UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 50-247-SP
CONSOLIDATED EDISON	)	50-286-SP
OF NEW YORK (Indian Point, Unit 2)	)	
	)	
POWER AUTHORITY OF THE STATE	)	
OF NEW YORK (Indian Point, Unit 3)	)	

DIRECT TESTIMONY OF ROGER BLOND
CONCERNING BOARD QUESTION 1.3

Q.1 State your name and position with the NRC.

A.2 My name is Roger M. Blond. I am Section Leader for the Accident Risk Section of the Reactor Risk Branch of the Division of Risk Analysis of the Office of Research.

Q.2 What are your responsibilities in that position?

A.2 I am responsible for providing technical and managerial direction in developing methods and research in accident risk analysis and in performing applications in risk assessment.

Q.3 Have you prepared a statement of your professional qualifications?

A.3 Yes, a the statement of my professional qualifications is attached to this testimony

Q.4 What is the purpose of this testimony?

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A.4 The purpose of this testimony is to respond to Board Question 1.3 which states: What are the probabilities associated with the consequences presented in the testimony of Dr. Beyea and Mr. Palenik?

Q.5 Please estimate the probability of the consequence estimates of Mr. Brian Palenik and Dr. Jan Beyea in their testimony submitted June 7, 1982.

A.5 It is very difficult to associate a probability with the consequence estimates given in Mr. Palenik and Dr. Beyea's testimony for the following reasons. First, their consequence estimates were not intended to represent the Indian Point reactors. They chose a PWR-2 source term from WASH-1400 as the accident release for their evaluation. This release is more or less equivalent to the release category A which is the worst (largest source term) release category analyzed for the Indian Point units. The probability associated with release category A as estimated in the staff testimony is 7×10^{-7} and 3.5×10^{-8} per year for Units 2 and 3, respectively.

Second, the Palenik/Beyea testimony present consequences for two time invariant weather conditions and two directions. This represents four discrete results. The Staff results develop consequences for a spectrum of realistic weather conditions and do not necessarily even duplicate the time invariant unrealistic conditions used in the Palenik/Beyea analysis. Third, the assumptions used by Palenik and Beyea to perform the calculations

are significantly different than the assumptions used for the staff calculations. This includes such parameters as emergency response estimates, distance truncation, and health effects conversion factors. Finally, the Palenik/Beyea testimony was not intended to be a risk estimate. It was prepared to "investigate the adequacy of current emergency plans for the Indian Point nuclear reactors in the case of a large release of radioactivity."

Recognizing all of the problems associated with assigning a probability to the Palenik/Beyea consequence estimates, it is possible to compare some of their results with the staff complementary cummulative distribution functions and arrive at a probability estimate. However, before any number is given it should be stated that such estimates have little or no meaning and do not represent the staff acceptance of the methods or assumptions used by Palenik and Beyea.

Palenik/Beyea estimate 6,000 to 50,000 delayed cancer deaths. This corresponds to a probability range from about 1×10^{-5} to 1×10^{-9} for Unit 2 (see figure III.C.6) and 5×10^{-6} to below 1×10^{-9} for Unit 3 (see figure III.C.17). This is the range of probabilities that would be associated with the Palenik/Beyea consequence estimates.

Q.6 Does this conclude your testimony

A. Yes.

PROFESSIONAL QUALIFICATIONS
ROGER M. BLOND
U.S. Nuclear Regulatory Commission

I am Roger M. Blond, Section Leader of the Accident Risk Section, Reactor Risk Branch, Division of Risk Analysis, Office of Research. I have been with the NRC since August 1974. In my present position, I am responsible for providing technical and managerial direction in developing methods and research in accident risk analysis and in performing applications in probabilistic risk assessment. This work includes: (1) developing risk models for calculating the physical processes and consequences of reactor accidents; (2) rebaselining accident consequences and reactor risk; and (3) developing value/impact analysis methods for reactor design improvements.

