5/15/81

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	Docket Nos. 50-250-SP
	)	50-251-SP
FLORIDA POWER & LIGHT COMPANY	)	
	)	(Proposed Amendments to
(Turkey Point Nuclear	)	Facility Operating License
Generating Units Nos. 3 and	)	to Permit Steam Generator
4)	)	Repair)

TESTIMONY
OF
FREDERIC G. FLUGGER,
H. H. JABALI, AND P. K. WAN
RELATING TO CONTENTION 4B

Q. Will each member of the panel state his name, business address, and title.

A. My name is Frederick G. Flugger. My business address is P.O. Box 529100, Miami, Florida 33152. I am Manager of Plant Engineering Licensing, Power Plant Engineering Department, Florida Power & Light Company (FPL).

My name is Habib H. Jabali. My business address is P.O. Box 529100, Miami, Florida 33152. I am Manager of Civil Engineering, Power Plant Engineering Department, Florida Power & Light Company.

My name is Ping K. Wan. My business address is 15740 Shady Grove Road, Gaithersburg, Maryland 20760. I am Environmental Sciences Section Supervisor, Environmental Engineering, Bechtel Power Corporation.

Q. Have each of you prepared a statement of educational and professional qualifications?

A. Yes.

Q. Are the statements attached to this testimony?

A. Yes.

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to address Contention 4B which states:

> There are likely to occur radioactive releases, (from the steam generator repair) to unrestricted areas which violate 10 CFR Part 20 or are not as low as reasonably achievable within the meaning of 10 CFR Part 50 as a result of a hurricane or tornado striking the site during the repairs.

In addition, in its February 23, 1981, "Order Accepting Negotiated Schedule," the Licensing Board stated that:

> it intends to hear evidence on the repair schedule as it relates to the timing of the hurricane seasons.

This testimony also addresses that subject.

Q. Are each of you familiar with the aspects of FPL's plans for the proposed repair of the steam generator lower assemblies (SGLAs) and storage thereof as they relate to this contention?

A. Yes.

Q. What is the timing and duration of the hurricane season?

A. According to Tropical Cyclones of the North Atlantic Ocean, 1871-1977, published by the National Oceanic and Atmospheric Administration (NOAA), "[t]he 'official' Atlantic hurricane season extends from June 1 through November 30."

Q. Does the actual hurricane season occasionally vary from the "official" hurricane season?

A. Yes. The actual season occasionally begins or ends outside of this "official" period. Based upon the date of detection of the first tropical storm and the date of dissipation of the last storm from 1886 through 1977, the median beginning date of the hurricane season is June 26, and the median ending date is October 29. Less than 20% of the hurricane seasons since 1886 have begun in early June or before, and over 90% of the hurricane seasons have concluded by late November.

Q. When is a hurricane most likely to occur?

A. Historical data contained in the previously referenced NOAA publication clearly shows that the hurricane season is in fact concentrated in the period from mid-August to late October with a maximum frequency of occurrence localized in the period from late August to mid-September. The frequency of occurrence of hurricanes at the actual peak of the season in mid-September is nearly 10 times greater than the frequency of occurrence in late October.

Q. With respect to tornadoes, what is the probability of a tornado occurring at the Turkey Point site?

A. The probability of occurrence of a severe tornado at the site is remote. In fact, both theoretical considerations and historical data demonstrate that severe tornadic events (wind speeds greater than 200 mph) are not expected to occur at the Turkey Point site.

Q. Would you explain these theoretical considerations?

A. The center of maximum tornado activity in the United States is in the Great Plains States such as Iowa, Missouri, Kansas and Oklahoma. The uniquely high frequency of severe tornadoes in the Great Plains and central United States is due to the relative location of the Rocky Mountains and the Gulf of Mexico. The

eastward-moving Pacific air mass is dried and cooled as it passes over the Rockies; it can then interact with the moist Gulf air mass, and if conditions favorable to the creation of tornadoes exist, which typically occur in the spring and early summer, a tornado may be created. Since this is a mid-latitude effect that occurs north of peninsular Florida, the meteorological conclusion is that peninsular Florida should not be subjected to the occurrence of severe tornadoes.

