2/24/81

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PENNSYLVANIA POWER & LIGHT COMPANY	)	
and	)	Docket Nos. 50-387
ALLEGHENY ELECTRIC COOPERATIVE, INC.	)	50-388
	)	
(Susquehanna Steam Electric Station,	)	
Units 1 and 2)	)	

AFFIDAVIT OF HOWARD T. WATANABE IN SUPPORT
OF SUMMARY DISPOSITION OF CONTENTION 12

County of Santa Clara)
: ss.
State of California)

Howard T. Watanabe, being duly sworn according to law, deposes and says as follows:

1. I am Program Manager, Services Licensing, General Electric Company ("GE"), and give this affidavit in support of Applicants' Motion for Summary Disposition of Contention 12. I have personal knowledge of the matters set forth herein and believe them to be true and correct. A summary of my professional qualifications and experience is attached as Exhibit "A" hereto.

2. Contention 12 alleges that the design of the Susquehanna Steam Electric Station ("Susquehanna") "fails to solve the problem of flow-induced vibrations in the core, thereby creating in-vessel sparger failure" and thus violates the NRC standards for protection against radiation in 10 CFR Subsections 20.1 and 20.105(a) and creates an unreasonable risk of harm to the health and safety of the public. This affidavit will show that the alleged problem does not exist in the spargers installed in the Susquehanna units and that the Susquehanna design does not violate NRC standards or create an unreasonable risk to the public.

3. Feedwater enters the reactor pressure vessel of a boiling water reactor ("BWR") through the feedwater nozzles. Components known as "feedwater spargers" are located inside the vessel and fitted into each feedwater nozzle. The function of the feedwater spargers is to distribute the flow of feedwater uniformly within the annulus of the vessel so that feedwater will form a homogeneous mixture with reactor recirculation coolant water. The resulting uniform distribution of feedwater assures proper subcooling of the inlet of the jet pumps and a uniform temperature of the water entering the reactor core. This in turn helps to maintain proper core power distribution.

4. Another function of the feedwater sparger is to prevent the relatively cold feedwater from impinging on the hot surface of the feedwater nozzle. This is achieved by means of a thermal sleeve, which projects from the sparger into the nozzle bore. Early BWRs employed spargers in which the thermal sleeve did not fit tightly against the nozzle bore. As a result, there was a leakage flow of feedwater through the gap between the thermal sleeve and the nozzle. Because the configuration did not have sufficient damping, the leakage flow of feedwater through the gap between the thermal sleeve and the nozzle caused vibration of the sparger. This vibration led to the formation of cracks at the junction of the sparger arms and the thermal sleeve. The vibration did not occur in the reactor core, but rather in the reactor vessel annulus.

5. As a consequence of some feedwater sparger failures in early BWR designs, a full scale sparger test facility was constructed by GE in San Jose, California in the Fall of 1973. The purpose of this facility was to identify the source of feedwater sparger vibrations so that corrective action could be implemented. It was determined through testing in this facility that the leakage flow between the sparger thermal sleeve and the feedwater nozzle was causing the vibration problem. It was also determined that elimination of the leakage flow by means of an "interference fit" or by other means, would end sparger vibration.

6. Based on these tests, GE designed and developed an "improved interference fit sparger", also known as the "triple sleeve sparger". This design utilizes three concentric thermal sleeves, the innermost of which conducts the feedwater to the sparger arms. The inner sleeve is fitted tightly with a piston-ring seal against the feedwater nozzle. Any water leaking past the inner seal would pass into the vessel through the annulus between the inner sleeve and the "mid-thermal" sleeve. Attached to the mid-thermal sleeve is the outer sleeve, which is also fitted tightly with a piston-ring seal in the nozzle bore at the upstream end to prevent vibratory motion and fatigue damage of the sparger assembly. The piston-ring seals reduce potential leakage flow to essentially zero because the pressure drop is very low across the outer seal. This design therefore eliminates the gap between the sparger and the nozzle and leakage flow through the gap.

7. Confirmatory tests of the new design were conducted at GE's Moss Landing Test Facility, where actual reactor operating conditions were duplicated. The new design was tested in this facility over the range of flows experienced in the reactor. The test program included the effects of installation tolerances, wear and other conditions that might impair the ability of the sparger to avoid vibration. In none of the tests was any significant vibration measured; the tests verified the soundness of the new sparger design and its ability to solve the vibration problem.

