UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	Docket Nos. STN 50-488
	)	STN 50-489
DUKE POWER COMPANY	)	STN 59-490
	)	
(Perkins Nuclear Station, Units 1, 2 and 3)	)	

TESTIMONY OF MIGUEL A MEDINA, JR.

I am an Assistant Professor of Civil Engineering at Duke University and my professional qualifications are set out on the attached curriculum vitae.

I have reviewed the information submitted by the applicant in these proceedings since July, 1978, and I have also reviewed the material submitted by the applicant to the Intervenors. In addition, I have examined the Final Environmental Impact Statement and the North Carolina Water Resources Framework Study issued in 1977 and other information from open literature, existing records and authoritative sources which will be referred to in my testimony.

My review of the above material has lead me to conclude that the alternative site evaluation by the NRC Staff was inadequate in many particulars as set forth hereinafter and that the Lake Norman sites and the Wateree site are clearly superior for the reasons and on the basis of the matters herein discussed.

According to Duke Power Company site studies X-81 and 8-82 (February, 1973) the consideration of costs in the building and maintenance of a three-unit nuclear plant such as purposed at Perkins clearly favors the Lake Norman N-18 and Wateree sites over the Yadkin River site which was known as Idols N-17 at that time (see sites studies at page 3). In addition to this conclusion in the studies of 1973, these studies further reveal and conclude that on an individual cost basis the Lake Wateree site is obviously superior to a Yadkin River site at Idols which was designated as N-17, and which subsequently became the Perkins site a short distance downstream and across the river.

An additional water impoundment for cooling tower makeup water (such as planned for Carter Creek at the Perkins site) would not be necessary at either the Lake Norman sites or at the Lake Wateree site.

The only upstream control of the Yadkin water to be used for the proposed Perkins site is on the upper Yadkin just above Wilkesboro at the W. Kerr Scott Dam. The storage capacity in this upstream reservoir is subject to demands and use of the water storage from the Scott Reservoir by the City of Winston-Salem downstream. This intake by the City of Winston-Salem is located upstream from the intake for the Perkins facility. According to the hydrology section of the Charleston District of U. S. Army Corps of Engineers, no dependable draft anaylsis of the W. Kerr Scott Reservoir has been performed to date. Approximately four hundred cubic feet

per second flow is guaranteed under contract to the City of Winston-Salem. At the same time, according to North Carolina Regulations a stream flow of 625 cubic feet per second must be maintained downstream from the Scott Reservior.

According to the recently completed North Carolina Water Resources Framework Study (Raleigh, North Carolina 1977, page 4-121) a shortage in water supply is projected for Guilford and Randolph Counties in the upper Cape Fear basin by 1985, which shortage will be as much as one hundred ten million gallons per day by the year 2020. This study indicates that inter-basin transfer of water from the Yadkin will be necessary to alleviate this shortage and further suggest that proposals in regard to the Reddies Lake near North Wilkesboro and the Roaring River Lake near North Wilkesboro, which are now in the planning stages, will add only sixty million gallons per day to the Yadkin River flow for use in the inter-basin transfer. It should also be noted that the three unit nuclear plant at the Perkins site will also evaporate approxiately sixty million gallons per day through cooling towers. According to the Charleston District of the Corps of Engineers recent unfavorable reports with regard to water supply at the Reddies River proposed dam could well result in a cancellation of the project.

The future demands for water use from the Yadkin and the uncertainty of future additional reservoir control upstream and the prior claim of the City of Winston-Salem to Yadkin flow rates raises serious and substantial questions

about the hydrological fitness of the proposed Perkins site, especially when compared to alternative sites such as Lake Norman and Wateree which do not have the same present and future impairments. It is particularly significant that the State Department of Natural and Economic Resources of North Carolina has listed the areas south of Lake Norman along the Catawba River as available for wet industries, indicating that no water shortages are foreseeable in the Catawba Basin such as the ones foreseeable in the upper Yadkin Basin.

