

Dated: January 22, 1988

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

before the

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)

PUBLIC SERVICE COMPANY)
OF NEW HAMPSHIRE, ET AL.)

(Seabrook Station, Units 1)
and 2))

Docket Nos. 50-443-OL
50-444-OL

(Offsite Emergency
Planning Issues)

APPLICANTS' REBUTTAL TESTIMONY NO. 5

(Rebuttal to the Testimony of Dr. Avishai Ceder
and Dr. Albert E. Luloff Regarding Panic)

Witness: Dennis S. Mileti

It is a widespread myth that panic occurs in mass emergencies. Members of the public do not panic in emergencies of the type considered in this hearing; that is, emergencies that involve community or neighborhood. However, it is true that most people believe that panic occurs in all sorts of emergency. This myth is perpetuated by, for example, Hollywood movies that have "panic" in their scripts. Hollywood and most people, however, are simply wrong. Panic in mass emergencies is a characteristic of science fiction and not scientific fact.

Those scholars who were pioneers in the research of

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emergencies and disasters began their work expecting to discover public panic; they were surprised at not finding panic in the disasters which they investigated. These researchers, for example, include Robert Kutak, "The Sociology of Crisis; Lewisville Flood of 1937," Social Forces 17: 66-72, 1938; Enrico Quarantelli, "The Nature and Conditions of Panic", American Journal of Sociology 60: 26-27, 1954; Charles Fritz and Eli Marks, "The NORC Studies of Human Behavior and Disaster," Journal of Social Issues X(3): 26-41, 1954; William Form and Sigmund Nosow, Community in Disaster. New York: Harper, 1958 and Samuel Prince, who in 1920 completed his doctoral dissertation, "Catastrophe and Social Change, Based Upon a Sociological Study of the Halifax Disaster", at Columbia University on a human-made disaster.

Subsequent investigations of more contemporary emergencies and disasters have provided additional evidence on panic. Enrico Quarantelli has performed an elaborate analysis of panic. His now classic work on the topic was published as "The Nature and Conditions of Panic", American Journal of Sociology 60: 267-275, 1954 and "The Behavior of Panic Participants" Sociology and Human Research 41: 187-194, 1957. In 1964 he wrote a chapter titled "The Behavior of Panic Participants," pages 69-81 in D. P. Schultz (Ed.), Panic Behavior, New York: Random House, in which he offers several conclusions about panic. The panic participant: (1) "acts in a nonsocial manner in his flight behavior" (page

78), (2) "perceives a specific threat to physical survival" (page 73), (3) "is future-threat rather than post-danger orientated" (page 74), (4) "is nonrational in his flight behavior" (page 76), (5) is relatively aware of his activities" (page 75), and (6) is acutely self-conscious and fearful" (page 75). In addition, in 1975, Dennis Mileti, Thomas Drabek and J. Eugene Haas wrote a monograph titled Human Systems in Extreme Environment. Boulder, Colorado: Institute of Behavioral Science. That text (page 58) attempted to define the conditions or determinants of panic in emergencies, concluding that three conditions were critical for panic to occur: (1) a person perceives that a specific threat to his "physical survival" is imminent and, as a result of this situational perception, that person becomes fearful of his physical survival; (2) there are escape routes that, if traversed, are perceived as being able to offer "safety"; and (3) those escape routes are seen to be blocked or closing off such that they cannot be traversed.

The determinants of panic need not result in panic. History provides examples of when these conditions have existed, but panic did not occur; for example, these conditions have prevailed on sinking ships, yet stories by survivors indicate panic did not occur. However, these determinants must exist for panic to arise. These determinants would not exist in an evacuation from the areas around a nuclear power plant such as Seabrook, because people

would be leaving an open geographic area (rather than, for example a closed building) and their escape would not be blocked. The prototypical case in which the determinants (sufficient but not necessary) of panic occur is, for example, a major fire in a crowded theater or nightclub. These conditions do not prevail as potential characteristics in a vehicle evacuation. As a widely-cited study of evacuation prepared by Joseph Hans and Thomas Sells for the Environmental Protection Agency summed it up (see Joseph Hans and Thomas Sells. 1974. Evacuation Risk an Evaluation Washington, D.C.: Environmental Protection Agency, pages 43, 45, and 54): (1) many studies in the United States and in other countries of public reaction in emergencies have essentially dispelled the myth of panic, (2) the idea that people panic in emergencies and disasters is widespread; however, it is not borne out in reality; and (3) neither panic nor hysteria has been observed during evacuations.