Q. Does the historical record support this conclusion?

A. Yes. "A Comparative Study of Florida's Most Severe Tornadoes with Those in Other Parts of the Continental U.S." evaluated the historical data associated with 429 peninsular Florida tornadoes that occurred from 1887 to 1968. (See Appendix 2C to the St. Lucie Unit 1, Docket No. 50-335, Final Safety Analysis Report; attached to this testimony.) Significant conclusions reached by this study are:

1. "The average tornado in Florida is of minimal intensity, barely able to unroof relatively old wooden farm buildings, packing houses and garages, and/or to defoliate, defruit or blow down trees." (P. 2C-12).

2. "No direct measurement of windspeed has been made in a Florida tornado. Indirect calculations have not been presented herein because speeds on the order of 150 to 200 mph could have produced all the damage that has been photographed and tabulated for Florida tornadoes." Id.

3. "From the standpoint of damage, photographs in Florida do not show buildings being swept clean to the ground and debris carried away as in the most severe continental tornadoes." (P. 2C-16).

4. " . . . key ingredients for severe tornadoes such as air-mass structure, jet maxima, vorticity advection, and dry air intrusion, have always been missing in varying degrees in Florida tornadoes. This is a result of Florida's southern latitude and its marine environment." (P. 2C-19).

A second study of Florida tornadoes evaluated all tornadoes that occurred within 4 miles of the Florida Atlantic Coast from 1950 to 1972. (See Appendix 2F to the St. Lucie 1, Docket No. 50-335, Final Safety Analysis Report; attached to this testimony.) The upper wind speed estimated for the tornadoes occurring during this 22 year period was 180 mph.

Thus, two independent studies of peninsular Florida tornadoes covering the 85 year historical record from 1887 to 1972 reach the same conclusion; namely, maximum wind speeds associated with peninsular Florida tornadoes are not likely to exceed 200 mph. This is to be expected since the theoretical considerations indicate that the conditions required for the formation of severe tornadoes exist in the mid-latitudes, north of peninsular Florida.

Q. I notice that the "Affidavit of Robert F. Abbey, Jr. on Contention 4B," which was attached to the "NRC Staff Objections to Proposed Amended Contention 1 and Third Motion for Summary Disposition," indicates that one tornado in the area surrounding the Turkey Point site achieved estimated wind speeds of 207-260 mph. Have you read the Abbey Affidavit and do you find it consistent with the studies mentioned by you?

A. Yes, I have read it and find its conclusions to be essentially the same as the conclusions in the two studies just mentioned.

Q. Would you explain the basis for your last answer?

A. It must be noted that consistent and reliable measurements of tornadic wind speeds are not available. Because of the difficulty of obtaining actual wind speed measurements, the maximum wind speed associated with tornadoes is usually estimated on the basis of examination of damage and displaced objects, by motion picture records when available, or by theoretical estimates. Different tornado intensification rating scales have been developed to classify tornadoes based on their observed effects. The intensity classification scales utilize ranges of wind speed. The substantial breadth of these ranges reflects the difficulty in correlating damage to the wind speed that actually produced the observed damage. Thus, independent researchers evaluating the same tornado may reach slightly different wind speed estimates based on their subjective judgment of observed damage and th. intensity classification scheme utilized.

The Abbey Affidavit apparently utilizes the Fujita "F" scale and places one tornado in category 4 (F4), i.e., 207 to 260 mph. The Fujita "F" scale is probably the most frequently used scale. However, other scales have also been developed, and the second

study referenced in this testimony utilizes the Dames & Moore scales. Table 1 sets out the wind speed classifications used in the Fujita scale and the scale used by Dames & Moore.

The two studies referenced in this testimony conclude that all observed damage could have been produced by winds that did not exceed 200 mph. The Abbey Affidavit estimates that one tornado achieved wind speeds of 207 to 260 mph. The conclusion to be drawn from these three studies is that Abbey's tornado was a marginal Fujita F4 and that tornadoes with intensities about 200 mph represent an upper limit of severity for tornadoes that should be associated with the Turkey Point site. Put otherwise, the Abbey Affidavit and the two studies referred to in this testimony are three independent studies of Florida tornadoes which reach essentially the same conclusions.