In addition to the Section Leader position, I have the following responsibilities:

- I am the Chairman of the International Benchmark Exercise on Consequence Modeling, sponsored by the Committee on the Safety of Nuclear Installations, of the Nuclear Energy Agency, Organization of Economic Cooperation and Development. As Chairman, I am responsible for organizing and directing the comparison study which includes the participation of 30 organizations representing 16 countries. The study was chartered to compare the large number of computer models that had been developed to calculate the offsite consequences of potential accidents at nuclear power facilities.

- I am responsible for developing the technical rationale for the development of improved siting criteria. This work includes the development of a set of representative potential reactor accident source terms, and a full parametric study of all the factors important to siting considerations from the risk perspective:

- I am a member of the Technical Writing Group of the IEEE/ANS PRA Procedures Guide - NUREG/CR-2300. This effort is developing a source document on PRA techniques. I am a co-author of the consequence modeling sections of the report.

- I am a member of the Department of Energy Working Group on Probabilistic Risk Assessment.

- I am a member of the NRC Incidence Response Center's Emergency Response Team.

In addition, I am directly involved in the development of a technical rationale for the NRC's Safety Goal, emergency planning and response, and numerous issues and questions which continuously arise in risk assessment.

I am also a lecturer on consequence modeling and accident analysis for the NRC Training Course on Probabilistic Safety and Reliability Analysis Techniques, for the IAEA Training Course on Nuclear Power, and for the George Washington University Seminar on Probabilistic Risk Assessment.

Risk Analyst

Before being selected for the Section Leader position, I was Senior Risk Analyst in the Office of Research. I was responsible for the following areas:

1. Consequence modeling research and development;
2. Performing and reviewing probabilistic risk assessments;
3. Siting and emergency planning and response criteria development; and
4. Integrating probabilistic risk assessment techniques into the regulatory and licensing process.

1. Consequence Modeling Research and Development

I was responsible for revising the consequence model that was developed for the Draft Reactor Safety Study. During the course of that effort, I developed the following modeling approaches and techniques which were used for the final Reactor Safety Study consequence model (CRAC) and are documented in Appendix VI of WASH-1400 and the CRAC User's Guide:

1. Meteorological sampling technique;
2. Diffusion modeling technique;
3. Time-varying meteorological model;
4. Depletion approach;
5. Finite cloud correction model for gamma shine;
6. Economic model;
7. Statistical sampling technique;
8. Emergency response model;
9. Property damage model; and
10. Population treatment.

After the completion of the Reactor Safety Study, I developed the following modeling techniques which have been incorporated into the CRAC-2 computer code and documented in the CRAC-2 User's Guide:

1. Revised comprehensive emergency response model;
2. Importance sampling for meteorological data and terrain diffusion model;
3. Revised dosimetry and health effects review; and
4. Comprehensive results display package.

I also performed numerous sensitivity and parametric studies on the models and input used in the consequence model and was responsible for an extensive research program to investigate the significance of various related phenomena to risk. This research involved from five to ten contractor personnel. I also have been responsible for preparing and defending the research program and budget in consequence modeling and emergency planning before the Senior Contract Review Board and the Advisory Committee for Reactor Safeguards.

2. Performing and Reviewing Probabilistic Risk Assessments

I was responsible for all of the risk calculations performed for the final Reactor Safety Study. At the completion of the study, I responded to critiques and questions concerning Probabilistic Risk Assessment from within the NRC, Congress, other Federal agencies, contractors and vendors, intervenors, state and local governments, utilities, and foreign governments. I have also performed risk studies or comparisons for the following analyses:

1. Task Force Report on Interim Operation of Indian Point;
2. Indian Point and Zion Site Risk and Alternative Containment Concepts Study;
3. Hatch consequence study;
4. Three Mile Island Potential Accident Consequence Study and Source Term Study;
5. Generic Environmental Statement on Mixed Oxide consequence study;
6. Anticipated transients without SCRAM consequence study;
7. Diablo Canyon Risk Assessment review; and
8. Clinch River Breeder Reactor consequence analysis review.

