Pennsylvania Public Utility Commission
North Office Building
P. O. Box 3265
Harrisburg, PA 17120
May 5, 1980

Mr. William T. Russell
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Bill:

Subject: NRC Staff Testimony

The following is a summary of the issues and matters I think we should cover at the Pennsylvania depositions in May, note that this letter includes only the Beaver Valley dynamic stress analysis and turbine spindle issues. My following letter will cover the low-head injection pump and chronology - history of inspection issues.

First, each witness should probably prepare a qualifications summary in written form. I will have the reporter insert each summary into the record at the outset, to save time. I have enclosed an example of expert qualification testimony submitted in another proceeding. Each witness should include a complete summary, with dates, of educational qualifications after high school or preparatory school, nature of educational concentration, any educational or professional scholarships or awards, work experience, and nature of duties to the present (emphasizing and describing in detail NRC employment), professional papers and articles authored or co-authored, membership in professional organizations, major work projects completed or in progress, testimony (and in what areas) given before courts, legislative bodies or administrative agencies and any other relevant factors or experience which would cause the Public Utility Commission to regard the witness as an expert in the specific areas to be addressed. Finally, if any witness holds a security clearance or is otherwise restricted from testifying on some aspect of work experience, so indicate.

Definitions - Dynamic Stress Analysis

It is desireable to define, at the outset all of the numerous technical terms and abbreviations to be used in testimony. Ordinarily, we would prepare a glossary in written form, but that is impractical in this proceeding. I have culled a few of the more difficult and important terms from the literature which could stand definition.

- dynamic stress analysis
- static stress analysis
- intermodal combination
- intramodal combination
- shock spectrum

- two directional and three directional analysis
- single and multiple pulse quakes
- RMS
- algebraic, square root sum of the squares (SRSS) and absolute summations
- response spectrum analysis
- ASME codes
- Regulatory Guides, and §1.92
- FSAR
- SER
- linear combination among nodes
- absolute combination among nodes
- SHOCK I code
- SHOCK II code
- NUPIPE code
- dynamic; static analysis
- phasing and earthquake phase relationships

Questions - Dynamic Stress Analysis

1. Name, address, present occupation, prior education and experience.
2. Present NRC position - role of NRC staff in nuclear safety review.
3. Scope of expertise and testimony in this case.
4. Definitions of terminology to be used.
5. What events led up to the March 13th shutdown?
6. What did Beaver Valley's SER say with respect to stress analysis? The FSAR?
7. What NRC regulations, regulatory guides or understandings with respect to stress analysis and when?
8. Who performed initial stress analysis computations? When?
9. What methodology was used? What methodology should have been used, in your opinion? Why?
10. Should S & W have known, or its mechanical engineers have known that its computer codes were wrong? Why?
11. Were there any subsequent events after B-V was planned which could have alerted S & W to a need for reanalysis? Was such reanalysis performed?
12. What was NRC staff's first reaction upon learning of the stress analysis methodology used? (What problems - regulatory and engineering - did it present?)
13. What actions did the NRC's show cause order require of Duquesne, the operating licensee?
14. How long did the shutdown last?
15. What specific reanalysis was <u>required</u> of the licensee? Who did it?
16. What analysis did S & W actually perform? (Did they do more than required? Did this delay start-up?)

16a. In your opinion, did S & W delay the reanalysis?

17. What deficiencies were uncovered as a result of the analysis? (DBE - OBE requirements and problems?)
18. Were those deficiencies corrected? How?
19. Describe the difference between SRSS, algebraic summation, and absolute summation stress analysis methods?
20. Which method predicts actual stress conditions best? Why?

21. What trade-offs must an engineer make in stress analysis and reinforcement? (harmonic coupling problems, overdesign problems, etc.)
22. What design features of B-V already contributed to stress resistance?
23. Why was a dynamic rather than a static analysis required?
24. Do all licensees now calculate stress by the SRSS method? Are other and older plants other than S & W plants being reanalized?

Definitions - Turbine Spindle Cracking

- parts of turbine spindle
- low pressure turbine vs. pressure turbine
- spindle
- shaft
- keyway
- rotors or blades
- necessary metallurgical terms
- stress corrosion cracking
- turbine missiles
- turbine discs

Questions - Turbine Spindle Cracking

Qualifications

1. What event alerted the NRC to a problem with turbine disc cracking?
2. Describe the current problems with disc cracking.
3. Is the problem peculiar to a specific turbine design or manufacturer?
4. What theories have been advanced to explain the cracking?
5. What steps have been taken to cure the cracking? (Duquesne? Other licencees?)
6. Are the replacement spindles of Duquesne of the same design as the original (cracked) spindles?
7. Could cracking problems occur with the replacement spindles?
8. Have the cracks appeared in Westinghouse spindles earlier than expected by the nature of the design?
9. Has spindle cracking contributed or is it likely to contribute to any B-V shutdown?