An additional point about panic is worth making. Even people who over-perceive the risk or hazard present in an emergency, and who evacuate unnecessarily as a result, act in quite controlled and adaptive ways that are rationally consistent with their situational perceptions of risk. The notion that overreaction is not panic, hysteria, or aberrant behavior is borne out by studies of how people respond in actual emergencies. For example, Dennis Mileti, Donald Hartsough and Patti Madson wrote a report entitled The Three

Mile Island Incident; A Study of Behavioral Indicators of Human Stress in 1982. In this work they examined the frequency of automobile accident rates before, during, and after the Three Mile Island accident. They concluded that there was not evidence to suggest that accidents increased during the evacuation despite the fact automobile travel in the area was likely up because of evacuation. If the 141,500 "overresponders" at TMI were panic-stricken, hysterical or the like, surely traffic accidents during evacuation would have shown some decisive increase. In fact, the rate of traffic accidents were for all practical purposes the same as if no emergency were occurring. Additionally, the research of Drs. Johnson and Zeigler on evacuation of The Three Mile Island Accident concludes that the evacuation was characterized by a calm and orderly movement of people rather than hysterical flight.

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M.S.	Florida State University, 1974, Statistics
B.S.	Cornell University, 1973, Biometry

PROFESSIONAL EXPERIENCE

1980 - present	Assistant to Associate Professor of Statistics and Education, Northwestern University
1985 - present	Director of Methodology Research Center, NORC, University of Chicago
1984	Visiting Assistant Professor, Department of Statistics and Center for Economic Policy Research, Stanford University
1982 - 1985	Sampling Statistician, NORC, University of Chicago
1978 - 1980	Senior Staff Officer and Study Director, Committee on National Statistics, National Academy of Sciences

PROFESSIONAL ACTIVITIES

Consulting

National Academy of Sciences
U.S. Bureau of the Census
U.S. General Accounting Office
U.S. Department of Education
Private businesses, law firms, and school districts

Awards

Palmer O. Johnson Memorial Award from the American Educational Research Association in 1985

Associate Editor

Journal of Educational Statistics

Memberships in Professional Organizations

American Educational Research Association
American Statistical Association
Institute of Mathematical Statistics
Royal Statistical Society
Population Association of America

PUBLICATIONS

Books

- B1 *Benefit-Cost Analysis of Data Used to Allocate Funds.* New York: Springer-Verlag, 1980 (based on my 1979 Yale doctoral dissertation, *Benefit-Cost Analysis of Data Used to Allocate Funds: General Revenue Sharing*).
- B2 *Estimating Population and Income of Small Areas.* Panel on Small-Area Estimates of Population and Income, Committee on National Statistics, National Research Council, Washington, D.C.: National Academy Press, 1980.

This book includes the Panel's report and nine papers with attributed authorship. As Study Director for the Panel, I was largely responsible for drafting the report. I also wrote seven papers in the book, which are listed below (with page references).

"Models for error in postcensal population estimates." (pp. 217-228)

"A note on the use of postcensal population estimates in employment and unemployment measures." (pp. 215-216)

Postcensal per capita income estimation methods of the Census Bureau: Summary." (pp. 188-193)

"Revenue sharing allocations and the effects of data errors." (pp. 205-214)

"Effects of biases in census estimates on evaluation of postcensal estimates." (pp. 232-236)

"Postcensal population estimation methods of the U.S. Bureau of the Census." (pp. 131-187)

"The role of judgement in postcensal estimation." (pp. 194-199)

