UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
HOUSTON LIGHTING AND POWER COMPANY, ET AL.	)	Docket Nos. 50-498 50-499
	)	
(South Texas Project, Units 1 & 2)	)	

AFFIDAVIT OF JAMES E. FAIROBENT

1. My name is James E. Fairobent. I am an employee of the U.S. Nuclear Regulatory Commission in Washington, D.C. My present position is Meteorologist, Meteorology and Effluent Treatment Branch, Division of Systems Integration within the Office of Nuclear Reactor Regulation. My responsibilities include review and evaluation of meteorological conditions used in the design of structures, systems, and components of nuclear power plants. A statement of my professional background and qualifications is provided as an attachment to this affidavit.

2. The purpose of this affidavit is to address Intervenor CCANP's Contention 4 in this proceeding regarding wind speeds considered in the design of structures at the STP facility.

3. I have reviewed the Applicants' Motion for Summary Disposition and all attachments thereto filed in this proceeding on March 12, 1985. I have also reviewed intervenor CCANP's response, filed on April 8, 1985. Specifically, my review and this affidavit are addressed to the examination of observations of extreme wind speeds and the calculation of the

operating basis wind, also referred to as the "design wind velocity," considered in the design of plant structures.

4. I agree with the statements of the Motion for Summary Disposition and those presented in the accompanying Affidavit of Dale E. Wolfe with respect to examination of observations of extreme wind speeds and the calculation of the operating basis wind for the STP facility.

5. This agreement is based on my review and evaluation of material contained in Section 2.3.1.2.1 of the Applicants' Final Safety Analysis Report (through Amendment 38), my independent review of observations of hurricane wind speeds in excess of 125 miles per hour reported in the North Atlantic Ocean and Gulf of Mexico (see the Staff's Responses to the State of Texas's First Set of Interrogatories on the South Texas Project), and my review of the following reference documents:

- Thom, H.C.S., 1968: "New Distributions of Extreme Winds in the United States," Journal of the Structural Division, Proceedings of the American Society of Civil Engineers, No. 6038, July 1968, pp. 1787-1801.
- Changery, M.J., 1982: "Historical Extreme Wind Speeds for the United States -- Atlantic and Gulf of Mexico Coastlines," NUREG/CR-2639, U.S. Nuclear Regulatory Commission, Washington, D.C.
- Simiu, E., M.J. Changery, and J.J. Filliben, 1979: "Extreme Wind Speeds at 129 Stations in the Contiguous United States," NBS Building Science Series 118, U.S. Department of Commerce, National Bureau of Standards, Washington, D.C.

° Batts, M.E., et al., 1980: "Hurricane Wind Speeds in the United States," NBS Building Science Series 124, U.S. Department of Commerce, National Bureau of Standards, Washington, D.C.

6. In addition, the Applicants' analyses of extreme wind speeds and the calculation of the operating basis wind conform to standard meteorological practice and applicable NRC guidance as described in Section 2.3.1 of the Standard Review Plan (NUREG-0800).

7. The concept of an operating basis wind speed (or "design wind velocity") for a nuclear power plant was developed analogously to the concept of operating basis earthquake defined in 10 CFR Part 100, Appendix A, III.d, as "that earthquake which, considering the regional and local geology and seismology and specific characteristics of local subsurface material, could reasonably be expected to affect the plant site during the operating life of the plant; it is that earthquake which produces the vibratory growth motion for which those features of the nuclear power plant necessary for continued operation without undue risk to the health and safety of the public are designed to remain functional." Analogously, the operating basis wind is a wind speed which could reasonably be expected to affect the plant site during the operating life of the plant; it is that wind speed which produces pressure loadings for which those features of the nuclear power plant necessary for continued operation without undue risk to the health and safety of the public are designed to remain functional.

8. A probability of occurrence of 10^{-2} per year (also expressed as a return period or recurrence interval of 100 years) was selected by the

Staff to represent a wind speed which could reasonably be expected to affect the plant site during the operating life of the plant. Such a probabilistic approach provides a consistent basis for evaluation and complements the probabilistic approach developed for design basis tornadoes described in Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants," and WASH-1300, "Technical Basis for Interim Regional Tornado Criteria." As discussed in WASH-1300, the probability of a tornado that exceeds the design basis tornado should be on the order of 10^{-7} per year.