8. The improved interference fit sparger design has been implemented in a number of GE plants. These include Browns Ferry 1 (operational since 1977), Browns Ferry 2 (1978), James A. Fitzpatrick (1978), Browns Ferry 3 (1979), Peach Bottom 2 (1980), Cooper (1980), Pilgrim (1980) and Quad Cities 2 (1980). Operating experience of this sparger design in the above plants has been excellent, with no sparger vibration problems or sparger failures reported to date.

9. The NRC Staff has reviewed in detail the sparger vibration problem and has reached the conclusion that "the GE triple-sleeve sparger design has acceptably resolved the vibration problem." NUREG-0619 (November 1980) at 11.

10. The design of Susquehanna Units 1 and 2 employs the improved interference fit sparger. Therefore, based on analysis, testing and operational experience, it is possible to predict that the possibility of sparger failure at Susquehanna due to flow-induced vibration is remote.

11. Contrary to the allegation in Contention 12, no evidence has been found of sparger failure due to flow-induced vibration in the core.

12. Should the feedwater sparger fail for whatever reason at Susquehanna, there would be no adverse consequences external to the reactor. The feedwater sparger is not a pressure boundary and is contained entirely within the reactor pressure vessel. Extreme sparger failure (i.e., complete severance) would result at most in cavitation of the jet pumps as a result of loss of subcooling. Such an occurrence would be easily detectable by the jet pump instrumentation. Another possible effect of complete sparger failure would be asymmetry in the neutron flux in the core due to non-uniform water temperature. This effect would also be detectable by the linear power radiation monitor. None of the consequences of sparger failure would affect the ability to achieve and maintain the safe shutdown of the reactor, and none would result in the release of radiation to the environment outside the reactor.

Edward T. Watanabe
(Affiant's name)

Sworn to and subscribed before me this 24 day of February 1981.

Karen S. Vogelhuber
Notary Public

OFFICIAL SEAL
KAREN S. VOGELHUBER
NOTARY PUBLIC - CALIFORNIA
SANTA CLARA COUNTY
My Commission Expires Dec. 21, 1984

csc/2E

Howard T. Watanabe

Professional Qualifications and Experience

Degree: B.S. in Mechanical Engineering - 1943
University of Utah

1972 - Pres. Program Manager-General Electric Company, San Jose, California. Specific projects include feedwater nozzle/sparger improvement, improvement of materials in BWR pressure boundary and assessment of brittle fracture of reactor materials.

1969 - 1972 Engineering Section Supervisor-Aerojet Nuclear Corporation, Idaho Falls, Idaho. In charge of test planning in the startup of the Power Burst Facility located in Arco, Idaho.

1963 - 1969 Section Supervisor Aerojet - General, Sacramento, California. In charge of test planning the NERVA nuclear reactor at Jackass Flats, Nevada.

1958 - 1963 Department Head Aerojet - General Nucleonics, San Ramon, California. In charge of testing fuel assemblies for the Army Gas-Cooled Reactors Program. Designed, installed, and tested fuel assemblies in General Electric Test Reactor, Engineering Test Reactor, and Battelle Research Reactor.

1952 - 1958 Project Engineering - Phillips Petroleum Company. Responsible for design, installation, and testing in test loops of reactor materials in the Materials Test Reactor, Arco, Idaho.

Registered Professional Nuclear Engineer, State of California

Member: American Nuclear Society; Atomic Industrial Forum Backfit Sub-committee

HTW:sem/1180 3D
2/25/81

EXHIBIT A

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PENNSYLVANIA POWER & LIGHT COMPANY and ALLEGHENY ELECTRIC COOPERATIVE, INC.	)	Docket Nos. 50-387 50-388
	)	
(Susquehanna Steam Electric Station, Units 1 and 2)	)	

CERTIFICATE OF SERVICE

This is to certify that copies of the foregoing "Applicants' Motion for Summary Disposition of Contention 12", "Applicants' Statement of Material Facts as to Which There is No Genuine Issue to Be Heard (Contention 12)" and "Affidavit of Howard T. Watanabe in Support of Summary Disposition of Contention 12" were served by deposit in the United States Mail, First Class, postage prepaid, this 9th day of March, 1981, to all those on the attached Service List.

Jay E. Silberg

Dated: March 9, 1981

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of PENNSYLVANIA POWER & LIGHT COMPANY AND ALLEGHENY ELECTRIC COOPERATIVE, INC. (Susquehanna Steam Electric Station, Units 1 and 2)	Docket Nos. 50-387 50-388

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