2827

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before Administrative Judges:
Helen F. Hoyt, Chairperson
Gustave A. Linenberger, Jr.
Jerry Harbour

In the Matter of	)	
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE, ET AL. (Seabrook Station, Units 1 and 2)	)	Docket Nos. 50-443/444-OL (Off-Site EP) March 18, 1987

ATTORNEY GENERAL JAMES M. SHANNON'S SUPPLEMENTAL RESPONSE TO APPLICANTS' OFF-SITE INTERROGATORIES (SET NO. 1) DATED APRIL 28, 1986

Pursuant to 10 C.F.R. §2.740(e), Attorney General James M. Shannon hereby files a supplemental response to Applicants' Interrogatories (Set No. 1) dated April 28, 1986. Specifically, with respect to the Applicants' "General Interrogatories" and interrogatory groups VI, XV, and XXXIX, the responses provided below supplement the prior responses made to these interrogatories in Attorney General Francis X. Bellotti's Response to Applicants' Interrogatories and Request for Production of Documents, filed July 3, 1986. In addition, supplemental responses are provided below to

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interrogatory groups IV, V, and XXXVII because Attorney General James M. Shannon has only recently, on March 2, 1987, given his notice of his intention to litigate these contentions (as revised).

Answers to Interrogatories IV, V, and XXXVII

IV-1. Yes, as revised.

IV-2. Yes. The Massachusetts Attorney General believes that the State of New Hampshire will not make arrangements to obtain sufficient vehicles to evacuate schools, other special facilities, non-auto owning residents and all other transit dependent persons in Hampton, including those at the beaches, because (a) insufficient bus and driver pairs are available within a reasonable distance from Hampton, (b) the State has undercounted this population, and (c) the Massachusetts Attorney General agrees with the reasons given in the bases submitted by Hampton with this contention, as revised.

IV-3. No.

IV-4. No.

IV-5. The Massachusetts Attorney General agrees with Comment 17 on p. 4 of the RAC Review of the Seabrook Station Evacuation

Time Estimates and Traffic Management Plan Update. It is not reasonable to assume that "not even a fraction" of the thousands of transients and summer employees will need transit assistance from the EPZ in the event of an evacuation.

IV-6. The Massachusetts Attorney General does not know whether any two-way roads will be converted to one way traffic flow during an emergency.

IV-7. The Massachusetts Attorney General does contend that, given the plans to install cones and traffic barricades at most key intersections in the EPZ, there would be at least a substantial delay in the arrival of many evacuation vehicles. The further each vehicle must travel, the longer the delay is likely to be . However, if these roads were all operated during an emergency in the "normal manner," i.e., without any cones or barricades, chaos would result and most out-of-town emergency vehicles would not reach Hampton.

IV-8. The Massachusetts Attorney General does not know.

IV-9. The Massachusetts Attorney General has no knowledge of the basis of the population estimates in Mr. French's affidavit.

IV-10. The Massachusetts Attorney General does not know.

IV-11. The Massachusetts Attorney General has not decided whether to offer the testimony of any expert witness with respect to this contention and will supplement this answer, if necessary, pursuant to 10 C.F.R. § 2.740(e).

V-1. Yes, as revised.

V-2. No. The Massachusetts Attorney General has no information or knowledge to support the assertions by Mr. French in his affidavit. The Massachusetts Attorney General is not aware of any studies, surveys, or analyses to provide a foundation for Mr. French's estimates.

V-3. The Massachusetts Attorney General does not know.

V-4. The Massachusetts Attorney General does not know.

V-5. The Massachusetts Attorney General is currently reviewing all studies which led to estimates of people population in Hampton, including the beaches. At this time, however, the Massachusetts Attorney General has not determined whether these studies are inaccurate or accurate.

V-6. The Massachusetts Attorney General has no such data.

V-7. The Massachusetts Attorney General does not know.

V-8. The Massachusetts Attorney General does not know.

V-9. The Massachusetts Attorney General does not know.

V-10. The Massachusetts Attorney General does not know.

V-11. The Massachusetts Attorney General does not know.

V-12. The Massachusetts Attorney General does not know.

V-13. The Massachusetts Attorney General does not know.

V-14. The Massachusetts Attorney General does not know.

V-15. The Massachusetts Attorney General does not know.

V-16. The Massachusetts Attorney General does not know.

V-17. The Town of Hampton is refusing to participate in evacuation and preparation for an emergency at the Seabrook nuclear plant.

V-18. See NHRERP Vols. 18 and 18A. See, in particular Vol. 18, p. II-28, 28a, 30, 31.

V-19. They may have been dropped off at the beach that day, or days or weeks earlier, and have no vehicle available to leave the beach area. They also may have pedalled a bike or walked to the beach from some distance away.

V-20. The Massachusetts Attorney General does not know. At this time the Massachusetts Attorney General is still in the process of identifying the data or studies in contending that accidents, breakdowns, driver disobedience, panic and gas shortages will occur to the extent that an orderly evacuation cannot be implemented.

V-21. The Massachusetts Attorney General does not know.

V-22. The Massachusetts Attorney General has insufficient information to answer this interrogatory.

V-23. The Massachusetts Attorney General does not know.

V-24. The Town of Hampton is refusing to participate in evacuation planning and preparation for an emergency at the Seabrook nuclear plant.

V-25. The Massachusetts Attorney General has not decided whether to offer the testimony of any expert witness with respect to this contention and will supplement this answer promptly, if necessary, pursuant to 10 C.F.R. § 2.740(e).