Q. Is it your testimony that tornadoes with wind speeds greater than 200 mph are impossible at the Turkey Point site?

A. No, not impossible but extremely unlikely. Using the methodology and results of the 1950 to 1972 Florida Atlantic Coast study discussed previously, the probability of a tornado with 200 mph winds occurring in peninsular Florida is 1.6×10^{-6} per year. The same study concludes that the probability of a tornado with wind speeds of 242 mph is 1.0×10^{-7} per year.

Q. How do these probabilities compare with those cited in the Abbey Affidavit?

A. The probabilities of tornadoes achieving maximum wind speeds of 200 mph and 242 mph predicted from the Florida Atlantic Coast study are in close agreement with the probability estimates provided by Table 1 of the Abbey Affidavit. Thus, it may be concluded that the probability of achieving severe tornadic conditions at the Turkey Point site, i.e., wind speeds about 200 mph, is exceedingly small. Consequently, a tornado with wind speeds of 200 mph may properly be used as the limiting tornado for the purposes of analysis of the steam generator repair and storage activities.

Q. What influence did consideration of the possibility of occurrence of a tornado or hurricane have upon the selection of the repair schedule?

A. The proposed steam generator repair for Unit 4 is currently scheduled to begin in late October 1981. The repair for Unit 3 is presently scheduled to begin in late October 1982. Performance of the repairs outside the hurricane season obviously reduces the likelihood of any inconvenience that might be associated with a hurricane. However, the current schedule is not based on the timing of the hurricane season, nor was

it based upon a consideration of the potential for occurrence of tornadoes. The possibility that these severe meteorological events may occur during the repairs in no way alters the acceptability of the repair activity.

Q. How would the occurrence of a hurricane or tornado affect repair activities inside the containment?

A. The physical work associated with the removal and replacement of the SGLAs will occur in the containment, which is designed to accommodate both tornadoes and the Probable Maximum Hurricane (PMH). Prior to commencement of these activities the nuclear fuel will be removed from the containment and placed in the spent fuel complex, which is a structure independent of the containment that is also designed to accommodate both tornadoes and the PMH. There is no incident within containment associated with the repair activity that could adversely interact with the stored nuclear fuel. Also, assuming that a hurricane or tornado-borne missile could enter the containment via the open equipment hatch, there is no way that the missile could interact with the stored nuclear fuel or cause an accident not previously evaluated. Thus during the portion of the repair activity conducted within containment, consideration

of the occurrence of a hurricane or tornado does not alter in any way the safety evaluations and conclusions reached by FPL and the NRC Staff.

Q. With respect to possible impacts outside the containment, what will be the greatest source of radioactivity as a result of the repairs which potentially could be affected by a hurricane or tornado?

A. The SGLAs.

Q. What incidents involving the SGLAs were considered?

A. Four different incidents involving the SGLAs were considered: 1) movement of an SGLA as a result of of the wind; 2) effect of a PMH storm surge upon an SGLA temporarily located on the laydown area; 3) impact of a tornado missile upon an SGLA; and 4) impact of a tornado upon the Steam Generator Storage Compound (SGSC).

Q. What was the result of your consideration with respect to movement of an SGLA by the wind associated with a tornado or PMH?

A. As an SGLA is removed from the reactor building, steel support saddles will be affixed to the SGLA. The SGLA may then be relocated to a temporary laydown

area at elevation +17.5' MLW or it may be placed in the SGSC. If it is assumed that the SGLAs are placed at a temporary laydown area on the +17.5' MLW plateau, and based on the current design of the SGLA steel support saddles, a wind speed of about 600 mph would be required to overcome the frictional forces associated with this 185 ton object, i.e., to begin to slide an SGLA. Obviously neither tornadic nor PMH winds are sufficient to move an SGLA temporarily located in an open unprotected area.

Q. What was the result of your consideration with respect to the effects of a PMH storm surge upon an SGLA temporarily located on the laydown area?

A. During a PMH, the still water level at the +17.5' MLW plain of the laydown area would be less than one foot and hurricane force waves would break on the 3/1 slopes, which would be well removed from any SGLA temporary laydown area that would be utilized. Thus, the SGLA steel support saddles would be partially immersed, and the SGLAs would be subjected to salt spray and minimal wave action by waves of less than one foot from crest to trough. The SGLAs would get wet, but would remain in their temporary location. Corrosion of an SGLA that could result from the hurricane would be negligible.

