUCATION (7% of the variance, $P < .0001$), PERSONAL RISK AVERSION (3% of the variance, $P < .0001$), and PERCEIVED RISK (2% of the variance, $P < .01$). The more educated and the more averse to personal risk-taking individuals were, the greater their inclination to test.²⁴ In addition, those who saw the risk in the story as more serious, important, and worrisome (the three components of the PERCEIVED RISK composite index variable) were more inclined to test.

5. DISCUSSION

The three studies reported here show that the outrage variable has a significant but not overwhelming effect on risk perception.

Study One found a very weak relationship for one news story and none for the other. But the sample was small, the dependent variable was a single question, and the differences between the stories were subtle. There

²² There was no high-seriousness high-outrage condition in the study reported here, so it is impossible to determine whether there is an interaction effect of seriousness and outrage. It is conceivable that the failure to prevent a serious risk is seen by many people as inappropriate and outrageous agency performance by definition. Even if the agency handles a high-risk incident superbly, the mere fact that the incident occurred may lead to low PERCEIVED APPROPRIATENESS; this would constitute, in essence, a floor for outrage when seriousness is high.

²³ The unique proportion of variance accounted for by each independent variable was computed from standardized partial regression weights using the formula provided in Cohen and Cohen,⁽⁴⁰⁾ p. 483.

²⁴ It is interesting that SOCIETAL RISK AVERSION was so closely connected to PERCEIVED RISK, while PERSONAL RISK AVERSION played an important role in INTENTION TO TEST. Considering an environmental risk serious, important, and worrisome is apparently tied to values such as corporate environmental accountability. Actually intending to do something about the risk, however, seems to have a closer tie to other self-protective behaviors, such as avoiding food additives and cleaning up home asbestos. To some extent self-protective behavior may be a personal characteristic that cuts across the many distinctions among risks. Radon research, for example, has found a stronger relationship between radon testing and personal risk aversion than between radon testing and societal risk aversion—or, indeed, between radon testing and radon knowledge.⁽⁴¹⁾ See also Wildavsky and Dake⁽⁴²⁾ for a finding that people with "egalitarian" views were societally more risk-averse than others, but personally tended to be risk-takers.

Table IV. Standardized Regression Coefficients and Significance Tests for Models Predicting Perceived Risk and Intention to Test (Study Three)

Overall model tests				
Response measure	Adjusted squared multiple correlation		F-value	Significance
Perceived risk	0.25		$F(9475) = 19.14$	—****
Intention to test	0.14		$F(10,449) = 8.69$	—****
Unique Contribution Tests				
Test	Standard regression coefficient	Unique variance	F-value	Significance
<u>Perceived risk</u>				
Age	-0.04	0.00	$F(1475) = 0.82$	NS
Education	-0.11	0.01	$F(1475) = 8.01$	—**
Sex	0.12	0.01	$F(1475) = 8.89$	—**
Societal risk aversion	0.32	0.07	$F(1475) = 45.37$	—***
Personal risk aversion	0.07	0.00	$F(1475) = 1.82$	NS
Perceived appropriateness	-0.23	0.04	$F(1475) = 23.65$	—***
Perceived detail	0.15	0.02	$F(1475) = 11.15$	—***
Outrage	0.02	0.00	$F(1475) = 0.21$	NS
Technical detail	-0.02	0.00	$F(1475) = 0.31$	NS
<u>Intention to test</u>				
Age	-0.05	0.00	$F(1448) = 1.43$	NS
Education	0.27	0.07	$F(1448) = 35.91$	—****
Sex	-0.03	0.00	$F(1448) = 0.34$	NS
Societal risk aversion	0.02	0.00	$F(1448) = 0.17$	NS
Personal risk aversion	0.22	0.03	$F(1448) = 17.16$	—****
Perceived appropriateness	-0.05	0.00	$F(1448) = 0.79$	NS
Perceived detail	0.03	0.00	$F(1448) = 0.41$	NS
Perceived risk	0.15	0.02	$F(1448) = 8.44$	—**
Outrage	0.03	0.00	$F(1448) = 0.50$	NS
Technical detail	-0.01	0.00	$F(1448) = 0.01$	NS

* $P < .05$; ** $P < .01$; *** $P < .001$; **** $P < .0001$.

was a strong correlation for both stories between perceived agency trustworthiness and secrecy and the perceived seriousness of the risk. But the outrage manipulation did not strongly affect perceived trustworthiness and secrecy. In Study Two, the sample was larger and the story differences much more extreme. In addition, subjects were not permitted to review the story to determine their answers. Strong relationships emerged between the experimental outrage manipulation and perceived seriousness.