XXXVII-1. Yes.

XXXVII-2. The Massachusetts Attorney General does not have sufficient information to answer this interrogatory at this time.

XXXVII-3. See response to interrogatory XXXVII-2.

XXXVII-4. See response to interrogatory XXXVII-2.

XXXVII-5. See response to interrogatory XXXVII-2.

XXXVII-6. See response to interrogatory XXXVII-2.

XXXVII-7. See response to interrogatory XXXVII-2.

XXXVII-8. See response to interrogatory XXXVII-2.

XXXVII-9. See response to interrogatory XXXVII-2.

XXXVII-10. See response to interrogatory XXXVII-2.

XXXVII-11. See response to interrogatory XXXVII-2.

XXXVII-12. The Massachusetts Attorney General is currently reviewing whether the State has adequate manpower to perform a broad range of emergency functions under various serious accident sequences. At this point the Massachusetts Attorney General contends that there is inadequate manpower assigned to drive transport vehicles and tow trucks. The basis for this assertion is that the NHRERP-Rev. 2 seriously undercounts the number of persons needing transit assistance, especially among those persons on the beaches, and the number of breakdowns and accidents which will occur that would impede traffic flow.

XXXVII-13. The Massachusetts Attorney General has not decided whether to offer the testimony of any expert witness with respect to this contention and will supplement this answer, if necessary, pursuant to 10 C.F.R. § 2.740(e).

Supplemental Response to
Interrogatories VI, XV and XXXIX

In addition to the expert witnesses previously identified by the Massachusetts Attorney General in his response dated July 3, 1986, the Attorney General intends to offer the testimony of Dr. Robert Goble, Center for Technology,

Environment and Development, Clark University, Worcester, Massachusetts, on: Hampton Contention 8; SAPL Contention 16 and NECNP Contention 8. A resume of Dr. Goble is attached hereto. Dr. Goble's testimony will be introduced with respect to the need for and adequacy or inadequacy of any plans for sheltering the summer beach population near Seabrook.

Dr. Goble is still in the process of preparing his testimony and the facts and final opinions which will form the substance of his testimony have not yet been determined. The Attorney General will provide a supplement to this response at such time as the substance of those facts and opinions is determined.

The Attorney General expects Dr. Jan Beyea, previously identified in our response of July 3, 1986, to testify as to the inadequacy of evacuation alone as a protective response action for the summer beach population. Dr. Beyea will base his testimony primarily on his analysis of the dose consequences to the summer beach population of four categories of accident releases, under varying meteorological conditions, assuming, as the NHRERP provides, that the population is instructed to evacuate without sheltering. Dr. Beyea's analysis will be based on essentially the same considerations (analyzing "skin deposition dose," "car deposition dose" and considering the same Pasquill stability classes, wind speeds, dose scaling factors etc.) as set forth at pp. 3-12

("Exhibit A") of the basis to the contention previously filed in this proceeding by the Massachusetts Attorney General on February 21, 1986 and September 9, 1983 [attached hereto]. The four categories of accident releases on which Dr. Beyea is expected to testify with respect to the adequacy of the evacuation response are:

> Category 1: Early containment failure with core oxidation. This category is respresented by an "S1" steam-explosion release defined in the Seabrook Probabilistic Safety Assessment (PSA). Also included in this category is a high-pressure melt ejection sequence.
>
> Category 2: A rapid containment bypass release, as represented by an "S6V-total" sequence defined by analysts at Brookhaven National Laboratory (as part of their review for the NRC of the Seabrook PSA). In this release category, a direct pathway to the atmosphere is opened as a result of containment bypass and the bulk of the escaping radioactivity leaves the reactor within a one-hour period. Included in this category are thermally induced steam generator tube failures and interfacing systems accidents.
>
> Category 3: An overpressurization ("PWR2") release as defined in the NRC's Reactor Safety Study (Wash-1400).
>
> Category 4: A slow containment bypass release, as defined in the Seabrook PSA, in which radioactivity escapes in puffs of varying duration.

The basic modelling to be employed by Dr. Beyea in analyzing the dose consequences to the beach population has been previously utilized by him as follows:

(a) Jan Beyea, Program BADAC-1, "Short-Term Doses Following a Hypothetical Core Meltdown (with Breach of Containment)" (1978), prepared for the New Jersey Department of Environmental Protection.

(b) Jan Beyea and Frank von Hippel, "Some Long-Term Consequences of Hypothetical Major Releases of Radioactivity to the Atmosphere from Three Mile Island," report to the President's Council on Environmental Quality, Center for Environmental Studies, Princeton University, (1979), Appendix E.

(c) Jan Beyea, "A Study of the Consequences of Hypothetical Reactor Accidents at Barseback," (Stockholm: Swedish Energy Commission, 1978) (See appendices for a detailed discussion of the basic dose calculations used in these programs).

(d) Brian Palenik and Jan Beyea, "Some Consequences of Catastrophic Accidents at Indian Point and Their Implications for Emergency Planning," direct testimony on behalf of New York State Attorney General, Union of Concerned Scientists (UCS), New York Public Interest Research Group (NYPIRG), New York City Audubon Society, before NRC Atomic Safety and Licensing Board, July, 1982.

The basic modelling is similar to the approach taken by radiological protection agencies around the world, including the NRC, and the only novel aspects of the calculations involve the following:

1) Radiation shielding: Radiation shielding factors for cars used in the 1975 Reactor Safety Study have been updated to account for changes in car construction that have been made to improve fuel economy in the intervening years.

