

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
ARIZONA PUBLIC SERVICE	)	Docket Nos. STN 50-528
COMPANY, <u>ET AL.</u>	)	STN 50-529
	)	STN 50-530
(Palo Verde Nuclear Generating	)	
Station, Units 1, 2 and 3)	)	

NRC STAFF TESTIMONY OF FRANCIS P. CARDILE AND  
MICHAEL L. KARLOWICZ FOR CONTENTION 7: DECOMMISSIONING

Q. Will you please state your names and place of employment and your responsibilities regarding the Palo Verde nuclear facility?

A. My name is Francis P. Cardile. I am employed by the U.S. Nuclear Regulatory Commission as a nuclear engineer in the Division of Engineering Technology, Office of Nuclear Regulatory Research. In my current capacity I am involved in the development of NRC policy regarding decommissioning of nuclear facilities. This has included evaluation of contractor reports on the technology, safety and costs of decommissioning, and preparation of an environmental impact statement on decommissioning. My professional qualifications are attached.

A. My name is Michael L. Karlowicz and I am employed as a Financial Analyst with the U.S. Nuclear Regulatory Commission. As part of my responsibilities with the U.S. Nuclear Regulatory Commission, I prepared an analysis which evaluates the financial qualifications of the applicants in this proceeding to operate and safely decommission the Palo

Verde facility. That analysis was published as Section 20.0 to the Staff's Safety Evaluation Report in this proceeding (NUREG-0857, November 1981). A statement of my professional qualifications as an expert in utility finance is appended hereto.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to respond to Contention 7 which states:

The Applicants have failed to demonstrate their financial qualifications as required by 10 C.F.R. Part 50.33(f) and 10 C.F.R. Part 50, Appendix C, because they have inadequately figured decommissioning costs."

Q. Mr. Cardile, what is the basis for the Intervenor's assertion that the Applicant has inadequately figured decommissioning costs?

A. In response to Interrogatory 33 of the Applicant's Second Set of Interrogatories regarding its basis for Contention 7, the Intervenor has cited two reports entitled "An Analysis of Decommissioning and Premature Shutdown Costs of Nuclear Power Plants," prepared by "Accountants for the Public Interest, August 1980" (the "API report") and "Nuclear Power Plant Decommissioning Costs," prepared by MHB Technical Associates, Draft Report, August 1979 by Richard Hubbard (the "Hubbard report"). The Hubbard and API reports specifically refer to decommissioning cost estimates made for the Three Mile Island Unit 1 (TMI-1) by GPU and for Millstone Point 1 and 3 (Millstone) by Northeast Utilities. As I shall explain later, these cost estimates, as cited in Interrogatory 33 by the Intervenor, are greater than the estimates for PVNGS.

Q. What is the Applicant's estimate of decommissioning costs for PVNGS and what is the basis for that estimate?

A. In Section 5.8.1 of the Environmental Report (Dec. 1979), the Applicant has estimated that the costs for decommissioning one Palo Verde Nuclear Generating Station (PVNGS) unit by immediate dismantlement is \$57 million. This estimate is based on an engineering analysis of decommissioning costs for the PVNGS entitled "Update of Estimated Costs for Decommissioning One of the Palo Verde Nuclear Generating Station (PVNGS) Units," (Oct. 1979) prepared by the S.M. Stoller Corp. ("the Stoller Report").

Q. What is the content of the Stoller Report and what is its basis?

A. The Stoller Report is an engineering analysis of the cost to decommission the PVNGS. Its costs are based on systems, components, and equipment specific to PVNGS and the methodology it utilizes in computing these costs are based upon a NRC sponsored study on decommissioning entitled, "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station," NUREG/CR-0130, prepared by Battelle Pacific Northwest Laboratories (June 1978 and Addendum, August 1979) ("the PNL report"). In making its cost estimates, the Stoller Report divides the dismantling operation into six basic tasks. These tasks include: (1) site and facility preparation (in which costs for electrical services, and licensing specific to PVNGS are estimated); (2) removal of spent fuel (in which amount of fuel to be shipped and costs of shipment are estimated); (3) decontamination of piping and equipment (in which costs of decontamination chemicals, staff labor, and power requirements are estimated); (4) removal of nuclear and containment system components (in which costs of dismantling radioactive components are estimated, to include the cost of manpower, equipment and supplies);

(5) shipment and burial of radioactive waste (in which quantities of waste generated during the decommissioning of PVNGS and costs of waste disposal are estimated); and (6) demolition of nonradioactive structures. The Stoller Report also includes estimates for contingencies.