Q. What was the result of your consideration with respect to the impact of a tornado missile upon an SGLA?

A. About one inch of steel would be sufficient to prevent penetration of an SGLA by a tornado-borne missile that may be associated with a tornado with wind speeds on the order of 200 mph. Since the SGLAs have a minimum wall thickness of about 2.6 inches, SGLA penetration by tornado-borne missiles while located temporarily in an open unprotected area is not likely.

Q. Thus, what is your conclusion with respect to the hazards associated with the interaction of a hurricane or tornado with an SGLA located in a temporary laydown area?

A. It may be concluded that if one to three SGLAs are placed in a temporary storage location at elevation +17.5' MLW, and either a hurricane or tornado were to interact with the Turkey Point facility, the SGLAs would be expected to remain in their temporary storage location and their physical integrity would be expected to remain intact. No radioactive release from an SGLA is to be expected from the occurrence of a hurricane or tornado.

Q. What impact would a severe tornado have upon the Steam Generator Storage Compound (SGSC)?

A. A tornado-borne missile that could be associated with the severe tornado could be contained by a reinforced concrete wall 12 inches thick. The SGSC has reinforced concrete walls 24 inches thick. Thus, SGSC wall penetration by tornado-borne missiles is not expected. Additionally, tornadic wind loads will cause structual materials in the SGSC to approach but not exceed their respective yield values. Thus, collapse of the SGSC walls is not anticipated. Finally, additional uplift forces on the roof associated with the pressure drop in the tornado's vortex are not sufficient to cause the roof to lift off the building and to be relocated to some other area of the facility. Consequently, the roof is expected to remain in place.

Q. What is your conclusion with respect to the ability of the SGSC to withstand the severe tornado?

A. Based on the SGSC evaluation of the 200 mph tornado, it is concluded that the building will maintain its structural integrity, i.e., it will not collapse. Cracks, concrete spalling, etc., can reasonably be expected to result from the occurrence of the tornadic event analyzed, but catastrophic failure will not occur.

Q. Even though a breach of the SGLAs is not expected as a result of a hurricane or tornado, what would be the consequences of such a breach if it were postulated to occur?

A. Any activity in the SGLAs that could be released would not be in a volatile or aerosol form, i.e., in a form that could be dispersed as a gaseous effluent. The oxide layer in the SGLAs does not contain any radionuclides that will vaporize. Additionally, this layer is tightly adherent and it is not likely that very much would be loosened by any of the events being considered here. Consequently, no significant airborne releases would be expected as a result of a postulated breach.

Q. Based upon these facts, what is your conclusion with respect to the scheduling of the repairs?

A. The proposed repair activity may be conducted at any time of the year. Any attempt to associate the time of the repair activity with the hurricane season is not warranted.

Q. Although no radioactive release is expected as a result of the interaction of a hurricane or tornado with the repair activities, did you evaluate the consequences of a postulated release?

A. Yes. A radioactive release was postulated for purposes of evaluation. This evaluation demonstrated that a hypothetical release of radioactivity can only result in inconsequential exposures to members of the public. Or stated differently, there is no radiation hazard to the public associated with the proposed repair activity. The SGLA drop accident was utilized for this evaluation since it is the limiting, i.e., worst case accident scenario that can be associated with the interaction of a hurricane or tornado and the Turkey Point site during the proposed repair activity.

Q. Would you describe the assumptions used in the SGLA drop accident?

A. The physical nature of the SGLA radioactivity notwithstanding, activity was assumed to be released from an SGLA drop accident by both FPL and NRC and to diffuse as a gas or aerosol in the atmosphere. Atmospheric conditions that inhibit rapid dilution, i.e., stable, low wind speed conditions were assumed to exist concurrently with the assumed SGLA drop accident. And finally, the member of the public was assumed to be standing at the site boundary. Both FPL and the Staff

have shown the accidental radiological exposure associated with this postulated event was within 10 CFR Part 20 limits. See Final Environmental Statement, § 4.4; letter from Robert E. Uhrig (FPL) to Steven A. Varga (NRC) dated February 17, 1981, (attached to this testimony).

