

United States of America
Nuclear Regulatory Commission

Before the Atomic Safety and Licensing Board

In the Matter of

Pennsylvania Power & Light Company

and

Docket No. 50-387 O.L.

Docket No. 50-388 O.L.

Allegheny Electric Cooperatives, Inc.

(Susquehanna Steam Electric Station Units 1 and 2)

Affidavit of Raghaw Prasad

I, Raghaw Prasad, being duly sworn, depose and state:

Q. By whom are you employed and describe the work you perform?

A. I am an Economist with the Environmental Impact Studies Division of the Argonne National Laboratory at Argonne, Illinois. My responsibilities consist of financial evaluation, cost-benefit analysis, and analysis of the demand for and supply of different energy sources. A copy of my professional qualifications is attached to this affidavit.

Q. Have you read Contention 14, as set forth by the Licensing Board in its Special Prehearing Conference Order of March 6, 1979?

A. Yes. That contention alleges that Applicants' cost-benefit balance overstates the benefits to be derived from Susquehanna Steam Electric Station, Units 1 and 2 (SSES) because Applicants used overoptimistic capacity factors.

Q. Would you describe the scope of the subject matter addressed in your affidavit?

A. I have been asked to evaluate the reasonableness of the capacity factor used by Applicants to arrive at the projected benefits in its cost-benefit analysis and to examine Applicants' methodology for calculating benefits from the operation of SSES. The projected capacity factor and the cost-benefit analysis considered by the staff are set forth in Applicants' Environmental Report, Operating License Stage, May, 1978 (ER-OL).

Q. What capacity factor was used by Applicants in its calculation of benefit?

A. Applicants assumed station operation at a 70% capacity factor at page 1.1-4 of the ER-OL.

Q. How reasonable is this assumed capacity factor?

A. In a study sponsored by the U.S. Nuclear Regulatory Commission, Esterling,¹ analyzing the historical capacity factor of nuclear units, concluded that capacity factors appear to be associated with a unit's age and type. From the statistical analysis of data, he estimated the average capacity factor of a 1100 MW Boiling Water Reactor (BWR) to be 65%. (Each unit of the Susquehanna Steam Electric Station will have a rating of 1050 MW.)⁴ Similarly, the "Licensed Operating Reactor Status Report" indicates that the average capacity factor of all operating nuclear reactors in the United States up to the end of January 1981 is 61.8%.² From these studies it appears that Applicants' projection of 70% as the SSES capacity factor is on the high side.

Q. How did Applicants estimate benefits in its cost-benefit analysis?

A. Applicants projected two major benefits - (1) the amount of electricity produced and (2) the cost savings resulting from the generation of electricity from SSES, Units 1 and 2 rather than the acquisition of electricity from other sources such as Applicants' other generating units and/or a power pool. In their ER-OL, Applicants project that 11.6 billion Kwh of electricity per year over the life of the plants will be produced by Units 1 and 2, assuming that the plants operate at a 70% capacity factor. Applicants assume that the demand for electricity on its system is unaffected by the issue of whether or not that electricity is generated by SSES, Units 1 and 2 or other generating units. Hence, in the absence of a generation contribution from SSES to the Applicant's System, Applicants will have to satisfy this unmet demand from other generating sources. These other sources may be higher in cost than electricity from SSES, Units 1 and 2. If, for example, Applicants satisfy this demand from a coal fired unit, it would incur fuel, operation and maintenance costs of 7-8 mills/Kwh higher than these costs at SSES, Units 1 and 2.³ Applicants estimate an operational savings of about \$35 to \$40 million/year per unit, if SSES is allowed to provide the replacement energy, assuming station operation at 60% to 70% capacity.

Q. If you used the methodology used by Applicants in its Environmental Report but applied a lower capacity factor, what effect would that have on Applicants' cost-benefit analysis?

A. If we assume a 60% capacity factor which is lower than that in previously referenced reports,^{1,2} the amount of electricity produced and the operational savings per year per unit would be 5.0 billion Kwh and \$35.0 million, respectively.

Q. Does a capacity factor of 60% rather than the 70% figure used by Applicants in its ER tilt the cost-benefit balance against operation of the plant?