Q. What is the content of the PNL report?

A. The PNL report on the decommissioning of a reference PWR is one in a series of reports prepared by Battelle-PNL on the technology, safety, and costs of decommissioning nuclear facilities. The purpose of these reports has been to develop a data base on decommissioning nuclear facilities to support an NRC reevaluation of its decommissioning policy. The PNL report which deals with the decommissioning of a reference PWR is a detailed engineering study of the conceptual decommissioning of a large PWR (the 1175 MW(e) Trojan Nuclear Plant is used as the reference plant). This report considers: (1) the detailed plant design and layout of the reference plant; (2) estimated conditions in the plant at the time of shutdown (just prior to decommissioning) including estimates of radionuclide inventory and radiation dose rates; (3) techniques for decontamination and dismantling which are current and proven; and (4) radiation protection requirements for workers and the public. Based on these considerations, the PNL report develops detailed work plans and time schedules to accomplish decommissioning, including those for planning and preparation, decontamination, and component disassembly and transport, as well as costs for demolition and site restoration. In making costs estimates of decommissioning, the PNL report includes such matters as work scheduling estimates, staffing requirements, specialty

contractors, essential systems, radioactive materials disposal, and supplies.

Q. Can the PNL cost methodology be used by utility applicants such as Arizona Public Power Service for estimating costs of decommissioning specific plants?

A. Yes. As is indicated in the PNL report in Volume I, Section 4.3, the PNL cost estimates are intended to provide background information useful to nuclear plant designers and operators, although items particular to a specific facility such as its location, design, and operating conditions must also be specifically considered by a user in arriving at estimates. The NRC in its Generic Environmental Impact Statement on Decommissioning Nuclear Facilities, NUREG-0586, states that the PNL cost estimates, with suitable adjustment to account for licensee facility differences, can be used by an applicant for initial cost estimates. As discussed earlier in this testimony, this is the procedure that the Applicant (in the Stoller Report) has used in estimating decommissioning costs for PVNGS.

Q. Do you consider the PVNGS decommissioning cost estimates to have been adequately figured?

A. Yes. The costs provided by the Stoller report appear to be reasonable estimates for the costs of decommissioning PVNGS because they are based on use of the cost methodology in the PNL report and on specific PVNGS plant design data.

Q. Are the cost estimates made by the Applicant the final ones which will be made for PVNGS?

A. No. As I have previously stated, the NRC is currently re-evaluating its policy on decommissioning. As part of that reevaluation, the NRC Staff has issued a Generic Environmental Impact Statement (GEIS) on Decommissioning Nuclear Facilities (NUREG-0586). In the GEIS, the NRC Staff has recommended that a utility make periodic review and revision, where necessary, of its cost estimates to take into account information on such factors as technology improvements, enhanced decommissioning experience, and inflationary/deflationary cost factors. The Commission has not yet acted upon the GEIS, but it is anticipated that a proposed rule and regulatory guide will be issued in early 1983.

Q. To put the PVNGS cost estimates into perspective, how do they compare with estimates made by other utilities for other nuclear power plants?

A. First of all, it should be noted that it is difficult and perhaps misleading to make simple comparisons between different cost estimates for different plants. This is because there are many site-specific and facility-specific considerations in computing cost estimates for specific facilities. These considerations include such items as plant design, operating conditions, and costs specific to a particular location such as taxes and labor costs. Nevertheless, a comparison of cost estimates may be somewhat useful in assessing the reasonableness of the cost estimates of a specific facility.

Such a cost comparison has been done by the Stone and Webster Engineering Corp. under sponsorship of the Atomic Industrial Forum's National Environmental Study Project (NESP). This comparison is contained in a report entitled "Analysis of Nuclear Power Reactor

Decommissioning Costs," AIF/NESP-021 (May, 1981) ("the NESP report"). This report compared thirteen different studies of cost estimates for decommissioning, including eight made for existing nuclear facilities (Arkansas Nuclear One, Prairie Island No. 1, Maine Yankee, Three Mile Island (TMI) No. 1, San Onofre No. 1, Millstone Pt. No. 2, Palisades, and Davis Besse No. 1), and five made for a generic or reference nuclear facility (an earlier NESP study, the NRC sponsored PNL report, a study by New York State Electric and Gas Co., a Department of Energy study, and a study by Nuklear-Ingenieur Services in Germany). To aid in this comparison, the NESP report adjusted all the estimates by use of inflation factors to a common year, i.e., 1980 dollars. The results of this report shows the average cost estimate made for the 13 studies to be \$54.5 million in 1980 dollars. While the NESP report indicates that ". . . direct comparison of dollar values alone is meaningless, site specific data, differences in planned decommissioning alternatives, and differences in the assumptions on which cost estimates are made must be taken into account" (NESP report, p. 3), this comparison of the PVNGS cost estimates with those made for the thirteen other studies supports the reasonableness of the decommissioning cost estimated for PVNGS.