Please feel free to telephone comments or suggestions for additional definitions or questions to me. I will be at out-of-town hearings until May 9, 1980, but my secretary will relay messages.

I hope this provides a good starting point for preparation.

Very truly yours,

John A. Levin
Assistant Counsel

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Enclosure

I. QUALIFICATIONS AND SUMMARY OF FINDINGS

Q. Please state your name and business address.

A. My name is John K. Stutz. My business address is Energy Systems Research Group, Inc., 120 Milk Street, Boston, Massachusetts 02109.

Q. Dr. Stutz, please describe your background and qualifications.

A. I am currently a senior research scientist at Energy Systems Research Group, Inc. (ESRG), a non-profit firm specializing in research on energy-related matters. At ESRG I have had extensive experience in the area of mathematical modelling and its application to energy-related problems, particularly long-range load forecasting for electric utilities. I have testified in electric utility cases in New York, Massachusetts, Rhode Island, Connecticut, Pennsylvania, and Michigan. I have prepared long-range electric load forecasts for utilities in New York, Connecticut, Pennsylvania and Ohio. Before joining ESRG, and after receiving my Ph.D. at Princeton University, I taught and did research in mathematics and economics at M.I.T., the State University of New York at Albany, and most recently at Fordham University, where I held the position of Associate Professor and co-director of the program in Mathematics and Economics. My background is described more fully in the Vita attached as Exhibit ___(JS-1) below.

What is the subject of your testimony today?

My testimony concerns the long-range load growth forecast by the member utilities of CAPCO. I am sponsoring independent

JOHN K. STUTZ

Research Scientist
Secretary of the Corporation
Energy Systems Research Group

Education

Ph.D.:	Mathematics, Princeton University, 1969.
B.S.:	Mathematics, State University of New York at Stony Brook, 1965.

Experience

1977 - Present:	Energy Systems Research Group, Inc. Responsibility for mathematical modelling for a range of energy studies, especially electrical demand forecasting and input-output analysis of the labor impacts of energy alternatives; research on cost of electric service and rate design issues; analysis of energy price impacts on consumers.
1976 - 1977:	Associate Professor, Mathematics Department, Fordham University. Co-director of the joint B.S. program in economics and mathematics.
1971 - 1976:	Assistant Professor to Associate Professor, State University of New York at Albany, Mathematics Department, then Allen Center.
1969 - 1971:	Instructor, Mathematics Department, Massachusetts Institute of Technology.

ESRG Research

Forthcoming:	Long Range Forecast of Ohio Electric Demand, ESRG Study No. 79-24. Principal Investigator.
March 1980:	Testimony, Pennsylvania Public Utility Commission (Duquesne Light Co. and CAPCO). Long range forecast of electric energy and demand.
January 1980:	Testimony, Case 20055, Massachusetts Department of Public Utilities (New Bedford Gas and Edison Light Co.). Electricity conservation strategies and alternative generation options; critique of and adjustments to long-range electric demand forecast.

December 1979: Testimony, Case 1232, Rhode Island Public Utility Commission (Blackstone Valley Electric Co.). Critique of cost of service study and analysis of alternative rate designs.

November 1979: Testimony, Docket R-79060865, Pennsylvania P.U.C. (Philadelphia Electric Co.) Long-range demand forecast (base case and conservation policy case).

October 1979: Testimony, Case U-6217, Michigan Public Service Commission (Detroit Edison Co.). Forecast critique.

September 1979: Energy and Jobs: Analyzing the Economic Impacts of State Policies to Promote Energy Conservation, ESRG Study No. 79-01. Development of input-output model and application to a region in Massachusetts. Principal Investigator.

September 1979: Testimony, The New York State Energy Master Planning and Long Range Electric and Gas System Proceeding. Long-range electric demand and the employment implications of energy conservation.

July 1979: Base Case Forecast and Employment Impacts of the Conservation Policy Case Alternative, volumes I and III of ESRG Study No. 79-12, Electricity Requirements in New York State. Principal Investigator for Volume III.

June 1979: Long-Range Forecast of Electric Energy and Demand in the Service Territory of the Duquesne Light Company, ESRG Study No. 79-17. Principal Investigator.

May 1979: Testimony, Case 19494, Massachusetts DPU (Boston Edison Co.). Growth in electric demand.

May 1979: Assessment of the New England Power Pool - Battelle Long Range Electric Demand Forecasting Model, ESRG Study No. 79-06, A Report to the New England Conference of Public Utility Commissioners. Co-author.

May 1979: Testimony, Case U-6006, Michigan P.S.C. (Detroit Edison Co.). Forecast critique.

March 1979: Testimony, Cases 27461 and 27462, New York Public Service Commission (Central Hudson Gas and Electric Co.). Critique of revenue and demand forecasts.