Q. Are the meteorological conditions you just described expected during a hurricane or tornado?

A. No. Meteorological conditions were selected by both FPL and the Staff to maximize the radiological exposure to the member of the public, namely, low wind speeds and a stable atmospheric condition that inhibits diffusion of the radioactive release. Neither of these conditions persist during hurricanes or tornadoes; these storms are characterized by very high wind speeds and atmospheric conditions that encourage rapid mixing.

Q. If FPL's evaluation had accounted for the meteorological conditions present during a hurricane or tornado, how would this have affected the resultant exposures?

A. The atmospheric dilution between the point of release and the radiological dose receptor is proportional to the wind speed, i.e., the higher the wind speed the greater the atmospheric dilution. Also, the

rapid mixing ability, i.e., turbulence, associated with these storms will further reduce airborne concentrations. To illustrate these effects, the atmospheric dilution factors (X/Qs) associated with FPL's SGLA drop accident, a minimal hurricane (74 mph) and a 200 mph tornado have been evaluated at the same site boundary. The results are:

Condition	X/Q (sec/m^3)
FPL SGLA drop accident	1.7×10^{-4}
74 mph hurricane	2.1×10^{-6}
200 mph tornado	7.9×10^{-7}

The calculated radiological exposure to the member of the public at the site boundary is reduced by the ratio of the X/Qs, i.e., the tornado exposure would be a factor of 4.7×10^{-3} (7.9×10^{-7} divided by 1.7×10^{-4}) lower than the exposure calculated by FPL in its SGLA drop accident evaluation. Thus, the radiological exposure calculated by both Licensee and Staff to result from a postulated airborne release would be reduced by about two orders of magnitude, or more, should the release be assumed to be concurrent with the interaction of a tornado or hurricane with the Turkey Point site.

Q. The SGLA drop accident analysis performed by the NRC Staff and FPL postulated a release from only one SGLA. What would the result be if all six SGLAs were involved in this hypothetical release?

A. The hurricane or tornado does not result in exceeding 10 CFR Part 20 limits if it were assumed that the activity in all six SGLAs is released consistently with the assumptions made by both FPL and the Staff for the SGLA drop accident. Based upon one year of radiological decay associated with three of the SGLAs and the atmospheric dilution effects of hurricanes or tornadoes, the accidental release associated with six SLGAs would result in a radiological exposure one to two orders of magnitude below 10 CFR Part 20 limits.

Q. In order to eliminate any possible misunderstandings, would you state whether your testimony is that such a release is likely to occur during a hurricane or tornado?

A. No. It must be reemphasized that the radiological exposures provided here are not likely and are not expected to occur. Neither the hurricane nor the peninsular Florida tornado is expected to breach the integrity of the SGLAs. The dose analysis was provided solely to demonstrate the inconsequential

nature of the radiological exposure that might be postulated to result from a hurricane or tornado.

Q. What is your overall conclusion with respect to the impact of a hurricane or tornado upon the repair activities?

A. Evaluation of the potential effects of hurricanes and tornadoes as they relate to the repair activity and SGLA storage indicates that these activities pose no undue risk to public health and safety. Consideration of tornadic and hurricane conditions does not influence the manner in which the proposed activity is to be implemented. Licensee's proposed repair activity may be conducted at any time of the year. Specifically, in respect to the Licensing Board's order, the repair schedule should not be related "to the timing of the hurricane season."

Q. In view of your foregoing testimony, what conclusions do you reach as to whether the statement contained in Contention 4B is correct?

A. The statement is incorrect. The radioactive releases postulated are not "likely to occur."

Table 1

Tornado Intensity Classification Schemes

Dames & Moore Scale*/		Fujita Scale**/	
Intensity Class	Estimated Velocity (mph)	Intensity Class	Estimated Velocity (mph)
1	50-90	1	73-112
2	80-120	2	113-157
3	100-150	3	158-206
4	120-180	4	207-260
5	150-225	5	261-368
6	200-300		

*/ See Appendix 2F to FSAR for St. Lucie Unit 1.