Q. How do you reconcile the higher cost estimates cited by the Intervenor in Interrogatory No. 33 for TMI 1 and Millstone with the lower cost for the PVNGS estimates?

A. In answering Interrogatory No. 33 concerning its basis for Contention 7, the Intervenor cites the API report at page 35 and the Hubbard report at page 20. The reference in the API report is to a \$117 million estimate made in 1975 by General Public Utilities (GPU) for

decommissioning TMI-1. The reference in the Hubbard report is to an estimate of property taxes for the Millstone Units 1 and 3 plants during partial dismantlement/delayed removal of Unit 1 and mothballing/delayed removal of Unit 3 at a cost of \$24 million and \$264 million, respectively.

In answer to these higher estimates for TMI-1 and Millstone, it should be pointed out that citing figures from other studies without considering the basis for those figures can be misleading due to the many site specific and facility specific factors which can enter into a cost estimate. The estimates made by GPU and Northeast Utilities are specific to their plants and are not directly applicable to PVNGS; hence, they should not be used in direct comparison. Furthermore, the cost estimates cited in Interrogatory 33 have been superseded by more recent estimates made by GPU and by Northeast Utilities.

Q. How have the cost estimates cited with respect to Interrogatory 33 been superceded for TMI-1?

A. For TMI-1, the cost estimate of \$117 million in 1974 dollars cited by Interrogatory 33 was made in 1975. GPU has subsequently made further estimates for TMI-1, and, despite accounting for the factor of escalation due to inflation, has reduced its estimate for decommissioning this plant to \$102 million in 1978 dollars. (Letter from R. L. Packard, Director, Bureau of Rates, Pennsylvania Public Utility Comm., to D. F. Greenwood, Stone and Webster Engineering Corp., June 23, 1980.) Thus, there is less of a difference between the TMI-1 estimate cited in Interrogatory 33 and the PVNGS estimate.

Q. What are the details of the TMI-1 cost estimates and why aren't they directly applicable to PVNGS?

A. As shown in the June 23, 1980 R. L. Packard letter which I just referred to, an important difference between cost estimates for PVNGS and TMI-1 is the amount of money attributed to demolition costs. Of the \$102 million estimated by GPU for decommissioning TMI-1, \$52 million is for dismantling and demolition of structures, or approximately 52% of the total. This is considerably higher than the same percentage as estimated in the PNL report where it was estimated that demolition costs would be 19% of the total and in the Stoller Report for PVNGS where it was estimated that demolition would be 10% of the total. The estimates of demolition cost made in the PNL report were arrived at through use of consultation with a demolition contractor and included costs of demolishing the decontaminated structures, disposal of excess rubble, backfitting to grade level, and site restoration, and included such specific items as job costs, supplies, overhead and profit. An important factor contributing to the percentage difference in demolition costs between the PNL report and the GPU estimate, and reemphasizing the need for consideration of site specific factors, is that the GPU study indicates in its discussion of demolition costs that ". . . in the particular case of TMI-1 and TMI-2, the structures containing safety related systems are hardened to withstand aircraft impact, making it a more heavily reinforced plant than the average nuclear site. Thus a substantial cost is incurred when site specific characteristics are considered for TMI-1." ("PENELEC

Decommissioning Study Comparison to AIF Decommissioning Study," Pennsylvania Electric Company, March 1977, page 6.)

Another important reason why the costs of the GPU study are inapplicable to PVNGS is that costs of demolition should not be included in NRC estimates of decommissioning. Demolition of buildings is not an NRC concern since it would take place after decontamination of the facilities, termination of the NRC license, and release of the buildings for unrestricted use. As stated in NUREG-0436, "Plan for Reevaluation of NRC Policy on Decommissioning of Nuclear Facilities," the NRC does not have the authority or responsibility to extend its criteria to the demolition of buildings or possible non-nuclear reuse of the buildings once the license has been terminated. If a comparison is made between the PVNGS and the TMI-1 cost estimates, excluding the costs of demolition beyond NRC license termination, the estimates are nearly equal.