9. Use of the "fastest mile" wind speed (defined as the fastest speed associated with the passage of one "mile" of air) for the operating basis wind follows from its availability in historical records (from data collected as early as 1872) and its historical incorporation into load determinations for structures. The determination of the operating basis wind for the STP site also considers all non-tornado meteorological phenomena which generate high wind speeds, including hurricanes. Consideration of only extreme winds associated with hurricanes would likely result in a lower wind speed for the operating basis wind.

10. References which describe hurricane wind speeds often do not provide sufficient information about the wind speed measurement to permit a standardized comparison, such as the "fastest mile" wind speed at a reference elevation.

11. Based on my independent examination of hurricane wind speeds in excess of 125 mph reported in the North Atlantic Ocean and Gulf of Mexico (see the Staff's responses to the State of Texas's First Set of Interrogatories on the South Texas Project), Applicants' concerns related

to representativeness of the location of the observation, monitoring elevation, instrument exposure, and quality of measurement for many of the observations are legitimate. Applicants are correct in examining questionable observations (see Wolfe Affidavit, at ¶ 16) separately from standardized and/or certified measurements. If observations are considered unrepresentative with respect to location, or are the result of poor instrument exposure, or of poor quality due to maintenance and calibration problems, these observations cannot be combined with standard or verifiable measurements. Corrections can be made to observations at different elevations (if known) to permit standardized comparisons, although the corrections introduce an element of uncertainty because of assumptions which must be made regarding the change of wind speed with height above the ground.

12. Of particular concern is the representativeness of the reporting station for the observation of extreme wind speed with respect to the STP site. For observations to be considered in a calculation such as the operating basis wind, the reporting station should be in a location similar to or representative of conditions in the vicinity of the STP site. The area of interest for consideration of natural phenomena is generally defined to be the site and surrounding area (see 10 CFR Part 50, Appendix A, Criterion 2), which, for meteorological conditions considered for the STP site, would encompass roughly an area along the Gulf coast of Texas from Corpus Christi to Galveston, and extend inland to a line parallel to the coast from Victoria to Houston. Observations of extreme winds from stations outside of this area would not likely be determined to be sufficiently representative of the site

and surrounding area for inclusion in the calculation of the operating basis wind for the STP site.

13. The presence of open water can also affect the observation of extreme winds. Thom (see ¶ 5) states that, "Water fetchs have a marked effect on extreme winds. Where a location has unobstructed access to a large body of water, extreme wind speeds may be as much as 30 mph greater than a short distance inland" primarily because of decreased surface friction over the water.

14. Estimated values of extreme wind speeds pose unique verification problems because of concerns related to quality of observer training and the possibility of improper chart or dial reading. Dial readings of fluctuating wind speeds are particularly inaccurate, and dials without the support of chart recorders leave no permanent record for evaluation.

15. Also based on my independent examination of hurricane wind speeds, many reported observations confuse or fail to distinguish between "gusts" and "fastest mile" wind speeds. "Gusts" (defined as peak, short-term fluctuations about a mean wind speed) are considered in structural loading separately from "fastest mile" wind speeds through "gust response factors," which are dependent on the type of exposure and dynamic response characteristics of the structure and which vary with increasing height above ground. Because of the separate consideration, gusts are not appropriate for inclusion in the determination of operating basis wind.

16. In my view, the Applicant has made a reasoned consideration of observations of extreme wind speeds based on factors such as

representativeness of reporting station, instrument elevation, instrument exposure, and quality of measurement and observation, and included those observations which are appropriately documented or sufficiently similar to standard observations for determination of the operating basis wind.

17. In the context of an operating condition as defined above, the selection of a design wind velocity ("fastest mile" wind speed) of 125 mph for the STP facility is consistent with NRC regulations and guidance and is supported by a variety of independent assessments of occurrences of extreme wind speeds in the STP area.