**/ "Technical Basis for Interim Regional Tornado Criteria", WASH-1300 (May, 1974), Table 1.

STATEMENT OF PROFESSIONAL QUALIFICATIONS

FREDERIC G. FLUGGER

EXPERIENCE

1973 to present — Florida Power & Light Company:

Manager, Plant Engineering Licensing, Power Plant Engineering Department for Florida Power & Light Company. Responsible for nuclear licensing, fossil licensing, quality assurance and administrative procedures. Direct engineering activities of FPL, the architect engineer and other consultants required to secure permits and licenses, to respond to NRC and other government agencies, and to select sites for the Company's generating facilities. Provide expert testimony at public hearings and to regulatory bodies; engineering evaluations required by regulatory bodies; safety evaluations for modifications to operating nuclear units; independent design review; QA training of engineering personnel; and develop and maintain licensing related computer codes.

Project Engineer, St. Lucie Units 1 and 2, for Florida Power & Light Company. Directed internal and external engineering efforts for two 810 Mw nuclear units (PWR). Numerous presentations to NRC and ACRS, and testified at the St. Lucie Unit #2 public hearing. Provided technical direction to Architect Engineer, Nuclear Steam System Supplier and technical consultants.

1972-1973 — NUS/Southern Nuclear Engineering:

Developed and managed the NUS Licensing Information Service. Responsible for the development of a 500 Mw nuclear units' (PWR) hot functional test program.

1970-1972 — Long Island Lighting Company:

Assistant to the Manager of Nuclear Projects for Long Island Lighting Company. Responsible for the licensing, safety, nuclear related design and fuel management aspects of the Shoreham Nuclear Project (819 Mw BWR). A member of the Company's Engineering Assurance Review Committee. Extensive involvement in the Shoreham public hearing.

1964-1970 Consolidated Edison Company of New York, Inc.:

Manager of Nuclear Bureau of Consolidated Edison Company of New York. Directed the Company's Nuclear and Reactor Fuels Divisions. Responsible for AEC licensing, shielding design, accident analysis, reactor plant safety, nuclear computer code development and fuel cycle engineering. Member Nuclear Facilities Safety Committee.

Engineer, Nuclear Division for Consolidated Edison Company of New York. Directed development of safety analysis reports and technical specifications; engineering associated with engineered safety features design, containment leak rate testing, urban nuclear plant siting studies and shielding design; and offsite radiological dose evaluations. Instructor for the Company's Power Reactor Technology course.

Engineer for Consolidated Edison Company of New York. An engineer in the Control and Instrument Division and at the Company's Ravenswood generating station.

1963-1964 U. S. Merchant Marine:

Licensed Engineering Officer aboard U.S. Merchant vessels. In charge of maintenance and operation of marine steam-turbine power plants and indirect mechanical refrigeration systems.

1962-1963 University of Maryland:

Teaching Assistantship in the Mechanical Engineering Department, University of Maryland. Taught undergraduate courses in Thermodynamics, Strength of Materials and Engineering Graphics.

EDUCATION: State University of New York Maritime College; Bachelor of Marine Engineering, with Honors, 1960.

University of California at Berkeley; Master of Science in Engineering Science, Atomic Energy Commission Science and Engineering Feollow, 1961.

Specialized graduate work in Advanced Mathematics, Heat Transfer, Reactor Theory, Reactor Kinetics, and Nuclear Fuel Management (42 credits), 1962-1968.

MIT - Nuclear Reactor Safety, 1966.

NUS - Advanced Nuclear Fuel Management, 1970.

Florida Power & Light - Management Development Courses, 1975 - Present.

MEMBERSHIP/ LICENSES

American Nuclear Society.

American Society of Mechanical Engineers (ASME).

ASME Committee on Nuclear Quality Assurance, 1977 - Present; Vice Chairman, Design Control Work Group, 1980 - Present.

Third Assistant Marine Engineer, Steam and Diesel.

Atomic Industrial Forum, Probablistic Risk Assessment Subcommittee, 1981 - Present.

PUBLICATIONS

1. F. G. Flugger, et. al., "Turkey Point Units 3 & 4 Steam Generator Repair-Licensing Evaluation", American Nuclear Society Winter Meeting, November 1978.