February 1979: Analyzing the Impacts of Energy Prices on New England Residents, ESRG Study No. 79-01. Principal Investigator.

December 1978: Energy Demand Study: Power Authority of the State of New York, ESRG Study No. 78-15. Principal Investigator.

December 1978: Economic Impact of an Electricity Rate Increase in New York City, ESRG Study No. 78-14. Principal Investigator.

December 1978: Gas Production from Nuclear Power Plant Waste Heat: An Economic Analysis, ESRG Study No. 78-12. Co-author.

October 1978: Testimony, Docket 780701, Connecticut Public Utilities Control Authority (United Illuminating Co.). Forecast critique and long-range demand forecast.

October 1978: The Employment Creation Potential of Energy Conservation and Solar Technologies: The Implications of the Long Island Jobs Study for New England, 1978-1993. Principal Investigator.

September 1978: Long Range Forecast of Electric Energy and Demand in New York State, ESRG Study No. 78-07. Co-author.

September 1978: Testimony, Case 27319, N.Y. Public Service Commission (Power Pool Long Range Plan). Forecast critique and demand forecast.

May 1978: A Methodology for Estimating Total Economic and Employment Impacts of Energy Related Construction, ESRG Study No. 78-03. Principal Investigator.

March 1978: Testimony, Docket 438, Pennsylvania Public Utility Commission (Philadelphia Electric Co.). Forecast critique and demand forecast.

September 1977: Testimony, Dockets 770319 and 770320, Connecticut Public Utilities Control Authority (Northeast Utility System). Forecast critique, conservaation options; comparative costs of generation alternatives.

April 1977: Assessing Demand, Alternative Generating Strategies, and Utility Economics in the Service Territory of Orange and Rockland Utilities, ESRG Study No. 77-01. Co-author.

April 1977: Testimony, Cases 27094 and 27095, N.Y. Public Service Commission (Orange and Rockland Utilities).

Other Publications

April 1979: Production of Synthetic Gas from Nuclear Energy Sources, Los Alamos Scientific Laboratory Report LA-7592-MS. Co-author.

February 1979: "Energy Policy and Employment," People Energy Primer, Syracuse Peace Council.

1976: "Equisingularity and Local Analytic Geometry," Proceedings of the American Mathematical Society, Summer Institute on Several Complex Variables.

April 1976: "Residual Equisingularity," with Joseph Becker. Proceedings of the American Mathematical Society, vol. 56.

1974: "Primitive Elements for Modules over O(Y)," Duke Mathematics Journal, vol. 4.

1973: "The C^1 Embedding Dimension of Certain Analytic Sets," with J. Becker. Duke Mathematics Journal, vol. 40.

1973: "Resolving Singularities via Local Quadratic Transformations," with J. Becker. Proceedings of the Conference on Singularities, Rice University Studies, vol. 59.

1973: "Wings in Analytic Sets," Indiana University Mathematics Journal, vol. 22.

1972: "Equisingularity and Equisaturation in Codimension I," American Journal of Mathematics, vol. 94.

1972: "Analytic Sets as Branched Coverings," Transactions of the American Mathematical Society, vol. 166.

1970: "The Representation Problem for Differential Operators on Analytic Sets," Math. Ann., vol. 189.

Selected Papers and Professional Activities

1979 - present: Consultant to National Consumer Law Center. Electric utility load research methodology.

1978 - 1979 Consultant to Council on Economic Priorities. Energy and employment.

1979: "Assessing Local Employment Impacts of Conservation and Solar-Related Activities," Conference sponsored by the International Solar Energy Society, Georgia Office of Energy Resources, and Solar Energy Research Institute.

October 1978: Panelist on electric utility rate structures and load forecasting, national meeting of the Critical Mass Energy Project.

August 1978: Participant, Boston workshop on electricity supply and demand planning sponsored by the National Governors' Association, National Association of Regulatory Utility Commissioners, and Department of Energy.

Fall 1977: "The Role of Public Agencies in Utility Load Forecasting Proceedings," Lawyers' Guild meeting, Hartford.

November 1977: "Utility Electrical Demand Projections," Northeastern Political Science Association meeting, Mt. Pocono, Pennsylvania.

Summer 1975: Invited speaker, American Mathematical Society's Summer Institute on Analytic Functions of Several Complex Variables.

1973: Invited Participant, Rice University Conference on Singularities of Analytic Sets.

1972 - Present: Referee, Proceedings of the American Mathematical Society and Duke Mathematics Journal.

1969 - 1975: Reviewer for Mathematical Reviews and Zentralblat für Mathematik.

Awards and Honors

State University of New York Faculty Fellowship, Summer 1972 and Summer 1973.

National Science Foundation Cooperative Fellowship, 1965 - 1967.

Professional Societies

American Mathematics Society.