Articles

- A1 "Sufficiency, minimal sufficiency, and the lack thereof." *The American Statistician* 30(1): 34-35, 1976 (with A. Sampson).
- A2 "Implications of equity and accuracy for undercount adjustment: A decision-theoretic approach." Pp. 204-216 in U.S. Bureau of the Census, *Conference on Census Undercount: Proceedings of the 1980 Conference*. Washington, D.C.: U.S. Department of Commerce, 1980.
- A3 "Issues of accuracy and equity in adjusting for census undercount." *Proceedings of the American Statistical Association, Social Statistics Section*, Washington, D.C., 1981.
- A4 "On estimating population and income for local areas." *Statistical Reporter*, 81-8: 377-381, 1981 (with E. Kitagawa).
- A5 "The sense and nonsense of school effectiveness." *Journal of Policy Analysis and Management* 1(1) 1981: 43-52, 1981 (with D. Wiley).
- A6 "Small-area analysis." Pp. 607-614 in J.A. Ross, editor, *International Encyclopedia of Population*, New York: The Free Press, 1982 (with R. Lapham).
- A7 "A note on statistical defensibility." *The American Statistician*, 36(3): 208-209 (with comments 209-216), 1982.
- A8 "Feasibility of benefit-cost analysis of data programs." *Evaluation Review*, 6(5): 649-672, 1982.
- A9 "Concerning dubious estimates of the effects of census undercount adjustment of federal aid to cities." *Urban Affairs Quarterly*, 18(1): 145-148, 1982.
- A10 "Technical issues in allocation formula design." *Public Administration Review*, 42(6): 524-529, 1982.
- A11 "Feasibility of benefit-cost analysis of public data." *Proceedings of the American Statistical Association, Social Statistics Section*, Washington, D.C., 1982.
- A12 "Distribution of federal benefits according to statistical formulas."

discussion of paper." *Proceedings of the American Statistical Association, Social Statistics Section*, Washington, D.C., 1982.

- A13 "On interpreting test scores as social indicators: statistical considerations." *Journal of Educational Measurement*, 20(4): 317-334, 1983.
- A14 "Test scores as social statistics: comparing distributions." *Journal of Educational Statistics*, 8(4): 249-270, 1983.
- A15 "Toward conducting benefit-cost analyses of data programs." *Proceedings of the American Statistical Association, Social Statistics Section*, pp. 46-51, 1984.
- A16 "Simplifying complex samples with the bootstrap." *Proceedings of the American Statistical Association, Survey Research Section* pp. 46-51, 1984.
- A17 "Uncertain population forecasting", *Journal of the American Statistical Association*, 80: 306-314, 1985 (with J. Alho).
- A18 "Avoiding bias in estimates of the effect of data error on allocations of public funds, *Evaluation Review*, 9: 511-518, 1985.
- A19 "Optimal data quality", *Journal of the American Statistical Association*, 80: 564-573, 1985.
- A20 "Statistical aspects of equitable apportionment," *Journal of the American Statistical Association*, 80: 815-822.
- A21 "Test score decline: what and how well does it measure? *Proceedings of the American Statistical Association, Social Statistics Section*, pp. 57-64, 1985.
- A22 "Conceptual issues in measuring improvement in population estimates," pp. 393-407 in *Second Annual Research Conference*. Washington, D.C.: U.S. Bureau of the Census, 1986.
- A23 "Toward conducting benefit-cost analyses of data programs." Pp. 38-59 in R. W. Pearson and R. F. Boruch (eds.) *Survey Research Designs: Towards a Better Understanding of Their Costs and Benefits*. New York: Springer-Verlag.

Technical Reports

"Needed data quality for an ambiguous decision problem." Discussion Paper #40, Center for Economic Policy Research, Stanford University, 1984 (with L.E. Moses).

"Efficient methods for sampling out-of-school seventeen-year-olds in the National Assessment of Educational Progress." Discussion paper #86-3, Methodology Research Center, NORC, 1986.

5 May 1987

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UNITED STATES OF AMERICA

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CERTIFICATE OF SERVICE

I, George H. Lewald, one of the attorneys for the Applicants herein, hereby certify that on January 22, 1988, I made service of the following documents:

1. Applicants' Rebuttal Testimony No. 2 (Rebuttal to the Corrected Testimony of Dr. Avishai Ceder and Dr. Albert E. Luloff on SAPL 31 and TOH III Regarding Drivers Following the Advice of Traffic Guides);
2. Applicants' Rebuttal Testimony No. 3 (Rebuttal to the Testimony of Zeigler, Johnson and Cole Regarding the SDA Telephone Survey Conducted for the Commonwealth of Massachusetts);
3. Applicants' Rebuttal Testimony No. 4 (Rebuttal to the Corrected Testimony of Dr. Albert E. Luloff Regarding the Beach Blanket Survey Conducted for the Commonwealth of Massachusetts);
4. Applicants' Rebuttal Testimony No. 5 (Rebuttal to the Testimony of Dr. Avishai Ceder and Dr. Albert E. Luloff Regarding Panic); and

5. Curriculum Vitae of Bruce David Spencer

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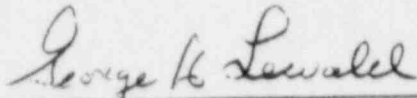
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