2. F. G. Flugger, J. N. Burford, "A Fire Hazard Evaluation for Operating Nuclear Plants", American Nuclear Society Winter Meeting, December 1977.

3. Masters Thesis, "Associated Particle Method for Measurement of the Absolute Neutron Flux Produced by the T (d,n) α Reaction", University of California at Berkeley, 1961.

STATEMENT OF PROFESSIONAL QUALIFICATIONS

HABIB H. JABALI

EXPERIENCE

Florida Power & Light Company - Miami, Florida:

1976 to present

Manager, Plant Civil Engineering, Power Plant Engineering Department. Responsible for overall plant Civil Engineering, both internal and external to FPL, for nuclear and fossil generating stations. Also responsible for monitoring plant construction to trouble shoot and resolve technical problems as they are identified to ensure that building codes and civil standards are met. Plan, organize and manage the Civil section to ensure most effective use of available manpower. Interview prospective employees, select, develop and assign personnel and oversee their training to ensure technical competence to meet civil engineering objectives.

Supervisor, Plant Civil Engineering, Power Plant Engineering Department. Establish scope and design criteria of power plants in the civil, structural and architectural areas and direct the engineering activities of architect-engineers and other consultants to ensure implementation thereof. Responsible for supervising the Civil Engineering Section personnel in preparing design modifications and additions at operating power plants and in providing technical assistance in the civil engineering areas to other FPL departments.

Senior Civil Engineer, Power Plant Engineering Department. Responsible for the review and approval of design, procurement, bid reviews and resolution of construction problems for all civil/structural related activities for St. Lucie Unit 1 and 2 Nuclear Power Plants.

1980 to present

Lecturer in civil engineering, University of Miami, Department of Civil Engineering.

1971 - 1976

Sargent & Lundy Engineers - Chicago Illinois

Senior Structural Engineer, Responsible for developing and coordinating structural standards pertaining to the design of power plants. Review and evaluate state of the art technical papers, studies and reports and determine their impact on on-going power plant design. Supervised the design of the Turbine Building Complex for the Bailly Nuclear Power Plant. Directed and supervised the design of major modifications and additions to several existing power plants. This included the design of structures supporting Electrostatic Precipitators, air and gas ducts, chimneys and ID and FD fan foundations. 1971 - 1973, Design Engineer. Worked on the design of various buildings and structures within power plant complex, such as: Auxiliary Building, Reactor Building, Fuel Handling Building, etc. This included steel as well as reinforced concrete designs for both Category I and non-Category I structures.

70 - 1971 Research Assistant, Northwestern University. This research dealt with the behavior of structures under dynamic loads and was sponsored by a grant from the U.S. Army. The results led to the development of an improved mathematical model for soil-structure interaction and the selection of dynamic stiffness of foundations.

1968 - 1969 Research Assistant, University of Miami. Duties consisted mainly of analyzing and developing solutions to stress concentrations around cracks in composite members. This research was sponsored by a grant from the National Science Foundation.

EDUCATION

University of Miami, Coral Gables, Florida. Graduated in 1968 with a Bachelor of Science in Civil Engineering, Cum Laude and Departmental Honors.

Graduated in 1970 with a Master of Science in Civil Engineering.

Northwestern University, Evanston, Illinois. Graduated in 1971 with a Master of Science in Theoretical & Applied Mechanics.

University of Miami, Coral Gables, Florida. Currently preparing for Doctoral Dissertation in Structural Mechanics.

MEMBERSHIPS

Professional Engineer in the states of Florida and Illinois.

Member of American Concrete Institute.

Member of American Society of Mechanical Engineers.

Member of American Institute of Steel Construction.

Academic Honorary - Phi Eta Sigma
Pi Mu Epilson
Pi Delta Phi

PUBLICATIONS

1. "Torsional Oscillations of a Layer Bonded to an Elastic Half-Space", INTERNATIONAL JOURNAL OF SOLIDS & STRUCTURES. Vol. 10, January 1974, pp. 1-13.

2. "Torsional Stiffness of Layer Bonded to an Elastic Half-Space", INTERNATIONAL JOURNAL OF SOLIDS & STRUCTURES. Vol. 11, 1975, pp. 1219-1221.