Q. What are the details of the Millstone cost estimates and why aren't they directly applicable to PVNGS?

A. For Millstone, the Hubbard Report indicated the cost of property tax for partial dismantlement/delayed removal of Unit 1 and mothballing/delayed removal of Unit 3 to be \$24 million and \$264 million, respectively. In comparing Millstone and PVNGS costs, it should first be noted that Millstone figures for property tax are not applicable to the cost estimate for PVNGS since the method of decommissioning assumed by the Applicant for PVNGS is immediate dismantlement and not mothballing with delayed dismantlement. With immediate dismantlement, the facility is decontaminated at the end of its operating life, the facility's NRC license is terminated, and it is released for unrestricted use. There is

thus no continued property tax as there would be if it were in a mothballed status.

Even if the PVNGS were to be put into a mothballed status for delayed dismantlement, the costs as cited for Millstone in Interrogatory 33 are not applicable to PVNGS. As the basis for its property tax estimate at Millstone, The Hubbard Report cites (p. 20) two reports entitled "Preliminary Nuclear Power Plant Decommissioning Study for Northeast Utilities," (January 1979) and "Assuring the Availability of Funds for Decommissioning Nuclear Facilities," NUREG-0584, (Draft Report, July 1979.) The cost estimates are now out-of-date, however, since NUREG-0584 has been subsequently updated by NUREG-0584, Rev. 2 (Oct., 1980) which indicates, with regard to the property tax estimates made for Millstone, that the initial brief filed by the Federal Energy Regulatory Commission Staff (FERC) disputes the size of Northeast Utilities property tax estimates and suggests that they may be much smaller. Furthermore, in a May 1981 report Northeast Utilities itself subsequently reviewed its procedures for estimating property taxes and has revised the Millstone estimates for decommissioning costs, including reducing its estimate of property taxes. Nuclear Power Plant Decommissioning Study for Millstone Units 1 & 2, Northeast Utilities Service Co., May 1981. In this report, the estimate of property taxes for Millstone 1 during the partial dismantlement/delayed removal period in 1981 dollars is a factor of 4 lower than the estimate in the January 1979 Preliminary Study which was in 1978 dollars. Similarly, this May 1981 report estimates that the property tax for the mothballing/delayed removal of Millstone Pt. Unit 2 to be \$14.8 million, which is a factor of

6 lower than the \$89 million estimated for Millstone Pt. 2 property tax in the January 1979 preliminary study. Since Millstone 3 has not been involved in a licensing or rate making proceeding since the preliminary estimate was made, there is no similarly revised lowered figure available for Millstone 3. However, it is reasonable to assume that estimates of the cost of property tax would be similarly reduced for Millstone 3 as they were for Millstone 1 and 2. This would result in the property tax estimates for Millstone 3 being significantly lower than that which is cited in the Hubbard report that is relied upon by the Intervenor.

Notwithstanding these other reasons, it should also be emphasized that it is inappropriate to cite property tax assessments for a nuclear reactor for one region of the country, namely for Millstone in the Northeast, and consider them applicable to another region, namely PVNGS in the Southwest. As pointed out in Volume 1, Section 6.3, p.6-4 in the PNL report, ". . . in practice, tax rates will be negotiated between the local tax assessor and the plant owner."

In summary, Intervenor's assertion that property tax values for Millstone are applicable to PVNGS is not appropriate because PVNGS is assumed to use a different decommissioning method, because the cost of property taxes as cited in the Interrogatory is outdated, and because it is for reactor located within a different taxing authority.

Q. What is your conclusion regarding the cost estimate for PVNGS with regard to estimates made by other parties?

A. As I have pointed out, the PVNGS cost estimates are in relatively good agreement with most other estimates. However, as I have also explained, the only way to make an accurate estimate of costs for a

specific facility is to consider the specific facility design and site location. Use of cost estimates from other facilities without considering the details of how those estimates have been made can be misleading. This had been illustrated by the discussions of some of the details of the TMI-1 and Millstone Pt. cost estimates.