2) Accounting for dispersion over water. Certain beach sites, e.g., Seabrook beach, have water between them and the reactor. Adjustments have been made for decreased dispersion using standard methodology.

3) Radioactivity deposited on vehicle surfaces.

4) Radioactivity deposited on the skin and clothing of beach-goers.

The testimony of Dr. Gordon Thompson, previously identified, may also be offered with respect to the types of

accident sequences considered by Dr. Beyea in his testimony. Attorney General Shannon will further supplement this response in accordance with section 2.740(e) when the facts and opinions to which Dr. Beyea will testify are determined, and when decisions are made as to whether supporting testimony from any additional experts, such as Dr. Thompson, will be relied upon.

Respectfully submitted,

JAMES M. SHANNON
Attorney General

By: Carol S. Sneider

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Dated: March 18, 1987

July, 1986

ROBERT L. GOBLE

Center for Technology,
Environment, and Development
and Department of Physics
Clark University
Worcester, MA 01610 617-793-7683

137 Gardner Road
Brookline, MA 02146

617-566-4574

Present Position

Research Associate Professor of Environment, Technology, and Society, and adjunct Associate Professor of Physics, Clark University.

Education

B.A. (Honors), Physics, Swarthmore College, June 1962
Ph.D., Physics, University of Wisconsin, January 1967

Previous Employment

1984-85	Princeton University, Center for Energy and Environmental Studies and Department of Philosophy: Hewlett Fellow
1976-	Clark University, Physics Department and Program on Science, Technology, and Society: Visiting Assistant Professor, Research Associate Professor (on leave 1984-85)
1974-76	Montana State University, Physics Department: Assistant Professor, Adjunct Assistant Professor
1972-74	University of Utah, Physics Department: Research Associate/Associate Instuctor
1969-72	University of Minnesota, Physics Department: Research Associate
1966-69	Yale University, Physics Department: Research Staff, Instructor
1962-66	University of Wisconsin, Physics Department: NSF Cooperative Fellow, Research Assistant

Current Research

Air Quality/Acid Deposition:	Assessments and Reviews Tracer and Transport Studies Local Air Quality
Risk Assessment/Hazard Mangement:	Comparing Hazards and Hazard Assmessment Methodologies Ethical Issues in Hazard Management Planning Issues for Waste Disposal Radon Exposure and Health Effects Emergency Planning for Nuclear Power Plants

Recent Research Activities

1983 - Emergency Planning for Nuclear Power Plants (Consultant to New Hampshire Attorney General's office, Three Mile Island Public Health Fund) Reviews, Planning Project is Pending.

1985 - Risk Assessment and Socio Economic Impacts in Radioactive Waste Management (Consultant to State of Mississippi, Citizens Against Nuclear Trash, and State of Nevada/Mountain West Inc.) Two reports, testimony.

1977- Ethical Issues in Hazard Management (supported by NSF-EVIST, Hewlett Foundation, Principal Investigator and Co-Principal Investigator.) Book in progress; articles on radioactive waste, occupational and environmental hazards comparison, susceptible workers.

1983 -86 Acid Deposition Assessment, (Consultant, U.S. EPA.) Co-author, Acid Deposition and its Effects: Critical Assessment Document, 1985.
Section Author, 1985 Assessment section on Sulfur Mass Balance.

1982-83 Implementation of the Occupational Lead Standard. (Supported by OTA; Principal Investigator, four researchers.) Report published as attachment to OTA Report: Preventing Illness and Injury in the Workplace.

1977-82 Nuclear Power Plant Performance, (supported in part by DOE, Principal Investigator, three researchers.) Articles relating nuclear power plant performance to general plant characteristics.

1976-83 Demonstration of a Grid-Connected Cogeneration System at Clark University; technical advisor and coordinator for Clark University. The program resulted in the construction of a $2.5 million National Demonstration Power Plant, based on a gas-fired 1.8 MW diesel engine with heat recovery from the exhaust and jacket. The plant began opration in Summer 1982; it supplies approximately half Clark's thermal energy needs and enough excess electricity so that half the output will be sold to the utility.

Teaching and Student Research Supervision

Dissertation Advisor for M. Yersel, May 1984 Ph.D.
Atmospheric Turbulence and Diffusion in an Urban Environment,

Student Research Projects:
Supervision of more than 20 graduate and undergraduate students in energy, air pollution, and physics: High Energy Cosmic Ray Showers; Clark Energy Use Profiles and Models; Environmental Tradeoffs in Cogeneration; Cogeneration Road Map for Colleges and Universities; Measurements of Worcester Weather; Pollutant Dispersal in Urban Areas; Effects of Buildings on Pollutant Dispersal; Cogeneration System Monitoring

Environment, Technology, and Society:
Introductory Case Studies on Population and Food; Special Topics in Alternative Energy: Cogeneration; Alternative Energy Systems Laboratory

Physics for Non-Science Student:
Einstein's Ideas; Cultural Astronomy; College Physics; Particle Physics (an honors course with laboratory); Urban Meteorology

Undergraduate Physics:
Electricity and Magnetism; Classical Physics

Graduate Physics:
Quantum Mechanics; Advanced Quantum Mechanics; Mathematical Methods

Professional Societies

American Association for the Advancement of Science
American Physical Society: Forum on Science and Society; Division of Particles and Fields
Sigma Xi
Society for Risk Analysis