3. "Stresses in Concrete Chimneys Weakened by Openings", JOURNAL OF THE AMERICAN CONCRETE INSTITUTE, Proceedings Vol. 73, No. 8, August 1976, PP. 465-468.

STATEMENT OF PROFESSIONAL QUALIFICATIONS

PING K. WAN

EXPERIENCE

1975 to present — Environmental Sciences Section Supervisor, Environmental Group, Bechtel Power Corporation. As supervisor of Environmental Sciences for the Environmental Staff, Mrs. Wan's primary responsibility is to conduct meteorological, climatological, air quality impact studies and chemical accident analyses for development of environmental reports, safety analysis reports, air quality studies, design features, and siting criteria for steam power plants. Her work also involves diffusion modeling for complex terrains, developing supplementary control systems, performing special limitation studies, air quality impact analyses for PSD permit applications, preparing air quality and meteorological evaluation testimonies, and serving as a witness in public hearings.

1973-1975 — Meteorology Group Leader, Environmental Group, Bechtel Power Corporation. In this capacity, Mrs. Wan was responsible for and/or conducted meteorological studies, consulted with projects and clients; assessed impacts of power plants on the environment, provided projects with meteorological design parameters; and maintained meteorological data and resource files for Bechtel Power Corporation.

1972 — Consultant to NUS Corporation. Mrs. Wan, as a consultant to NUS Corporation, assisted in investigating the environmental effects of a heat dissipation system, including studies of vapor plume and its dispersion characteristics. She also contributed to the development and application of mathematical models to determine the frequency of fogging and icing conditions resulting from an evaporative heat dissipation system.

1965-1971 — Research Assistant. Mrs. Wan assisted in designing and constructing models and instruments for assessing the results of meteorological research at the University of Maryland, Montana State University, and Pacific Lutheran University. A numeric model for

determining the geographical distribution of mean surface temperature and instruments for electrical microwave measurements of the dielectric constant for researching studies were among her contributions.

EDUCATION

Chung Chi College, Hong Kong. B.S. in Physics, 1961.

Montana State University. M.S. in Physics, 1969.

Pacific Lutheran University. M.S. in Natural Science, 1967.

University of Maryland. Course work completed for PhD in Meteorology, 1971 - 1974.

PROFESSIONAL MEMBERSHIPS

American Meteorological Society

PUBLICATIONS

"Icing and Contamination Study for Midland Plant Units 1 & 2 Transmission Lines," Prepared for Consumers Power Company, Bechtel Power Corporation, 1974.

"Some Atmospheric Effects of Cooling Towers at a Steam Electric Power Plant," R.R. Chu and P.K. Wan, IEEE, Earth Environmental and Resource Conference, September 1974.

"Icing Study for Rochester Gas and Electric Company's 765-115 kV Substation and On-Site Transmission Lines," Bechtel Power Corporation, 1975.

"Sulfur Dioxide Evaluation Study for Bowline Point Station," Prepared for Orange and Rockland, Inc., Bechtel Associates Professional Corporation, 1976.

"Sulfur Dioxide Evaluation Study for Lovett Station," Prepared for Orange and Rockland Inc., Bechtel Associates Professional Corporation, 1976.

"Analysis of SO_2 Concentrations at South Mountains Monitoring Stations," Prepared for Orange and Rockland, Inc., Bechtel Associates Professional Corporation, 1976.

"Ambient Air Quality in Complex Terrain," P.K. Wan and L.A. Hembree, AMS, The 3rd Symposium on Atmospheric Turbulence

Diffusion and Air Quality, October 1976.

"Air Quality Impact Study of Special Limitations Concerning Fuel Use for Bowline Point Station," Prepared for Orange and Rockland, Inc., Bechtel Associates Professional Corporation, 1977.

"The Role of Hourly Mixing Height Data in Air Quality Impact Study," The AMS/APCA Joint Conference on Applications of Air Pollution Meteorology, November 1977.

"Calibration Program for Complex Terrain Diffusion Model," P.K. Wan, The 4th Symposium on Turbulence, Diffusion, and Air Pollution, January 1979.