I have been responsible for advising and reviewing the following foreign risk assessments:

1. Norwegian Energy Study
2. Swedish Reactor Safety Study
3. German Reactor Safety Study
4. British Windscale and PWR Inquiries

In addition, the Norwegian Government personally invited me to Norway to review the approach and assumptions used in their study.

3. Siting and Emergency Planning and Response Criteria Development

I was the research consultant and member of the NRC/EPA Task Force on Emergency Planning. For the work of the Task Force, I was responsible for formulating the rationale for the emergency planning basis criteria

and was the principal author of the Task Force Report on Emergency Planning (NUREG-0396). I also was responsible for developing the Emergency Action Level Guidance (NUREG-0654, Appendix 1) which establishes consistent criteria for declaring emergencies based upon plant parameters.

I performed a study on the cost/benefit of issuing Potassium-Iodide to the general public. Based on this report (NUREG/CR-1433), Potassium-Iodide is not being stockpiled for public distribution. In addition, I have performed numerous studies on emergency protective measures such as sheltering versus evacuation. I also developed the Three Mile Island Emergency Contingency Plan at the time of the accident.

I developed a ranking of high population sites which has been used to designate potentially high risk contributors.

4. Integrating Probabilistic Risk Assessment Into the Regulatory Process

I have provided technical direction on consequence modeling to the regulatory and licensing process for the following areas: Perryman Alternative Site Review; Environmental Impact Statement for Class 9 Accidents; Liquid Pathway Generic Study; in understanding the course and importance of potential accidents; and in source term development. I have on numerous occasions presented the results of my work on consequence modeling and emergency planning and response to other Offices within the agency, other organizations, the Advisory Committee on Reactor Safeguards, and the NRC Commissioners.

Science Applications, Inc. (SAI), April 1973 to April 1975, McLean, Virginia

I was involved with the design and implementation of two major projects.

The first project was the Atomic Energy Commission's Reactor Safety Study. I was a research analyst involved in developing and applying reliability methods in reactor accident sequence quantification and error/uncertainty propagation. I also was given responsibility for the development of an improved consequence model for the final version of the study.

The second project was the Federal Trade Commission's Market Basket Survey. This survey was designed to statistically determine a "typical" market basket of food for the average family and have an accurate comparison of grocery store pricing. I was retained as an expert consultant to the F.T.C. and helped design and implement the survey and analysis techniques.

Computer Sciences Corporation - August 1970 to April 1973, Arlington, Virginia

I was a task leader with Computer Sciences Corporation where I worked on the general support contract for the National Military Command System Support Center (NMCSSC) in the modeling and gaming department. I designed, implemented, and documented the Data Base Preparation Subsystem of the QUICK Reacting General War Gaming model. I was task leader for the QUICK production support task with responsibilities for

maintenance and production support of the model and the associated damage assessment models. I was chosen as War Gaming Analysis Section representative to study and evaluate the consolidation and conversion of the Antiballistic Missile System (ABM-I) and QUICK Strategic War Gaming Models.

Imcor-Glenn Engineering, Inc. - June 1968 to April 1970, Rockville, Maryland

Imcor-Glenn Engineering, Inc. Operations Supervisor, Programmer - I was contracted to work for the Naval Ships Research and Development Center on testing and evaluation of the Small Boats Project (PCF) and on the Sonar Dome Project. I was also contracted to the Naval Research Laboratory as site team leader for testing and evaluation of Ultra High Frequency Radio Wave Study. As operations supervisor for the Data Division of Imcor, I was responsible for programming and quality control of processed data.