Q. What is your conclusion regarding the adequacy of the cost estimate for PVNGS?

A. The cost estimate for PVNGS is based on engineering analysis of costs considering the PVNGS facility design and site location as well as cost estimation methodology developed in the NRC sponsored PNL report. In my opinion this estimate represents a reasonable estimate of the costs to decommission the facility.

Q. Mr. Karlowicz, Mr. Cardile has stated that the estimated decommissioning costs in the S.M. Stoller study are reasonable. Even if these costs are greatly exceeded, in your opinion would the Applicants still have the financial capability to safely decommission the Palo Verde facility?

A. Contrary to the Intervenors' assertion in Contention 7, I believe that even if greater decommissioning costs are incurred for the Palo Verde facility, the Applicants would have little if any difficulty in obtaining sufficient funds to cover increased amounts of ultimate decommissioning costs.

Q. What is the Applicants' estimated cost to decommission the Palo Verde facility?

A. As part of their operating license application and in response to the Staff's request for financial information, the Applicants

submitted an estimate of the costs necessary to safely decommission the Palo Verde facility and their plan to finance such costs under letter dated September 15, 1981. The Applicants estimated in this submittal that it will cost \$56.7 million to safely decommission each unit of the Palo Verde Station or \$170.1 million for the entire facility. The Applicants based this amount on an independent cost study by the S.M. Stoller Corporation dated October 3, 1979.

Q. Why did you adopt the Applicant's estimate of decommissioning costs in your analysis which evaluates their financial qualifications to safely decommission the Palo Verde facility?

A. As a result of the inherent conservativeness of the Applicants' estimate to safely decommission the Palo Verde facility by being higher than the PNL Report, I adopted the \$170.1 million as a funding requirement to evaluate the Applicants' financial qualifications to obtain such an amount.

Q. What is the Applicants' plan to finance Palo Verde's estimated cost of decommissioning?

A. The Applicants' plan to finance the estimated \$170.1 million necessary to safely decommission the facility is to collect these funds through revenues over the operating life of the facility. Since this amount will be collected over 33 years, the annual funding requirement will be \$5.2 million for all of the co-owners. This amount will be shared by each co-owner to the extent of percentage ownership. The premise behind this approach is that customers who receive the benefits of electric energy provided by a nuclear facility over its service life should pay for the total costs of providing for such service, including

the costs of ultimately decommissioning the facility safely, and that future customers should not be required to pay for facilities from which they derive little or no benefit. To adjust for inflation and other cost factor revisions, utilities commonly conduct periodic reviews of decommissioning costs to account for any changes in economic conditions and advances in technology, and such changes are customarily incorporated into the annual charge for decommissioning costs. Under contractual arrangement, each of the participants in Palo Verde is responsible for its share, equal to its ownership interest in the facility, of the costs of decommissioning Palo Verde. Each of the participants in Palo Verde intends to collect such revenues through rates charged to customers for their respective share of decommissioning costs. The manner in which decommissioning costs are accounted for, included in cost of service determinations, and finally recovered from the respective customers of each of the participants will be ultimately decided by those federal, state, and local agencies having jurisdiction over the rates charged and operations of each of the participants.

Q. If this source of funds is inadequate, do the Applicants have additional sources of funds?

A. Yes, should additional amounts be needed over and above those realized through accrual of annual decommissioning charges the Applicants have two other traditional sources of funds available to meet any such amounts. The first source is internal cash generation attributable to: (1) depreciation expenses for all utility plant; (2) retained earnings; and (3) normalized tax depreciation and levelized investment tax credits for the investor-owned electric utility Applicants.

The second source of funds is the external capital market. As public utilities constitute the most capital-intensive industry in the United States, they have long had access to funds in the public securities market. To access such additional external funds the Applicants would issue debt in the form of bonds and the investor-owned Applicants would also issue additional preferred or common stock, or a combination of both. The Applicants' combined demonstrated ability in raising over \$6.3 billion over the past five years, including their present \$2.5 billion investment in the facility, leads one to reasonably conclude they would have little difficulty in financing additional amounts over the \$170.1 million estimate in costs if required by the decommissioning of the Palo Verde facility.

Q. Mr. Karlowicz, would you summarize your conclusion with respect to the Applicants' ability to finance the decommissioning of the Palo Verde facility?