Service

1976-	City of Worcester Energy Task Force
1977-	Clark Science, Technology, and Society, Program Committee
1978-80	Alternate, Clark Graduate Board
1978-	Clark Energy Task Force
1981-	Faculty Lounge Committee (installation and operation of new faculty dining room)
1983-	CENTED Steering Committee

Recent Individual Awards and Honors

National Science Foundation/National Endowment for the Humanities: Individual Incentive Award (Jan. 1984-Jan. 1986)
Princeton University: Hewlett Fellow (Sept. 1984-June 1985)
American Association for the Advacement of Science: Summer Fellowship in Environmental Science (Summer 1982)

Other Activities

Consulting Agreements:

1986-87 - Rhode Island Dept. of Environmental Management. Risk Assessment Methods for Toxic Substances in Seafood.

1986-87 - State of Nevada/Mountain West Inc., Risk Analysis for Radioactive Waste Disposal.

1986 - Citizens Against Nuclear Trash - Socio Economic Impacts of Radioactive Waste Disposal.

1985 - Mississippi Health and Safety Office -- Radioactive Waste Risk Analysis.

1983 - New Hampshire Attorney General - Nuclear Emergency Planning.

October 1982-present. U.S. EPA: Acid Deposition Assessment.

1986 - Lecturer, Harvard School of Public Health, Short Course on Risk Assessment and Occupational Health.

1981 - Lecturer, Department of Engineering and Applied Science, University of Wisconsin--Extension Program on Industrial Facility Cogeneration.

GRANTS AND AWARDS

DATE	TITLE	AMOUNT
University Grants		
Demonstration of a Grid-Connected Integrated Community Energy System		
1982-84	Mass Electric Company/Colt Industries/ Mass Electric Construction. Grants for Cogeneration Monitoring	20,000
1981-83	Mass Energy Office/DOE-Energy Conservation Measures in Schools and Hospitals, 2 matching grants for cogeneration heat recovery equipment co-authored with J. Collins and B. Kimball) #DE-FG41-81R 113973	104,000
	#DE-FG41-82R 143391	13,750
1980-82	HUD: Loan for Plant Construction (co-authored with J. Collins, B. Kimball)	1,200,000
1980-82	DOE Phase III: Constuction: grid connection and constuction management costs (co-authored with J. Collins)	330,000
1977-78	DOE Phase II: Detailed Feasibility and Preliminary Design (co-authored with C. Hohenemser	206,000
1977	DOE Phase I: Preliminary Feasibility Study (co-authored with C. Hohenemser).	$ 149,000

Other Grants and Grant Support Received

DATE	TITLE	AMOUNT
1984-86	NSF/NEH-Interdisciplinary Incentive Award Ethical Issues in Hazard Management (Principal Investigator- Individual Award)	45,800
1983-85	NSF-Sensitive Workers, Ethical Issues and Differential Sensitivity to Workplace Hazard (Co-Principal Investigator with R. Kasperson) #RII 8217297	170,500
1983-84	Clark University-Elemental Analysis of Particulates (Jointly with C. Hohenemser-Faculty Development Award)	1,500
1982-83	OTA-Implementation of Occupational Lead Standard (Principal Investigator) Contract #233-7040.0	29,000

1982	DOE-Nuclear Power Plant Performance (Principal Investigator) Purchase Order #DE-AP01-82 E119625	9,000
1982	AAAS-Summer Fellowship in Environmental Sciences (for work on Acid Rain in EPA's Office of Strategy Assessment and Long Range Planning).	5,800
1980-82	NSF-Labor Laity-Comparison of Worker & Public Protection from Technological Hazards (Co-Principal Investiator with R. Kasperson). #OSS 79-24516	$ 240,000
1979-80	Association of Physical Plant Ad ministration, Preparation of a Cogeneration Reference Manual for Colleges and Universities (Principal Investigator)	4,000
1979	Argonne Laboratories-Testing Computer Models for Cogeneration System Design (Principal Investigator). Univ. #98456-01	5,240
1977-80	NSF-Equity Issues in Radioactive Waste Management #oss 77-16564 (Co-principal Investigator with Roger Kasperson).	190,000

Publications

ARTICLES (Energy/Hazards/Air Quality)

1986

"Turbulence Parameters in an Urban Environment" (with M. Yersel) To be published in Boundary Layer Meteorology.

"Methods for Analyzing and Comparing Technological Hazards: Definitions and Factor Structures" (with C. Hohenemser, J. Kasperson, R. Kasperson, R. Kates, P. Collins, P. Slovic, B. Fischoff, S. Lichtenstein and T. Layman.) In Risk Evaluations and Management, V. Covello, J. Menkes and Y. Mumpower, eds. Plenum Press, New York, 1986.

1985

"Protecting Workers, Protecting Publics: The Ethics of Differential Protection" (with P. Derr, R. Kasperson, R. Kates) in V.T. Covello (ed.) Risk Analysis in the Private Sector, Plenum Press, New York, 1985.

1983

"Time Scales in the Radioactive Waste Problem" Equity Issues in Radioactive Waste Management, R. Kasperson, Ed. Oelgeschlager Gunn, Hain, Cambridge 1983, Chapter 6, p. 139-174.

"Short Distance Diffusion in an Urban Atmosphere" (with M. Yersel, J. Morrill), Atmospheric Environment, V. 17, No. 2, 275 (1983).

