UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of CLEVELAND ELECTRIC ILLUMINATING COMPANY, ET AL. (Perry Nuclear Power Plant, Units 1 and 2)	)))))))	Docket No. 50-440 OL 50-441 OL

AFFIDAVIT OF S.B. SUN IN SUPPORT OF SUMMARY DISPOSITION OF ISSUE #4

I, S.B. Sun, state under oath that:

1. I am a Nuclear Engineer in the Core Performance Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. I have knowledge of the matters set forth herein and believe them to be true and correct. A statement of my professional qualifications is attached.

2. Issue #4 states that:

   > The safety of Applicant's emergency core cooling system has not been demonstrated with appropriate experimental data because a full scale 30 degree sector steam test has not been performed.

3. I understand that the Licensing Board admitted Issue #4 because of its view that a full-scale 30-degree-sector steam test "appears to be required by 10 CFR 50, Appendix K, Part I, ¶ D.6" and because Applicants' FSAR indicated that no such test had been performed. LBP-81-24, 14 NRC 175, 215-216 (1981).

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4. Full-scale 30-degree-sector steam tests are not specifically mandated by Appendix K to 10 CFR 50. Section I.D.6 of Appendix K requires only that during spray cooling following the blowdown period in a loss-of-coolant accident convective heat transfer for BWR fuel rods be calculated using coefficients based on appropriate experimental data.
5. Section I.D.6 also specifies acceptable heat transfer coefficients for reactors with jet pumps and 7 x 7 fuel assembly arrays. The BWR/6 employs an 8 x 8 fuel assembly array.
6. General Electric has confirmed by test that if the flow rate through a BWR fuel assembly is approximately 1 gallon per minute a convective heat transfer coefficient of 1.5 Btu/hr-ft^2-°F, the value employed in the GE ECCS Evaluation Model, will be achieved.
7. GE also has conducted full-scale spray distribution tests in air at atmospheric pressure for the BWR/2 and later designs, including the BWR/6 design, to confirm that the necessary minimum coolant flow will be provided to each fuel assembly. Those tests were performed in a full-scale test facility that used the actual core spray nozzle geometry to spray water over a mockup of the top of the reactor core.
8. However, later tests conducted in Europe (the results of which were confirmed in tests conducted by GE) indicated that the presence of steam and/or increased pressure in and above the upper core region could adversely affect the distribution of flow from certain types of core spray nozzles.
9. To assess these effects GE developed a methodology for determining the distribution of BWR spray flow in a steam environment. Using

that methodology GE predicted core spray system performance for a full-scale 30-degree-sector of a simulated BWR. Tests in a steam environment were conducted by GE on the configuration for which performance was predicted using the GE methodology.

10. The test configuration was designed to be representative of a reference BWR/6 with a 218-inch diameter core. Prototypical hardware was used, and the upper plenum of the test apparatus was a full-scale mockup of a 30-degree sector of the reference upper plenum with accurate simulation of its geometry.

11. The results of these tests confirmed GE's capability to predict with its methodology spray distribution performance-in a steam environment-of multiple-nozzle core spray systems similar to that of the BWR/6 design tested. Pre-test predictions compared well with the test results.

12. The data from these full-scale 30-degree-sector steam tests, together with data from the 360-degree-sector air-water tests and tests on other variously sized sector test configurations have confirmed the core spray cooling convective heat transfer coefficient assumptions in the GE ECCS Evaluation Model.

13. Moreover, because other data show that even without any of the core spray water flowing through the 8x8 fuel assembly array steam cooling alone would result in a significantly greater convective heat transfer coefficient than the 1.5 Btu/hr-ft^2-°F assumed in the GE ECCS Evaluation Model for a BWR/6, the Staff has concluded that the core spray

distribution for Perry is of no safety concern. See NUREG-2229 (Vol. 1), "BWR Large Break Simulation Tests - BWR Blowdown/Emergency Core Cooling Program," dated April 1982.

14. Thus convective heat transfer from fuel rods in the Perry reactor core is calculated using coefficients that are based on appropriate experimental data as required by Section I.D.6 of Appendix K to 10 CFR 50. See Perry SER, NUREG-0887, pp. 6-27 and 6-28.

S.B. Sun

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Subscribed and sworn to before me this 4th day of November, 1982.

Patricia Fischetti

Notary Public

My commission expires: 7/1/86

Summer B. K. Sun
Core Performance Branch
Division of Systems Integration
U.S. Nuclear Regulatory Commission

PROFESSIONAL QUALIFICATIONS

I am employed as a nuclear engineer of the Thermal-Hydraulics Section in the Core Performance Branch of the Division of Systems Integration.

I received a BS degree with Chemical Engineering Major from National Taiwan University in 1967 and a Ph.D degree with Chemical Engineering Major from University of Missouri of Columbia, Missouri, in 1974. I am a registered Professional Engineer, Certificate Number 11309, in the state of Connecticut.

In my present work assignment at the NRC, I have technical responsibility for the review of the reactor core thermal-hydraulics design submitted in BWR reactor construction permit and operating license applications. In addition, I participate in the review of analytical models used in licensing evaluation of the core thermal-hydraulic behavior under various operating and postulated accident and transient conditions. The latter responsibility includes technical review of the core spray issue and the instrumentation for monitoring inadequate core cooling to comply with the Commission requirements.

Prior to joining the NRC staff in August 1980, I was employed by Combustion Engineering Company, as a consulting engineer. I was responsible for the development and application of computer codes and methods for the analysis of transients for PWRs. My tenure at CE was from 1974 through 1980.

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(Perry Nuclear Power Plant, Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF'S MOTION FOR SUMMARY DISPOSITION OF ISSUE NO. 4" 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, by deposit in the Nuclear Regulatory Commission's internal mail system, this 5th day of November, 1982:

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