UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF ROBERT F. ABBEY, JR. ON CONTENTION 4B

I, Robert F. Abbey, Jr., being duly sworn, state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission as a Senior Environmental Scientist (Meteorologist), presently on detail to the Division of Systems Integration, Office of Nuclear Reactor Regulation, from the Office of Nuclear Regulatory Research.

2. Contention 4B 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 is reasonably achievable within the meaning of 10 CFR Part 50 as a result of a hurricane or tornado striking the site during the steam generator repairs."

3. I have reviewed the tornado, hurricane, and fastest-mile windspeed data corresponding to the area encompassing the Turkey Point plant site. The data, in part, consisted of frequency of occurrence of tornadoes and hurricanes, their associated windspeeds (measured and calculated), and the actual date of occurrence of each event. The data period of record for tornadoes was 1950-1979; the data period for hurricanes was 1871-1978.[1,2,3] The area that encompasses the Turkey Point site was considered to be 50 miles in coastline length.[4]

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a. All major hurricanes (windspeeds greater than 110 mph) in the southeast area of Florida have occurred in August, September, and October only; with one, seven, and two occurrences, respectively. [5] For the 50 mile segment encompassing the Turkey Point site, the earliest recorded hurricane made landfall on September 8; the latest occurring hurricane occurred on October 21. [2] The hurricane season is defined as June 1 through November 30. [6] Hurricanes are tropical cyclones that have attained windspeeds at least 74 mph. [1]

b. The tornado season is more difficult to define. Within 125 nautical miles of the Turkey Point site, 253 tornadoes have been reported in the period 1950-1980. Of these tornadoes, 14 occurred in the months of January and December combined; 51 tornadoes were reported in June, the maximum in any one month. In the one degree square encompassing the Turkey Point site, 37 tornadoes have been reported in the period 1950-1979. One tornado had estimated windspeeds in the range 207-260 mph; one tornado had estimated windspeeds in the range 158-206 mph; three tornadoes had estimated windspeeds 113-157 mph; nine with windspeeds 73-112 mph; and 23 had windspeeds between 40-72 mph.

c. The windspeed hazard probabilities for the Turkey Point site have been calculated; the fastest-mile windspeeds from Key West, Florida have been used to represent the Turkey Point site. These are thought to be conservative (higher) windspeeds that would occur at Turkey Point due to the more exposed

location of Key West as compared to Turkey Point. Table 1 summarizes the results of these calculations.

TABLE 1

SUMMARY OF WINDSPEED HAZARD PROBABILITIES FOR TURKEY POINT

Mean Recurrence Interval [yr]	Hazard Probability [yr^{-1}]	Expected Windspeed [mph]	Type of Storm
10	1.0×10^{-1}	73	straight wind
100	1.0×10^{-2}	105/110*	straight wind/ hurricane
1,000	1.0×10^{-3}	136	straight wind/ hurricane
2,000	5.0×10^{-4}	142*	straight wind/ hurricane
10,000	1.0×10^{-4}	167	straight wind/ hurricane
100,000	1.0×10^{-5}	198	hurricane
1,000,000	1.0×10^{-6}	228	hurricane
10,000,000	1.0×10^{-7}	272	tornado
100,000,000	1.0×10^{-8}	311	tornado

* Computed for hurricane windspeeds only. [7]

4. A windspeed sufficient to dislodge and overturn the replaced steam generator lower assembly (SGLA) following its removal from the containment and prior to its destined onsite storage when located on two three-foot high supports ranges from 390 mph to 635 mph depending on the support width; the narrower the distance between supports, the less windspeed required to overturn the SGLA. The greatest recorded hurricane windspeed at the site is about 150 mph; the greatest inferred tornado windspeed is between 207 and 260 mph. As shown in Table 1, the probability of the site experiencing a 150 mph windspeed event is about 5 x 10^{-4}/yr; the probability of the site experiencing a 260 mph event is 1.5 x 10^{-7}/yr. The probability of a windspeed necessary to overturn the SGLA is on the order of 1 x 10^{-10}/yr. These windspeeds could only be caused by a tornado passage. Should the SGLA be in the containment building during a tornado passage, no appreciable, if any, damage would result, even considering the hatch door to be open.