"Responding to the Double Standard of Worker/Public Protection (with P. Derr, R. Kasperson, R. Kates), Environment V. 25, No. 6, 6 (1983).

1982

"Airborne Lead: A Clear-cut Case of Differential Protection," (with D. Hattis and N. Ashford), Environment V. 24, No. 1, 14 (1982)

"Technological Risk Perception and Nuclear Power Costs: The Quantification of Uncertainty" (with D. Shakow) Technological Forecasting and Social Change, V. 21, No. 3, 185 (1982)

1981

"Worker/Public Protection: The Double Standard" (with P. Derr, R. Kasperson, R. Kates), Environment, V. 23, No. 7, 6 (1981)

1979

"Nuclear Power Plant Performance: An Update," (with C. Hohenemser) Environment V. 21, No. 8, 32 (1979)

1978

"Power Plant Performance" (with C. Hohenemser), Environment V. 20, No.3, 25, (1978).

TECHNICAL MONOGRAPHS

1986

The proposed Sebago Lake nuclear waste repository area: A preliminary assessment of selected risk and social impact considerations, (with J. Emel, J. Kasperson, and R. Kasperson.) Worcester, MA: Hazard Assessment Group, CENTED, Clark University.

1985

Risk issues associated with a salt-dome repository at Richton, Mississippi, (with H. Brown, J. Emel, J. Kasperson, and R. Kasperson.) New York: Social Impact Assessment Network.

1983

Methods for Analyzing and Comparing Technological Hazards: Definitions and Factor Structures, (with C. Hohenemser, J. Kasperson, R. Kasperson, R. Kates, P. Collins, A. Goldman, P. Slovic, B. Fischoff, S. Lichtenstein, and M. Layman), CENTED Research Report #3, October 1983.

1982

Atmospheric Processes Affecting Acid Deposition: Assessing the Assessments and Suggestions for Further Research, AAAS, Fall 1982.

1980

Cogeneration: A Campus Option, (with W. Goble) Association of Physical Plant Administrators, Washington, 1980).

1978

Statistical Analysis of Nuclear and Coal Power Plant Performance, (with C. Hohenemser) Scientists Institute for Public Information, New York, 1978.

GOVERNMENT REPORTS

1985

Implementation of the Occupational Lead Standard, (with D. Hattis, M. Ballew, D. Thurston), CENTED Working Paper HAG/WP 83-1, October 1983; in Preventing Illness and Injury in the Workplace, Vol. 2, NTIS. Office of Technology Assessment, Washington, Spring, 1985.

The Acid Deposition Phenomenon and Its Effects: Critical Assessment Document Co-authors D. Bennett, R. Linthurst) U.S. EPA, EPA/60018-851001, August 1985.

1977-78

"Grid-Connected Integrated Community Energy System, Clark University":
Phase I, Preliminary Feasibility Study,
v.1: Executive Summary, DOE Report #C00-4211-1/1 (NTIS, 1977)
v.2: Final Report, DOE Report #C00-4211-1/2 (NTIS, 1977).

Phase II, Detailed Feasibility and Preliminary Design
Preliminary Report, DOE Report #C00-4211-2 (NTIS, 1978).
v.1: Final Report, DOE Report #C00-4211-3/1 (NTIS, 1978).
v.2: Appendices, DOE Report #C00-4211-3/2 (NTIS, 1978).

(These reports were produced by the Clark Demonstration Team and consultants. I wrote the main text and edited each volume.)

CONFERENCE PROCEEDINGS (Energy, Hazards, Air Quality).

1985

"The Variation in Worker Response to Occupational Hazards" in Symposium on Managing High Risk Workers, Society for Risk Analysis, October 1985.

1984

"Acid Rain." Invited talk presented at American Institute of Hydrology Conference, Future Issues in Hydrology, May 31, 1984.

1983

"Short Range Dispersion from a Point Source in an Urban Area," (with M. Yersel), Proceedings of the 6th Symposium on Turbulence and Diffusion American Meteorological Society, Boston (1983)

1981

"A Participatory Approach to Undergraduate Energy Education: the Case of Clark Universiy" (with D. Ducsik) Proceedings of the International Conference on Energy Education, Providence, Rhode Island, 1981

"Clark University's Grid-Connected Cogeneration Plant," (with J. Rodousakis, J. Cook), District Heating, V. 67, No. 1, 4 (1981)

1979

"A Micrometeorological Study in the Worcester Area" (with A. Molod, M. Yersel), Proceedings of the Conference on the Meteorology of Northern New England and the Maritime Provinces, Gorham, ME (1979).

1978

"Grid-Connected Cogeneration at Clark University: The Effect of Terms of Utility Interconnection: (with S.E. Nydick), Proceedings of the International Conference on Energy Use Management, Tucson (1978).

1977

"Energy Profiles at Clark University: Implications for Cogeneration" (with R. Collins, A. Gottlieb), Proceedings fo the First National Conference on Technology for Energy Conservation, Washington, D.C. (1977).

ARTICLES (Particle Physics)

1975

"Determination of the $\Delta^{++} - \Delta^{0}$ Mass Difference (with J.S. Ball), Phys. Rev. D 11, 1971 (1975).

1973

"Two Pion Intermediate States in Decay $K_0^S - 2\gamma$," Phys. Rev. D 4, 931 (1973).

1972

"Soft Pion Production in Electron-Positron Collisions" (with J.L. Rosner), Phys. Rev. D 5 2345 (1972).