Study Three had a much larger sample and a much more sensitive design, with risk aversion as a covariate

and a 3-item index of perceived risk (seriousness, worry, importance). The stories were less obviously different than in the second study, but more so than in the first. Here the outrage manipulation significantly affected perceived risk, though not the one-item measure of intention to test. By contrast, a seriousness manipulation of roughly five orders of magnitude barely affected perceived seriousness and did not affect other components of perceived risk. And experimental manipulation of the amount of technical detail in the story did not significantly affect any dependent variables.

Among the three variables examined in these

studies, in other words, outrage was the most powerful in its impact on risk perception. The studies suggest that an agency or company that deals responsively, openly, and respectfully with concerned citizens, and succeeds in avoiding hostile public reactions, is likely to reduce risk perceptions by doing so—much more than by providing technical information or even by reducing the technical risk by several orders of magnitude.

Nonetheless, the regression analysis in Study Three shows that outrage is a significant but by no means a strong predictor of risk perception, much less of self-protective behavior. Education, sex, and risk aversion—all factors beyond the control of the agency or corporate communicator—are more potent still. And all the factors assessed in the research reported here together accounted for relatively small percentages of the variance in perceived risk, and still smaller percentages of the variance in behavioral intentions. Clearly, many other factors, as yet unknown, are at work.

In fact, the outrage manipulation was not significantly related to perceived risk in the regression analysis except when perceived appropriateness was omitted. Whether people *consider* an agency's or a company's behavior outrageous seems to matter a good deal in risk perception. How closely the public's view of agency behavior tracks actual agency–community interactions remains to be determined.

The use of hypothetical news stories adds three more caveats. Study Three compared effects of outrage as reflected in news stories with technical detail as given in news stories. Other, more personal vehicles might work very differently. People who attend a public meeting, receive an informational brochure, or telephone an agency with questions can acquire far more technical detail than the few extra paragraphs of the high-technical detail condition in Study Three—and they acquire it in a very different setting. Similarly, each of these settings might convey agency responsiveness or unresponsiveness and community acceptance or outrage very differently. The effects of outrage *vis-à-vis* technical detail and other variables need to be studied in contexts other than newspaper journalism.

The second caveat concerns the fact that the news stories in all three studies were hypothetical. Subjects were asked to imagine that the stories had appeared in their local newspapers and that their own communities were faced with the situations described. It is impossible to say how realistic subjects found these simulations and how realistically they responded to them. It seems likely that the effects of outrage on risk perception were suppressed by the hypothetical nature of

the study, while the effects of seriousness and technical detail were more likely augmented—that is, we would expect subjects to be more attentive to data and less liable to outrage in these studies than they would be in a real situation. But no research findings back this supposition.

Finally, real community hazard situations develop over days, months, or even years; the simulations compress these histories into written materials that take only a few minutes to read. Once again, we consider it likely that the distortion is conservative, that prolonged exposure to a risk controversy makes people more responsive to outrage and less responsive to seriousness and technical detail than they were in this research. Yet no studies demonstrate or dispute this point either.

Note also that the research reported here treats outrage as a single variable, though it is in fact a cluster of related—and perhaps not so closely related—variables.²⁵ Among the factors varied in the hypothetical news stories were agency secretiveness/openness, agency courtesy/contemptuousness, agency responsiveness/unresponsiveness to community input, etc. In Study Two and Study Three, the community's reported response (angry, suspicious, and frightened or grateful, trusting, and calm) was also varied. These factors are all conceptually distinguishable from one another. Furthermore, Sandman and colleagues have applied the term “outrage” to a far wider range of variables, including less interactional ones like voluntariness, familiarity, dread, and the like.⁽¹⁸⁻²²⁾ To develop a powerful explanatory model of the effects of outrage on risk perception, these variables must be teased apart experimentally (not just through factor analysis of survey data) to measure their effects independently.

Nonetheless, the evidence so far suggests strongly that the outrage cluster (communicator behavior, community response, and the communicator–community interaction) has a substantial impact on people's perception of risk. As government agencies and corporations struggle to reassure communities about risks that represent small threats to health and environmental quality, much that determines the public response is beyond the risk manager's control: risk aversion, demographics, etc. But how risk managers interact with communities is very much in their control. Further research is needed to guide

²⁵ Note that seriousness and technical detail are also clusters. Seriousness, for example, includes probability, magnitude, exposure, etc. Technical detail includes various sorts of content (detail on exposure, toxicity, epidemiology, etc.), as well as variations in tone, clarity, and the like. See Ref. 37.

this interaction, to help risk managers avoid exacerbating outrage in the public's response to low-consequence hazards.

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