In addition to the problems of water quantity related to the Perkins site above, there are also considerations of water quality which penalize severely the Perkins site as it is contrasted with the Lake Norman and Wateree sites. The North Carolina Water Resources Framework Study of 1977 at page 4-124 indicates that the Perkins site is a water quality limited area.

According to the Environmental Impact Statement the Yadkin River at the Perkins site contains total suspended solids of 180 m per liter. The endangered species, the Carolina Darter (etheostoma collis) is known to occur in the Yadkin River at the Perkins site. EPA studies have shown High Rock Lake, below the Perkins site, to have the greatest degree of eutrophication of lakes in North Carolina.

Blow-down water from Perkins will increase the total dissolved solids in the Yadkin River by 18 m per liter. More importantly, it will increase the biochemical oxygen demand by 2.7 m per liter. In spite of this projected effect in

the Environmental Impact Statement there has been no receiving water quality modeling of such parameters as dissolved oxygen profile. The total suspended solid level in the Yadkin River at the Perkins site is already sufficiently high to stress aquatic life. On account of the reduction of light penetration and photosynthesis, impairment of respiratory and feeding functions clogging of bottom substrates, smothering of spawning sites, and lowering of fish production. Also, the thirty-five thousand gallons per day of domestic sewerage by the proposed Perkins operation and the erosion that will occur during construction will cause intolerable burdens for turbidity-intolerant biota.

It should further be noted that no detail hydrologic and environmental impact comparisons among the proposed sites have been constructed by the staff or applicant with regard to the impacts on water use which would include comprehensive water budgets and industrial and municipal demands nor has there been such comparative anaylsis of the water quality downstream and waste assimilative capacity of the water downstream from the proposed sites. As indicated above, based upon the present available information, the Perkins site is clearly inferior to the Lake Norman sites and Wateree in these regards.

According to the North Carolina Water Resources Framework Study in 1977, future water needs will grow in the Piedmont basis. The Environmental Impact Statement for the

Perkins site indicates that if future water needs of the Yadkin River grow significantly, critical water shortages could develop due to the consumption by the Perkins Nuclear Station. The Framework Study at pages 4-26 indicate that water supply sources in the Catawba River Basin are expected to meet 1990 water demands and that no additional supply sources are planned or needed. Also, as indicated earlier, areas suitable for wet industry are indicated in this study downstream from Lake Norman.

In material supplied by the applicant and a copy of which is attached and shown as Page No. 11 at the upper right-hand corner, a rule of thumb for lake cooling indicates that Lake Norman is a viable alternative for condensor cooling as well as cooling towers. Lake Norman has 32,500 acres and based upon applicant's rule of thumb, the Marshal Plant of 2,136 mw requires 3,630 acres, and the McGuire Plant of 2,360 mw requires 5,900 acres. An additional nuclear plant as proposed for either Lake Norman sites D or E would require 8,885 acres which would still leave a surplus available of 14,120 acres at Lake Norman for cooling purposes. Lake Wateree, after using the same 8,850 acres, would still have a surplus of 4,400 acres.

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Lake Norman will receive the heated discharge from the McGuire condenser cooling water system. A typical North Piedmont soft-water lake, Lake Norman was impounded by Cowan's Ford Dam in 1963. ~~Before Lake Norman was built, Duke's engineering and environmental studies showed that the reservoir was capable of supporting more than~~ 10-million killowatts of thermal cooling capacity.

Surface waters generally flow in a southwesterly direction into the Catawba River. The Catawba River, a fresh water river, flows south until it reaches a terminus in the Atlantic Ocean. North Carolina has classified this segment of the Catawba as A-II waters.