1971

"Current Algebra and Analyticity: Bootstrapping the ρ and σ with the Pion Decay Constant Setting the Scale" (with (L.S. Brown), Phys. Rev. D 4 723 (1971).

1968

"Pion-Pion Scattering, Current Algebra, Unitarity, and the Width of the Rho Meson" (with L.S. Brown), Phys. Rev. Lett. 20 346 (1968).

"Soft Photons and the Classical Limit" (with L.S. Brown), Phys. Rev. 173, 1505 (1968).

1965

"Cross Section for the Production of a Possible Bound Cascade-Nucleon System" (with M.E. Ebel) Phys. Rev. B 140 1675 (1965).

CONFERENCE PROCEEDINGS (Particle Physics)

1973

"Pion Form Factor and Inelastic $\pi - \pi$ Scattering," Proceedings of the International Conference on $\pi - \pi$ Scattering (Tallahassee, 1973).

Dept #1:VITAERG

EXHIBIT "A"

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
Helen F. Hoyt, Chairperson
Emmeth A. Luebke
Jerry Harbour

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 September 9, 1983

CONTENTION OF ATTORNEY GENERAL
FRANCIS X. BELLOTTI RELATIVE TO EMERGENCY
PLANNING FOR THE NEW HAMPSHIRE BEACH COMMUNITIES

On August 23, 1983, the Board ordered that contentions relating to off-site emergency planning for any or all of the fifteen New Hampshire communities for which draft emergency plans were recently submitted[1/] be filed on or before this date. In accordance with that order, Attorney General Bellotti hereby submits a single contention which relates to off-site

1/ The fifteen communities are Hampton, Newton, Rye, Stratham, Exeter, New Castle, North Hampton, Seabrook, Brentwood, Kensington, Newfields, Portsmouth, South Hampton, East Kingston, and Kingston.

emergency action in the coastal beach areas of Seabrook, Hampton, North Hampton, and Rye which are frequented by Massachusetts citizens.

CONTENTION:

The draft radiological emergency response plans for the Towns of Seabrook, Hampton, North Hampton, and Rye do not provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency at the Seabrook Station, as required by 10 C.F.R. §50.47(a)(1), because in the event of a severe accident on a summer weekend some or all of the beach area transient populations within those communities cannot under many plausible meteorological conditions be protected by means of evacuation even from early death and because there are not adequate plans or provisions for sheltering the beach area transients within those communities.

BASES:

The draft emergency response plans for the Towns of Seabrook, Hampton, North Hampton, and Rye all rely on evacuation and sheltering as the two options for protecting persons present in those communities at the time of a radiological emergency at Seabrook Station which results in a radiological release to areas within those communities. See, e.g., Seabrook Plan, at II-I6 - II-I8; Rye Plan, at II-I6 - II-I8; North Hampton Plan, at II-I7 - II-20; and Hampton Plan,

at II-I7 - II-20. However, a preliminary site-specific accident consequence analysis performed for the Massachusetts Attorney General has revealed that, given the unusual circumstances associated with dense beach populations, evacuation cannot protect the transient beach area populations in the vicinity of the Seabrook site from early death in the event of a PWR 2 release as defined in the NRC's Reactor Safety Study (WASH-1400) on a summer weekend.

A Seabrook-specific accident consequence analysis is being performed for the Department of the Attorney General by Dr. Jan Beyea, a nuclear physicist with extensive experience in accident consequence modelling and analysis. (A copy of Dr. Beyea's resumé is attached hereto as Exhibit A and incorporated herein by reference.) Dr. Beyea has advised the Department that there are unique considerations involved in the modelling and analysis of accident consequences for a site such as Seabrook having a large summer beach area population which have never before been taken into account in generic or site-specific consequence studies. In addition to the obvious effects on accident consequences of the increased population and evacuation times associated with summer beach areas and the absence of shielding normally provided by buildings, there are increased consequences due to material deposited directly on the skin and hair of beachgoers and on vehicles in the plume. The former factor has received no consideration in accident

consequence analyses in the past and the latter has received inadequate consideration.

In the work which Dr. Beyea and his assistant Brian Palenik, a graduate student at the Massachusetts Institute of Technology, have performed for this Department to date they have investigated the conditions under which the nearest beach population to this site, at about two miles, might be exposed to doses at a threshold level for early death (200 rem) in the event of a PWR 2 release as defined in the Reactor Safety Study (WASH-1400). Estimates of the time within which that population would receive a 200 rem dose have been calculated for various weather stability classes and wind speeds using two sets of assumptions. The first set assumes that all persons are inside automobiles when the release occurs and receive only a fraction of the doses they would receive if they were in the open, exposed directly to a plane of contaminated ground. These results have been calculated using the assumptions which have heretofore been considered standard in accident consequence calculations. The second set of results goes beyond the standard assumptions, to account specifically for the Seabrook beach situation. Those results assume that some of the population will not have reached their vehicles before plume passage such that there will be a "skin deposition dose" and a "car deposition dose." For each of the two sets of results calculations have been performed separately for high

and low energy release rates. This division was necessary given the large uncertainty in the height to which the radioactive plume will rise, a factor which is affected by energy release rates and which is an important determinant of the doses to a nearby population.

Tables 1 and 2, which follow hereafter, contain the results of Dr. Beyea's modelling and analysis as described above. The entries in the last column of each table result from a comparison between the time required to reach a 200 rem dose and current estimates of the time required to evacuate the population within two miles on a summer weekend. See Table 3. The data set forth in these tables reveal that the summer weekend beach population within two miles of the Seabrook site cannot be protected from early death by means of evacuation under many weather conditions.