A. No. Applicants have reported the benefit from the operation of Susquehanna units (in terms of cost savings) at both 60 and 70% capacity factor. A change in the capacity factor of operation leaves the capital cost and the environmental cost virtually unchanged. There will only be a change in the amount of electricity produced and the fuel, operation and maintenance cost. Applicants will have to acquire more replacement electricity if the Susquehanna units operate at 60% instead of 70% capacity factor. As the acquisition cost of replacement electricity is projected to be higher than the cost of electricity produced from the Susquehanna units, the total cost of electricity will rise, and hence the projected savings from the operations of Susquehanna units will decrease. A decrease in the operation of Susquehanna Units 1 from 70% to 60% of capacity will decrease the savings from \$40 to \$35 million/year and decrease the amount of electricity produced from 5.8 to 5.0 billion Kwh per unit per year. I conclude that at this lower capacity factor (60%), the benefits from operation of the Susquehanna units outweigh the environmental cost. Because a lower capacity factor simply reduces the savings, using Applicants' ER-OL numbers, by \$5 million/year and the amount of

electricity produced by .8 billion Kwh, the overall cost/benefit balance still supports operation of the facility.

- Q. Why is the Staff's estimate of savings from operation of SSES as reported in the FES higher than that estimated by Applicants in its ER-OL?
- A. Since the preparation of ER-OL, Applicants' projected sources of replacement electricity and the projected cost associated with it has changed as shown in Table 7.1 of FES. The cost of acquiring replacement electricity has further increased because of rise in the price of fuel oil. In 1980, the fuel cost of generating electricity from an oil-fired unit was 43.1 mills/Kwh. This figure is higher than that shown in Table 7.1 because that projection was made in 1978 and does not reflect price increases due to events in the mideast during 1979. The fuel, operation and maintenance cost of acquiring replacement electricity is projected to cost about 19-20 mills/Kwh (as compared to 7-8 mills/Kwh in ER-OL report) higher than the fuel, operation and maintenance cost of electricity generated from the Susquehanna units. Based on this differential cost, the savings (and hence the benefit) from the operation of the Susquehanna units are projected to be \$112 million/year/unit. At a capacity factor of 60%, this savings is approximately 320% higher than what was reported by Applicants in the ER-OL.

Raghaw Prasad

Raghaw Prasad

Subscribed and sworn to before

me this 31st day of August

19 81

Barton L. Robertson

Notary Public

References used to respond to Contention 14

1. Easterling, Robert C., "Statistical Analysis of Power Plant Capacity Factors Through 1979," Sandia National Laboratories, Albuquerque, New Mexico, prepared for U.S. Nuclear Regulatory Commission, NUREG/CR-1881, SAND 81-0018, Manuscript, December, 1980.
2. "Licensed Operating Reactor Status Report," U.S. Nuclear Regulatory Commission, NUREG/0020, Vol. 5, No. 2, February, 1981.
3. "Environmental Report Operating License Stage," Susquehanna Steam Electric Station Units 1 and 2, Vol. 2, May, 1978.
4. "Final Environmental Statement Relating to the Operation of the Susquehanna Steam Electric Station, Units 1 and 2," NUREG-0564, June 1981, at p. 1-1.

PROFESSIONAL QUALIFICATIONS

Raghaw Prasad

Argonne National Laboratory

I am an Economist with the Environmental Impact Studies Division of the Argonne National Laboratory at Argonne, Illinois. My responsibilities consist of financial evaluation, cost-benefit analysis, analyzing the demand and supply of different energy resources, and transport network analysis, as part of the preparation of environmental impact statements. I joined the Division in May, 1979, and since have participated in the preparation of about half a dozen statements.

I have a Bachelor of Science degree (1961) in Electrical Engineering from Ranchi University, India, a Master of Business Administration degree (1973), a Master of Arts (1977) in Economics, and a Ph.D. Candidacy in Economics from Temple University, Philadelphia. My dissertation topic is "Evaluation of Time-of-day and Lifeline Rate Structures and Estimation of Electricity Demand". I have completed all requirements of a Ph.D. degree.

From 1961 to 1970, I worked as an operations research analyst. My responsibilities involved production scheduling, inventory control, cash management, and capital budgeting.

From 1971 to 1973, I was a consultant at a community mental health center, Albert Einstein Hospital, Philadelphia. I directed a program which utilized Eastern philosophy, yoga, and meditation to help individual's and family's mental and physical problems.

From 1973 to 1974, I was a senior systems analyst with Combustion Engineering Refractory Division at Valley Forge, Pennsylvania. I developed and managed a Management Information System, and Business Planning Model.