5. Based on my review of the possibility of tornadoes or hurricanes causing the SGLAs to be moved or bump into one another or other solid object, I conclude that the SGLAs have an extremely small probability (1 x 10^{-10}/yr) of even being moved by the wind, let alone cause a release of radioactive material. This conclusion is based on the following:

1) the season for hurricanes (September-late October) for the Turkey Point site compared to the proposed SGLA repair schedule (approximately October-June);

2) the remote chance of a tornado occurrence, much less a tornado of the magnitude required to move the SGLA;

3) the remote probability of a windspeed occurring sufficient to dislodge the SGLA from its supports (1×10^{-10}/yr based on worst case support width); and

4) the unlikely chance that even if the SGLA should be moved, it would strike some other object with an impact as great as for the 12 ft drop analyzed in Section 4.4 of the Final Environmental Statement (NUREG-0743) related to the steam generator repair.

6. I have examined the probabilities associated with tornado or hurricane generated missiles (projectiles) with regard to their penetrating the SGLA when the SGLA is outside of the containment building. In addition to the probability of the site experiencing a hurricane or tornado of sufficient windspeed, the following probabilities have to be factored in:

a. the probability that a significant postulated missile exists at the site in such a location (generally not on the ground) as to make itself available for pickup;

b. the probability that once the missile is picked up it will transverse such a path so as to strike the SGLA;

c. the probability that the missile will attain a speed necessary to penetrate the steel shell of the SGLA;

d. the probability that the missile with the required speed will penetrate the SGLA in a critical part so as to breach the SGLA in such a manner as to expose radioactive material to the passage of air; and

e. the probability that once exposed to the air, the radioactive material will become airborne and disperse downwind.

7. Hurricane winds have not been known to cause large objects to become projectiles with sufficient velocity to penetrate reinforced concrete buildings. The most likely generating event would then be a tornado; the tornado begins to dominate the windspeed hazard probabilities at about a level of 1.5 x 10^{-7}/yr with a windspeed of about 260 mph. If one assumes that the probabilities associated with 6(a)-(e) equal 1, then the probability of missiles eventually causing a release of radioactive material from a SGLA during transit from the containment to temporary outside storage is at least of the order 1 x 10^{-7}/yr.

8. It can reasonably be argued that the probabilities associated with 6(a)-(e) are of the order 1 x 10^{-2}/yr or less. This would yield the probability of missiles caused by tornadoes resulting in release of radioactive material to be on the order of 1 x 10^{-9}/yr or less. It is important to realize that if the breaching of the SGLA be by a tornado (or even by a hurricane with windspeeds about 100 mph), that the resulting dilution of the radioactive material would be increased in proportion to the windspeed.

9. In the FES, Section 4.4, the limiting accident, the 12 foot drop, assumed a windspeed of 2 mph and very stable atmospheric conditions. A tornado or hurricane passage would increase the dilution a factor of 50 to 150 by virtue of the windspeed alone; and yet again increase the dilution by virtue of the highly unstable conditions giving rise to dispersion coefficients greater than those used for the 12 foot drop. This, in turn, would increase the dilution even more.

10. I concur with the previous staff analysis and conclusion concerning the potential effects of breaching the SGLA outside of containment; the pertinent portion of Section 8.6.5 of the FES reads:

> ...breaching the generators during the transit from the containment to the storage building has been considered by the staff (Section 4.4). Regardless of the mechanism, the staff concluded that the most pessimistic result (i.e., the largest calculated dose) is as indicated; namely, dropping the generator outside containment during normal (non-storm) meteorological conditions. Should the breaching mechanism be by hurricane or tornado, which is a highly unlikely occurrence due to the weight of the generators and the strength of the welds, the conservatively evaluated release would be the same. However, the dispersion factor would be much larger and the environmental impact thus reduced.

Robert F. Abbey, Jr.

Robert F. Abbey, Jr.