It should be noted that neither precipitation nor slow wind speeds have been considered in the analyses set forth in Tables 1 and 2. Both such conditions are more severe than those represented in the tables. The frequencies of the Pasquill stability classes reflected in Tables 1 and 2 as reported in the Applicants' ER-OL are given in Table 4. The frequencies of the A, B, and C stability classes increase during the summer months, with C the most frequent of the three. D and E are the dominant stability classes. The results discussed herein are not, therefore, based on infrequently occurring or worst-case weather conditions.

TABLE 1

PROTECTION OF CLOSEST BEACH POPULATION[a] FROM EARLY DEATH ON A SUMMER WEEKEND DAY

HIGH ENERGY RELEASE RATE[b]

Stability Class[c]	Wind Speed (m/sec)	Dose Scaling Factor[d]	Time to Reach 200 rem	Protection of Population[e]
A	2	.53-.78	14.5-20.9	Yes
A	2	1.0-1.3	9.0-11.5	Yes
A	4	.53-.78	> 24	Yes
A	4	1.0-1.3	19.2-25.0	Yes
B	2	.53-.78	4.6-6.4	No
B	2	1.0-1.3	3.2-3.8	No
B	4	.53-.78	12.2-17.8	Yes
B	4	1.0-1.3	7.6-9.6	Yes
C	2	.53-.78	2.6-3.4	No
C	2	1.0-1.3	1.9-2.2	No
C	4	.53-.78	8-11.5	Yes
C	4	1.0-1.3	5.1-6.4	No
D	2	.53-.78	> 24	Yes
D	2	1.0-1.3	> 24	Yes
D	4	.53-.78	6.5-9.2	Yes
D	4	1.0-1.3	4.2-5.3	No

a) The population two miles from the plant.
b) Assumes an energy release rate of 176×10^6 Btu/hour.
c) Pasquill stability class.
d) The dose scaling factor range of .53-.78 assumes an individual is in a car within the plume. The dose scaling factor range of 1.0-1.3 assumes an individual is in a car within the plume, with a dose component from radioactive material deposited on the car and directly on the individual
e) Protection of the population from a 200 rem dose or higher. This assumes an evacuation time of about five and a half hours. If the evacuation time is longer, the population is not necessarily protected.

TABLE 2

PROTECTION OF CLOSEST BEACH POPULATION [a] FROM EARLY DEATH ON A SUMMER WEEKEND DAY

LOW ENERGY RELEASE RATE [b]

Stability Class [c]	Wind Speed (m/sec)	Dose Scaling Factor [d]	Time to Reach 200 rem	Protection of Population [e]
A	2	.53-.78	13.8-19.9	Yes
A	2	1.0-1.3	8.6-10.9	Yes
A	4	.53-.78	> 24	Yes
A	4	1.0-1.3	18.4-23.7	Yes
B	2	.53-.78	3.7-4.9	No
B	2	1.0-1.3	2.5-3.0	No
B	4	.53-.78	9.9-14.2	Yes
B	4	1.0-1.3	6.2-7.8	Yes
C	2	.53-.78	< 1	No
C	2	1.0-1.3	< 1	No
C	4	.53-.78	1.7-2.2	No
C	4	1.0-1.3	1.3-1.5	No
D	2	.53-.78	< 1	No
D	2	1.0-1.3	< 1	No
D	4	.53-.78	< 1	No
D	4	1.0-1.3	< 1	No

a) The population two miles from the plant.
b) Assumes an energy release rate of 20×10^6 Btu/hour, or an equivalently low plume for reasons unrelated to the energy release rate.
c) Pasquill stability class.
d) The dose scaling factor range of .53-.78 assumes an individual is in a car within the plume. The dose scaling factor range of 1.0-1.3 assumes an individual is in a car within the plume, with a dose component from radioactive material deposited on the car and directly on the individual.
e) Protection of the population from a 200 rem dose or higher. This assumes an evacuation time of about five and a half hours. If the evacuation time is longer, the population is not necessarily protected.

TABLE 3

SEABROOK EVACUATION CLEAR TIME ESTIMATES [a]
SUMMER WEEKEND/FAIR WEATHER SCENARIO

Radius	Degrees	HMM[b]	Vorhees[c]	Maguire[d]	NRC[e]
0-2	360°	4:50	5:10	5:40	---
0-3	180° E	5:20	---	---	---
0-5	360°	5:50	5:10-5:40	---	---
0-10	360°	6:05	5:10-6:10	5:50	11:25

a) Time (hours:minutes) for the population to clear the indicated area after notification.

b) Preliminary Evacuation Clear Time Estimates for Areas Near Seabrook Station, HMM Document No. C-80-024A, HMM Associates, Inc., May 20, 1980.

c) Final Report, Estimate of Evacuation Times, Alan M. Vorhees & Associates, July 1980.

d) Emergency Planning Zone Evacuation Clear Time Estimates, C.E. Maguire, Inc., February 1983.

e) An Independent Assessment of Evacuation Time Estimates for a Peak Population Scenario in the Emergency Planning Zone of the Seabrook Nuclear Power Station, M.P. Mueller, et al., Pacific Northwest Laboratory NUREG/CR-2903, PNL-4290.