From 1974 to 1977, I worked as a senior systems planner with Sperry Univac, Blue Bell, Pennsylvania. As a part of my responsibilities I designed and developed a financial and accounting inventory control system to handle the flow of computer parts to and from their subsidiaries located throughout the world.

From 1977 to 1978, I was employed as a senior economist with General Public Utilities, New Jersey. My responsibilities included development of residential and industrial electricity demand models, regional economic impact analyses and electricity demand forecast.

Since joining Argonne, I have performed a number of cost-benefit analysis, financial evaluations, and energy supply and demand analyses to be incorporated into the environmental impact statements. I developed a production and financial model for estimating the natural gas production and financial viability of U.S. Lake Erie Gas Development Program. The results of the model were utilized in the preparation of draft environmental impact statement of U.S. Lake Erie Natural Gas Development Program. I was asked to defend the production and financial data before a public hearing at Buffalo, New York.

I also developed a levelized cost model for comparing per unit cost of generation of electricity using different primary energy fuels. The results were utilized for the Pebble Springs project. I also developed a model to

evaluate the need for the Pond Hill Reservoir to supply the consumptive needs of Susquehanna Steam Electric Station during periods of low river flow.

As a part of my responsibility in the preparation of the Northeast Regional EIS, I provided the coal supply/demand scenario to evaluate the impact of incremental coal demand resulting from conversion of power plants from oil to coal. Presently, I am involved in developing a Northeast Regional Transportation Model.

I am a member of the American Economic Association.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

PENNSYLVANIA POWER AND LIGHT CO.
ALLEGHENY ELECTRIC COOPERATIVE, INC.

(Susquehanna Steam Electric Station,
Units 1 and 2)

Docket Nos. 50-387
50-388

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF MOTION FOR SUMMARY DISPOSITION OF CONTENTION 14" and "STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE TO BE HEARD" and "AFFIDAVIT OF RAGHAW PRASAD" dated September 10, 1981 in the above captioned proceeding have been served on the following by deposit in the United States mail or as indicated by an asterisk through deposit in the Nuclear Regulatory Commission's internal mail system, this 10th day of September, 1981:

James P. Gleason, Chairman
Administrative Judge
513 Gilmore Drive
Silver Spring, Maryland 20901

*Mr. Glenn O. Bright
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dr. Paul W. Purdom
Administrative Judge
245 Gulph Hills Road
Radnor, Pennsylvania 19087

Jay Silberg, Esq.
Shaw, Pittman, Potts and Trowbridge
1800 M Street, N.W.
Washington, D.C. 20036

Bryan A. Snapp, Esq.
Pennsylvania Power & Light Company
Two North Ninth Street
Allentown, Pennsylvania 18101

Dr. Judith H. Johnsrud
Co-Director
Environmental Coalition on
Nuclear Power
433 Orlando Avenue
State College, Pennsylvania 16801

Mr. Thomas M. Gerusky, Director
Bureau of Radiation Protection
Department of Environmental Resources
Commonwealth of Pennsylvania
P. O. Box 2063
Harrisburg, Pennsylvania 17120

Ms. Colleen Marsh
Box 538A, RD#4
Mountain Top, Pennsylvania 17120

Mr. Thomas J. Halligan
Correspondent: CAND
P. O. Box 5
Scranton, Pennsylvania 18501

*Richard S. Salzman, Esq., Chairman,
Administrative Judge
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Dr. John H. Buck, Administrative Judge
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Mr. Thomas S. Moore, Administrative Judge
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Atomic Safety & Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Atomic Safety & Licensing Appeal Board
Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

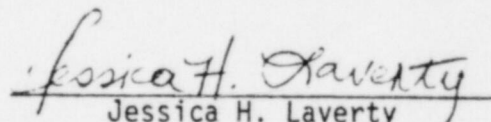
*Secretary
U.S. Nuclear Regulatory Commission
ATTN: Chief, Docketing & Service Branch
Washington, D.C. 20555

Susquehanna Environmental
Advocates
c/o Gerald Schultz, Esq.
P.O. Box 1560
Wilkes-Barre, PA 18703

Mr. Robert M. Gallo
Resident Inspector
P.O. Box 52
Shickshinny, Pennsylvania 18655

Robert W. Adler
Dept. of Environmental Resources
505 Executive House
P.O. Box 2357
Harrisburg, Pennsylvania 17120

Mr. DeWitt C. Smith, Director
Pennsylvania Emergency Management Agency
Transportation and Safety Building
Harrisburg, Pennsylvania 17120


Jessica H. Lavery
Counsel for NRC Staff