Subscribed and sworn to before me
this 27th day of April, 1981

Karen L. McElyea
Notary Public

My Commission expires: July 1, 1982

KAREN McELYEA
NOTARY PUBLIC
MONTGOMERY COUNTY, MD.

References:

1. Neumann, C.J., et al.,: Tropical Cyclones of the North Atlantic Ocean, 1871-1977. National Climatic Center, Asheville, N.C., 170 pp. (1978).

2. Schwerdt, R.W., Ho, F.P., and Watkins, R.R.,: Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Casts of the United States. NOAA Tech. Rept. NWS 23, National Oceanic & Atmospheric Administration, National Weather Service, Washington, D.C., pp. 4, 77, 81-91 (1979).

3. Hebert, P.J. and Taylor, G.: Hurricane Experience Levels of Coastal County Populations-Texas to Maine. National Hurricane Center, National Oceanic & Atmospheric Administration, Coral Gables, FL. pp. 1-23, 55, 118, 119, 122 (1975).

4. Simpson, R.H., and Lawrence, M.B.,: Atlantic Hurricane Frequencies Along the U.S. Coastline. NOAA Tech. Memo NWS SR-58, National Oceanic & Atmospheric Administration, National Weather Service, Southern Region, Fort Worth, Texas, 14 pp. (1970).

5. Hebert, P.J. and Taylor, G.,: Hurricanes Part; II 32 Weatherwise, 100 pp. 100-107 (1979).

6. Hebert, P.J. and Taylor, G.,: Hurricanes, Part I. 32 Weatherwise, pp. 60-67 (1979).

7. Batts, M.E., et al.: Hurricane Wind Speeds in the United States. NBS Building Science Series 124, National Bureau of Standards, Washington, D.C., pp. 14, A-6 (1980).

* All references are available from the National Hurricane Center, National Weather Service, National Oceanic & Atmospheric Administration, One Gables Tower, South Dixie Highway, Coral Gables, Florida.

<u>BRIEF RESUME</u>

Robert F. Abbey, Jr.

Education: Ph.D. candidate in Atmospheric Science, Colorado State University (all academic course work completed; projected graduation, 1982)

M.S. in Atmospheric Science, Colorado State University, 1972

B.S. (Honors) in Physics, University of Oregon, 1969

Professional: Since 1972, served as director of the meteorology research program in the Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, D.C. Similar position with the Atomic Energy Commission and the Energy Research and Development Administration prior to governmental reorganization.

Chairman, American Meteorological Society's Committee on Severe Local Storms, 1976-1977

Member, AMS Committee on Severe Local Storms, 1975-1981

Member, AMS Scientific and Technological Activities Commission

Member (Secretary), ANSI Committee for Developing Standards and Guidelines for Extreme Wind and Tornado Criteria, American Nuclear Society

Member, Committee for Wind Effects, Structural Division, ASCE

Chairman, Symposium on Tornadoes, June 22-24, 1976, Lubbock, Texas

Chairman, 10th Conference on Severe Local Storms, 1977

Invited lecturer, FEMA (formerly DCPA) Staff College Summer Institute on Designing for Extreme Winds, 1975-1981

NRC representative to the Federal Committee for Meteorological Services and Supporting Research

Chairman, Federal Working Group on Radiological, Gaseous, and Particulate Transport Models

Certified Consulting Meteorologist, American Meteorological Society

Technical reviewer for several professional journals of the AMS, ANS, ASCE, Nuclear Technology, Industrial Aerodynamics,

Publications: Several publications related to the nature and effects of severe storms (tornadoes, hurricanes, lightning), atmospheric transport and diffusion of effluents, and characterization of the general circulation of the atmosphere by statistical methodology

e.g., "Risk Probabilities Associated with Tornado Windspeeds," <u>Symposium on Tornadoes: Assessment of Knowledge and Implications for Man</u>, June 22-24, 1976, Lubbock, Texas, pages 177-236.

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CERTIFICATE OF SERVICE

I hereby certify that copies of NRC STAFF OBJECTIONS TO PROPOSED AMENDED CONTENTION 1 AND THIRD MOTION FOR SUMMARY DISPOSITION in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class or, as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 27th day of April, 1981.

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