TABLE 4

FREQUENCY OF PASQUILL STABILITY CLASSES AT SEABROOK [a]
(Values in % of Time)

Month	A	B	C	D	E	F	G
Apr 1979	1.27	2.11	3.80	49.65	29.10	7.88	5.91
May	1.20	2.86	4.82	52.86	26.51	5.27	6.48
June	2.92	6.69	12.26	39.83	25.49	6.13	6.69
July	4.90	6.94	11.56	29.12	28.84	12.65	5.99
Aug	2.91	4.71	9.97	43.07	26.59	7.34	5.40
Sep	1.25	7.64	11.81	30.69	27.36	10.83	10.42
Oct	0.81	2.96	5.79	39.30	34.05	10.09	7.00
Nov	0.00	0.56	4.76	43.92	34.83	9.37	6.57
Dec	0.00	0.41	2.70	47.03	41.35	5.81	2.70
Jan 1980	0.13	1.88	6.59	51.88	30.38	5.78	3.36
Feb	0.44	2.03	5.37	50.36	34.69	5.66	1.45
Mar	10.68	1.64	5.34	43.15	24.66	6.03	8.49
Yearly	2.22	3.37	7.08	43.31	30.38	7.76	5.87

a) Period of Record: April 1979 - March 1980. Stability class calculated using 43'-209' delta temperature. Source: SB 1&2, ER-OLS, Table 2.3-24.

The size of the beach area population around Seabrook is uncertain. One estimate of this population for 1980 has been made by Public Service Company of New Hampshire and is found in Table 5. Although its accuracy is uncertain, this estimate does indicate that a substantial number of people are located within two miles of the plant. The number of persons that would be located within a plume obviously varies with wind direction, but it also varies with stability class and distance from the plant. At two miles the plume could be viewed as being between a 29° wedge (A stability class) and a 13° wedge (D stability class)[2/] compared to the 22.5° population wedges in the table.

In addition to investigating the conditions under which the beach population within two miles of the Seabrook site might be exposed to early death doses, Dr. Beyea and Mr. Palenik have commenced work designed to determine the radius within which early deaths might result in the vicinity of this site assuming an accidental release on a summer weekend. Dr. Beyea has found early death radii ranging from <2 to 4.3 miles assuming a PWR 2 release as defined in the Reactor Safety Study (WASH-1400), C stability class weather conditions, an evacuation time of 5-1/2 hours, and the two sets of dose scaling factors discussed previously. For weather conditions with overcast skies (D

2/ Wedges are assumed to have plume widths equal to three times the horizontal dispersion coefficient.

TABLE 5

1980 BEACH AREA TRANSIENT POPULATION ESTIMATE [a] BY SECTOR [b]

Ring Radii (miles)	NE	ENE	E	ESE	SE	SSE
0-1	0	0	0	0	0	0
1-2	464	14,647	12,780	5,842	129	23
2-3	1,104	8,882	0	0	3,905	654
3-4	8,710	608	0	0	0	6,198
4-5	4,344	0	0	0	0	8,880
5-10	5,660	0	0	0	0	16,597

Source: Public Service of New Hampshire, Seabrook Station - Units 1 & 2, Environmental Report, Operating License Stage, Figure 2.1-19.

a) Estimate of peak transient population found by multiplying the capacity of beach area parking lots (less leased space) by 3.2 persons per vehicle, and contributions from off-street parking users, seasonal residents, and overnight visitors.
b) Each direction in the table is the centerline of a 22.5 degree wedge.

stability class), or longer evacuation times,[3/] the early death radii will be larger. And the time before doses reach 200 rem, assuming a PWR 2 release on a summer weekend evening and a low energy release rate such as that assumed in the draft Seabrook Probabilistic Risk Assessment, is less than four hours out to 6-7 miles from the site. Thus, the beach area population within 6-7 miles exposed to the plume would not be protected from early death even if there were a 20-30 percent reduction in evacuation times from daytime to evening. It should be noted in this connection that at least the Hampton Beach area has a very substantial nighttime population.

Thus, primary accident consequence data developed for this Department reveal that evacuation cannot under a number of plausible weather conditions protect the summer weekend beach area populations in the vicinity of this site from even early death. The results described herein do not account for the less severe consequences of radiation illness and delayed fatalities due to latent cancers. Despite the severe limitations on the utility of evacuation as a protective option for the transient beach population, however, there are currently no provisions for sheltering that population within the EPZ. Neither the New Hampshire Radiological Emergency

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3/ The Applicants have now provided a 6 hours 5 minutes estimate for summer weekend simultaneous beach evacuation within ten miles of the site. See Applicants' Direct Testimony No. 1, filed July 15, 1983, at 19-20.

Response Plan nor the local community plans contain any analysis of available public sheltering, or its capacity to accommodate the beach populations or to provide shielding from radionuclides, or any plans for effecting such sheltering. In short, there is at present no basis for (and has not been) any development of sheltering as a potential protective action for the beach population.

Respectfully submitted,

FRANCIS X. BELLOTTI
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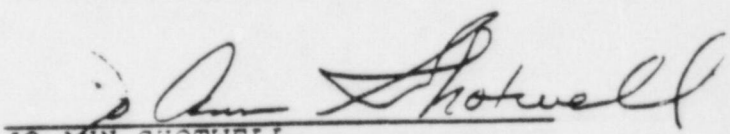
By: 

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE, ET AL. (Seabrook Station, Units 1 and 2)	Docket No.(s) 50-443/444-OL

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