Bill McCabe please omit part, or all, of [illegible] statement on this subject – + EIS ⇒ NRC

Before Lake Norman was built, Duke's engineering and environmental studies on similar lake cooling sites (Allen, Riverbend) resulted in the establishment of a "rule of thumb" cooling capacity allowance factor of 1.7 acres per MW_e generated. THE 32,500 ACRE Lake Norman could very conservatively support the 17,000 acres estimated for 10,000 MW_e Fossil. As for Nuclear, Duke's "rule-of-thumb" assigned 2.5 Acres per MW_e. For McGuire, the N C Department of Water & Air Resources assigned a mixing of 3500 acres for nominally 2400 MW_e. Based on these prescribed physical limitations, Lake Norman reservoir was concluded to be capable of supporting more than

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CURRICULUM VITAE

MIGUEL A. MEDINA, JR.

PERSONAL INFORMATION:

Date of Birth:	December 9, 1946
Place of Birth:	Havana, Cuba
Naturalized U.S. Citizen:	April 13, 1971
Marital Status:	Married (Spouse: Margarita)
Current Position:	Assistant Professor of Civil Engineering Duke University Durham, North Carolina 27706 (919) 684-2434

EDUCATION:

BS	(Civil Engineering) University of Alabama, 1968
MS	(Civil Engineering-Environmental) University of Alabama, 1972
Ph.D.	(Environmental Engineering Sciences) University of Florida, 1976

EXPERIENCE:

1969	Commissioned in Field Artillery, U.S. Army
1969-1970	558th Artillery Group S-2, Intelligence Officer, U.S. Army, NATO, Turkey. Supervised 5 officers, 30 enlisted men. Security clearance: Top Secret, NATO COSMIC ATOMAL
1970-1971	Assistant Post Engineer, Third U.S. Army, Ft. McPherson, Atlanta, Ga. Project Officer for Lake Allatoona, Ga., tertiary treatment plant and sanitary sewer system. Involved in design, supervised entire construction project. plant start-up. Contractors: Arthur Pew Construction Co., Chamblee, Ga. Project cost over $200,000
1971-1972	Research on laboratory analysis techniques for wastewater, statistical computer analysis of data, University of Alabama
1972-1976	Research Assistant, University of Florida. Consultant for Black, Crow & Eidsness, Inc., Gainesville, Florida. Involved in: refinements and testing of the EPA Stormwater Management Model (SWMM); application of

SWMM to large urban areas with complex sewer systems; application of the Hydrologic Engineering Center STORM model to SMSA's; calibration of both STORM and SWMM pollutant surface loading rates; development of receiving water models for studies of relative impacts of point and non-point sources of pollution; costing of alternative control measures for urban stormwater runoff and sanitary flows; mathematical modeling of advective-dispersive storage/treatment systems.

Jan. 1977-
Sept. 1977 — Acting Director, Duke Environmental Center. Administration of the Center's activities, which include: Federal research grants, promoting the development of multi-disciplinary instructional programs, conducting inter-departmental seminars, and sponsorship of outside speakers in specialized areas of environmental resources and management.

1976-
Present — Assistant Professor of Civil Engineering, Duke University. Teaching of graduate and undergraduate courses in Dynamic Hydrology (Surface and Subsurface), Water Resources Engineering, and Environmental Resources and Management. Conducting research on urban stormwater modeling for EPA and the National Science Foundation.

Duke University, School of Engineering representative for the U. S. Geological Survey National Water Data Exchange (NAWDEX).

Member, North Carolina Working Group on Urban Storm Drainage, Water Resources Research Institute.

TEACHING AND RESEARCH INTERESTS:

Wastewater Engineering (Unit Processes)
Stream Sanitation
Water Quality Management and Modeling
Environmental Resource Systems
Pollution Transport Systems (Diffusive and Advective Transport Phenomena)
Groundwater Hydrology
Applied Engineering Mathematics (Mathematical Statistics, Differential Equations, Transform Methods)
Surface Hydrology (Hydrometeorology, Precipitation, Runoff, Streamflow, Catchment Dynamics, etc.)
Operational Hydrology (Stochastic, Linear Hydrologic Systems)
Hydrologic Simulation (Urban Hydrologic Models, Storage/Treatment Systems for Urban Stormwater Control)
Computers in Engineering

MEMBERSHIP IN PROFESSIONAL SOCIETIES:

Sigma Xi, Scientific Research Society of North America
Tau Beta Pi, National Engineering Honor Society
Chi Epsilon, National Civil Engineering Honor Society
American Society of Civil Engineers
Water Pollution Control Federation
American Geophysical Union
Association of Environmental Engineering Professors
American Public Works Association, Institute for Water Resources

HONORS AND AWARDS:

William Simpson Keller Prize (1967-1968). Awarded annually to senior in Civil Engineering attaining highest grades among students from State of Alabama
Distinguished Military Graduate, Field Artillery, 1969
U.S. Army Commendation Medal, 1970
U.S. Army Commendation Medal, First Oak Leaf, 1971
U.S. Environmental Protection Agency Traineeship, 1971-1972
Recipient of University of Florida College of Engineering Fellowship, 1972-1973
National Science Foundation Research Initiation Grant, 1978-1980
American Men and Women of Science, 1979

CONSULTING ACTIVITIES:

Black, Crow & Eidsness, Inc., Gainesville, Florida. Urban stormwater management studies, deep-well waste disposal systems

University of Florida Industrial and Experimental Station Gainesville, Florida. Nationwide assessment of receiving water impacts under contract with U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory, Cincinnati, Ohio.

Blanchard, Tucker, Twiggs & Denson, Attorneys At Law, Raleigh, North Carolina. Technical advice on safety of Carolina Power & Light Company dam at Quaker Neck, near Goldsboro, North Carolina.

SPONSORED RESEARCH:

U.S. Environmental Protection Agency - development of continuous receiving water quality model for preliminary screening of urban wastewater treatment strategies; $20,500. Municipal Environmental Research Laboratory, Edison, New Jersey.

National Science Foundation - a unified approach to the modeling of transient storage, treatment and transport of urban point and nonpoint water pollutants; $25,000. Washington, D.C.

TECHNICAL PAPERS AND PUBLICATIONS:

Medina, M.A., Jr., "Studies of Total Organic Carbon Analysis Utility for Water Resources Management," Master's Thesis, University of Alabama, 1972.

Medina, M.A., Jr. and G.P. Whittle, "Utility of Total Organic Carbon Analysis for Waste Characterization," Technical Paper Presented at the 27th Annual Conference of the Alabama Water and Pollution Control Association, Auburn, Alabama, August 29, 1972.

Huber, W.C., Medina, M.A., Jr., Sheikh, H., and J.P. Heaney, "The EPA Storm Water Management Model (SWMM) - An Introduction," Proceedings: Storm-Water Management Workshop, February 26-27, 1975, edited by M.P. Wanielista, Florida Technological University at Orlando.

Medina, M.A., Jr., "Data Needs for Stormwater Treatment and Control," Proceedings Third Annual Environmental Short Course, Florida Engineering Society, October 8, 1974, Lake Buena Vista, Florida.

Huber, W.C., Heaney, J.P., M.A. Medina, Jr., et al., "Storm Water Management Model - User's Manual Version II," EPA-670/2-75-017, March 1975.

Heaney, J.P., Huber, W.C., Sheikh, H., M.A. Medina, Jr., et al., "Urban Stormwater Management Modeling and Decision-Making," EPA-670/2-75-022, May 1975.

Medina, M.A., Jr., "A Continuous Model to Study the Relative Importance of Storm, Combined, and DWF Sewer Runoff," Technical Paper Presented at 2nd Annual National Conference on Environmental Engineering Research, Development and Design, extended abstracts, Environmental Engineering Division of American Society of Civil Engineers, Gainesville, July 20-23, 1975.

Medina, M.A., Jr. and M.P. Murphy, "The Costs of Stormwater Control," Technical Paper Presented at 1975 Annual Meeting, Florida Section, American Society of Civil Engineers, Gainesville, September 18-20, 1975.

Medina, M.A., Jr., "Interaction of Urban Stormwater Runoff, Control Measures and Receiving Water Response," Doctoral Dissertation, University of Florida, 1976.