A. Based upon the Applicants' financial plan and their additional financial resources as stated above it is my judgment that the Applicants have demonstrated the reasonable assurance required by 10 C.F.R. 50.33(f) and the guidance stated in 10 C.F.R. Part 50, Appendix C(I)(B) that they can obtain the necessary funds to safely decommission the Palo Verde facility. As a consequence of this, I find that the Applicants are financially qualified to safely decommission the Palo Verde facility to the extent of each of their respective ownership interests even if decommissioning costs ultimately proved to be greater than presently estimated. In summary, this conclusion is based on each of the Applicants' status as an electric public utility, the size of their

respective operations, their demonstrated ability to achieve revenues sufficient to cover each of their total operating expenses, the contractual agreements among the ownership participants, and their historical financing capability.

Francis P. Cardile  
Professional Qualifications  
Office of Nuclear Regulatory Research

My name is Francis P. Cardile. I am a nuclear engineer in the Chemical Engineering Branch, Division of Engineering Technology, Office of Nuclear Regulatory Research. I attended the University of Notre Dame and received a Bachelor of Science Degree in Mechanical Engineering in 1969. I attended the University of Illinois and received a Master of Science Degree in Nuclear Engineering in 1970.

After graduation I worked for the Bechtel Power Corporation which is an architect/engineering company engaged in the design and construction of nuclear power plants. I was responsible for assessing the effects of plant radioactive effluents on the environment and the preparation of Safety Analysis Reports and Environmental Reports. I also was responsible for the design of process systems and writing specifications for process equipment. My experience included work on both pressurized and boiling water reactors.

In 1974 I joined the Nuclear Regulatory Commission (formerly AEC) as a nuclear engineer in the Effluent Treatment Systems Branch, Office of Nuclear Reactor Regulation. In this position I was responsible for the review and evaluation of radwaste treatment systems and for the calculation of releases of radioactivity from nuclear power reactors. I have participated in generic studies of the relationship between reactor operation and radwaste generation and in the preparation of staff papers related to effluent control technology and cost-benefit analysis.

Between 1979 and 1980 I was a member of the Three Mile Island Support Staff. In that position I was responsible for evaluation of systems to be used in the cleanup of Three Mile Island Unit No. 2 following the accident at that plant.

Since 1980 I have been a member of the Chemical Engineering Branch, Office of Nuclear Regulatory Research (formerly Standards Development). In that position I have been primarily involved in development of NRC policy regarding decommissioning of nuclear facilities. This has included evaluation of contractor and cost reports on safety and cost of decommissioning, preparation of environmental statements on decommissioning, and development of staff positions on funding for decommissioning. I have also been involved in research projects related to decontamination of nuclear facilities.

Professional Qualifications of Michael L. Karlowicz, Jr.

1. I am employed as a Financial Analyst by the U.S. Nuclear Regulatory Commission. My primary responsibility is the performance of the financial qualifications review of applicants during the nuclear licensing process. This review includes an analysis of estimated construction costs in construction permit proceedings and operating expenses in operating license matters. Concomitantly, the financial review encompasses the projected financing methods by which the required funds will be obtained. I also review the climate and trends of state utility commissions. In this regard, I have prepared financial testimony for inclusion in supplements to the Staff's Safety Evaluation Report and for presentation at Atomic Safety and Licensing Board Hearings.
2. My responsibilities also include the monitoring and keeping abreast of the money and capital markets, particularly those affecting the nuclear energy sector of the economy. In this respect, I maintain a regular course of communication with the financial community. This includes utility securities officers and specialists representing the major rating firms, investment banking institutions, brokerage houses, and the Securities and Exchange Commission. Additionally, I serve as liaison for the NRC in financial matters with the Federal and State Utility Commissions.
3. I received a Bachelor of Science Degree with a major in Mathematics in 1972 from Saint Peter's College. In 1976, I received my Juris Doctorate from the Delaware Law School. Thereafter, I attended the post-graduate L.L.M. tax law program at New York University in 1976 through 1977. I have also undertaken studies in finance in the graduate program at the American University School of Business Administration.
4. Prior to my joining the U.S. Nuclear Regulatory Commission in December 1977, I spent three years with the New Jersey Department of the Public Advocate, Division of Rate Counsel. As both attorney and economist, my responsibilities included the representation of the public interest in litigation involving proposals of increases in rates or discontinuance of service by regulated industries. From 1969 through 1974, I was employed by Public Service Electric and Gas Company in their System Planning and Development Department and the Office of the Corporate Economist. There, I was responsible for conducting short, medium, and long-range studies in financial planning, the preparation of expert testimony, the implementation and development of financial modeling, and the performance of economic analysis.