18. Research on the climatology of tornadoes associated with hurricanes indicates that almost all true hurricanes (as compared to tropical storms and depressions) which enter the United States south of Long Island, New York, spawn tornadoes. Such tornadoes tend to occur "along the outer bands of hurricanes or well in advance of hurricane force winds." (See R. C. Gentry, "Genesis of Tornadoes Associated with Hurricanes," Monthly Weather Review, Volume III, 1793-1835, September 1983.) Tornadoes spawned by hurricanes move at the speed of winds in the parent storm. Maximum wind speeds associated with tornadoes reflect the contribution of both translational speed (storm movement) and rotational speed. For example, the design basis tornado wind speed, 360 miles per hour, is composed of the sum of a rotational speed of 290 mph plus a translational speed of 70 mph. A translational speed of 70 mph is probably very conservative for tornadoes which form over land "along the outer bands of hurricanes or well in advance of hurricane force winds."

19. In addition, tornadoes spawned by hurricanes are also reflected in reported tornado occurrences, such as the data base compiled by the

National Severe Storm Forecast Center (NSSFC) of the National Oceanic and Atmospheric Administration. In my examination of the NSSFC data base for the Texas Coast for the period 1954-1981 and my examination of an independent evaluation of all violent tornadoes reported for the period 1880-1982 (see T. P. Grazulis, "Violent Tornado Climatography," NUREG/CR-3670, May 1984), no tornado associated with any hurricane has exceeded a maximum wind speed (translational plus rotational speed) of 260 mph.

20. Using the NSSFC data base described above, I have independently computed the probability of a tornado strike of any magnitude at the STP site to be about 1.7 x 10^{-4} per year, which is considerably lower than the probability of "expected" events typically considered as operating basis conditions. Considering that hurricane-spawned tornadoes reflect translational speeds associated with hurricanes and considering an operating basis wind which includes hurricane wind speeds, the combination of an operating basis wind with a design basis tornado at the STP site results in an event with a probability of less than 10^{-9} per year.

21. I, James E. Fairobent, Meteorologist, being duly sworn, certify that I have reviewed this affidavit and that the statements contained herein are true and correct to the best of my knowledge and belief.

James E. Fairobent

James E. Fairobent

Subscribed and sworn to before me
this 15th day of April, 1985

Malinda L. McDonald

Notary Public

My Commission expires: 7/1/86

James E. Fairobent
Professional Qualifications
Meteorology and Effluent Treatment Branch
Division of Systems Integration

I am a meteorologist in the Meteorology Section, Meteorology and Effluent Treatment Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. My duties include evaluation of the meteorological aspects of nuclear reactor siting and operation.

I received a Bachelor of Science degree in meteorology and oceanography from the University of Michigan in 1970, and a Master of Science degree in meteorology from the University of Michigan in 1972. While at the University of Michigan, I performed as a research assistant on a rain scavenging project, weather observer, and teaching assistant.

In 1973, I joined the U.S. Atomic Energy Commission, Division of Technical Review. I was responsible for the evaluation of the meteorological aspects of nuclear power plant siting and design for Construction Permit and Operating License applicants. In addition, I performed evaluations of the meteorological aspects related to license amendments for operating reactors. I served as the senior NRC meteorologist at the Incident Response Center during the Three Mile Island accident (March 1979) where I coordinated all relevant meteorological information and disseminated it to NRC officials and representatives of other Federal Agencies.

In 1979, I joined the staff of the National Commission on Air Quality (NCAQ) as the only meteorologist. I participated in the review of the Clean Air Act and in the making of recommendations for legislative improvements for revision of the Act. My particular responsibilities included atmospheric dispersion modeling, long-range transport of air pollutants, and climatic change due to increased anthropogenic emissions to the atmosphere.

I returned to the position of meteorologist with the U.S. Nuclear Regulatory Commission in 1981 after the NCAQ submitted its report to Congress. I resumed my former duties related to evaluations of the meteorological aspects of nuclear power plant siting and operation.

I am a professional member of the American Meteorological Society (AMS), the National Weather Association (NWA) and the Air Pollution Control Association. I have participated on the Meteorological Aspects of Air Pollution committee of the AMS and the Industrial Meteorology Committee of the NWA. I have co-authored several technical papers and chapters of textbooks related to atmospheric dispersion. I have participated in the development of regulatory guides and standard review plans related to the meteorological aspects of nuclear power plant siting and operation. I have provided expert testimony at hearings conducted by the Atomic Safety and Licensing Board and made presentations to the Advisory Committee on Reactor Safeguards.