Medina, M.A., Jr., "Solution Methodology: Impact of Urban Water Pollution Control on Receiving Water Quality," U.S. Environmental Protection Agency State-of-the-Art Research Seminar Series, Waterside Mall T.V. Studio, Washington, D.C., November 3, 1976.

Heaney, J.P., Huber, W.C., M.A. Medina, Jr., et al., "Nationwide Evaluation of Combined Sewer Overflows and Urban Storwater Discharges," Volume II: Cost Assessment and impacts, EPA-600/2-77-064, March 1977.

Medina, M.A., Jr., Huber, W.C., and J.P. Heaney, "Impact of Urban Water Pollution Control on Receiving Water Quality," Preprint No. 2859, ASCE Spring Convention, Dallas, Texas, April 28,1977.

Sullivan, Richard H., Manning, Martin J., Heaney, James P., Huber, Wayne C., Medina, M. A., Jr., Murphy, M. P., Nix, S. J., and Hasan, S. M., "Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges, Volume I: Executive Summary," EPA-600/2-77-064A, September, 1977.

Medina, M. A., Jr., "On Modeling the Transport of Urban Stormwater Runoff Pollutants, Control Systems and Receiving Water Quality," Proceedings of ASCE Conference on Computing in Civil Engineering, ASCE, N.Y.,N.Y., June 1978.

Medina, M. A., Jr., "A Simplified Continuous Receiving Water Quality Model," Proceedings of U.S. EPA and Ontario Ministry of Environment Stormwater Management Model (SWMM) Users Group Meeting, May 4-5, 1978 (Ottawa, Canada), EPA-600/9-78-019, Washington, D.C., July 1978.

Medina, M.A., Jr., and L.R. Mohns, "Kinematic Wave Approximation to Forested Watershed Overland Flow with Urban Hydrologic Models," Proceedings - International Symposium on Urban Storm Water Management, Lexington, Kentucky, July 1978.

Medina, M.A., Jr., Huber, W.C., and J.P. Heaney, "Interaction of Urban Stormwater Runoff, Storage/Treatment Systems and Receiving Water Response," American Geophysical Union, Urban Hydrology Session, San Francisco, California, December 1978.

Courses Taught at Duke University:
Graduate Level:

CE 225. Engineering Hydrology. Dynamics of the occurrence, circulation, and distribution of water; hydrometeorology, geophysical fluid motions. Precipitation, surface runoff and stream flow, infiltration, water losses. Hydrograph analysis, catchment characteristics, hydrologic instrumentation, and computer simulation models. Prerequisite: Engineering 145, or consent of instructor.

CE 245. Pollutant Transport Systems. Distribution of pollutants in natural waters and the atmosphere, diffusive and advective transport phenomena within the natural environment and through man-made artificial conduits and storage/treatment systems. Analytical and numerical prediction methods. Prerequisites: Engineering 145, and Mathematics 111 or equivalent.

Undergraduate Level:

EGR 51. Computers in Engineering. Introduction to use of digital computers in engineering. Attributes of digital computer systems; program languages, flow charts; numerical analysis, including approximation and interpolation, searches and maximization, linear equations; applications to engineering; introduction to decision processes in engineering, including linear programming, optimization network methods; punched card operation; graphical output.

EGR 123. Water Resources Engineering. Hydraulics of pressure conduits and measurement of flow, compound pipe systems, analysis of flow in pressure distribution systems, descriptive and quantitative hydrology applied to problems of irrigation and drainage, open channel flow, reservoirs and distribution system storage. Selected laboratory work. Prerequisite: Engineering 145.

EGR 126. Environmental Resources and Management. Standards and criteria for evaluation of environmental resources and the management of these resources. Emphasis is placed on water, its distribution, estimated use, role of federal agencies and water quality legislation, parameters of pollution, sources and control, and water resources projects. Air resources and land planning and management. Evaluation procedures and preparation of environmental impact statements. Prerequisite: junior standing or consent of instructor.