Awards, Honors, and Publications

I received the NRC Special Achievement Award on October 29, 1976 and a NRC High Quality Award on May 11, 1978. I was a session chairman in Consequence Modeling for the American Nuclear Society/European Nuclear Society Topical Meeting on Probabilistic Risk Assessment, September 20-24, 1981 in Port Chester, New York. I was also a session chairman for the American Nuclear

Society Review Conference on the PRA Procedures Guide, April 1982, in Arlington, Virginia. For this conference, I organized three formal debates on current issues in consequence modeling. I have published numerous papers and reports in probabilistic risk assessment, consequence modeling, siting, emergency planning and response, and on the source term. A list of all publications is attached.

Education

I was awarded a Batchelors of Science in Computer Science in 1970 and a Masters of Science in Operations Research in 1973 from the American University in Washington, DC.

AUTHORED OR CO-AUTHORED THE FOLLOWING PUBLICATIONS

"Relationship of Source Term Issue to Emergency Planning," EPRI/NSA Workshop on Technical Factor Relating Impacts from Reactor Releases to Emergency Planning, Bethesda, MD, January 12-13, 1982.

Reactor Safety Study, WASH-1400, Appendix II and VI.

Nuclear Energy Center Site Survey Study, NUREG-001, Exhibit A, Section 6, part IV, "NEC Accident Risk Analysis."

Reactor Accident Source Terms: Design and Siting Perspectives, NUREG-0773, draft.

Regulatory Impact of Nuclear Reactor Accident Source Term Assumptions, NUREG-0771, April 1981.

Task Force Report on Interim Operation of Indian Point, NUREG-0715, August 1980.

Planning Basis for the Development of State and Local Government Radiological Response Plans in Support of Light Water Nuclear Power Plants, NUREG-0396, December 1978.

Emergency Action Level Guidelines for Nuclear Power Plants, NUREG-0610 (Appendix 1 of NUREG-0654, November 1980).

"Consequence Analysis Results Regarding Siting," 1981, Water Reactor Safety Meeting, Gaithersburg, MD.

"Calculations of Reactor Accident Consequences: User's Guide," draft.

A Model of Public Evacuation for Atmospheric Radiological Releases, SAND78-0092, Sandia Laboratories, Albuquerque, NM, June 1978.

Examination of the Use of Potassium Iodide (KI) as an Emergency Protective Measure for Nuclear Reactor Accidents, NUREG/CR-1433, SAND80-0981, Sandia National Laboratories, Albuquerque, NM, March 1980.

"Radiation Protection: An Analysis of Thyroid Blocking," IAEA International Conference on Current Nuclear Power Plant Safety Issues, Stockholm, Sweden, October 20-24, 1980.

"International Standard Problem for Consequence Modeling: Results," International ANS/ENS Topical Meeting on Probabilistic Risk Assessment, Port Chester, NY, September 1981.

"Recent Developments in Consequence Modeling," presented at the Jahreskolloquium PNS, Kernforschungszentrum Karlsruhe, Federal Republic of Germany, November 1981.

"International Standard Problem for Consequence Modeling," International ANS/ENS Topical Meeting on Probabilistic Risk Assessment, Port Chester, NY, September 20-24, 1981.

"Environmental Transport and Consequence Analysis," International ANS/ENS Topical Meeting on Probabilistic Risk Assessment, Port Chester, NY, September 20-24, 1981..

"Weather Sequence Sampling for Risk Calculations," Transactions of the American Nuclear Society, 38, 113, June 1981.

Calculations of Reactor Accident Consequences, Version 2: User's Guide, NUREG/CR-2326, SAND81-1994, Sandia National Laboratories, Albuquerque, NM, (to be published).

"Investigation of the Adequacy of the Meteorological Transport Model Developed for the Reactor Safety Study," ANS Topical Meeting on Probabilistic Analysis of Nuclear Reactor Safety, Newport Beach, CA, May 8-10, 1978.

USNRC, "Environmental Transport and Consequence Analysis," Chapter 9 and Appendices D, E, and F in PRA Procedures Guide, Review Draft, NUREG/CR-2300, 1981.

Overview of the Reactor Safety Study Consequence Model, U. S. Nuclear Regulatory Commission, NUREG-0340, 1977.