September 17, 1988

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

before the

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE, et al.	)	Docket Nos. 50-443-OL-1 50-444-OL-1
(Seabrook Station, Units 1 and 2)	)	(On-Site Emergency Planning and Safety Issues)

AFFIDAVIT OF LOUIS C. SUTHERLAND

I, Louis C. Sutherland, being on oath, depose and say as follows:

1. I am Deputy Director and Chief Scientist of Wyle Research, a division of Wyle Laboratories, El Segundo, California. A statement of my professional qualifications is attached hereto and marked "A".

2. The purpose of this affidavit is to address allegations in Contention Bases A.7 and A.8 regarding (1) hearing damage to anyone within 100 feet of the siren during its operation [Basis A.7]; and (2) sound irregularities [Basis A.8].

Basis A.7: Hearing Damage

3. In response to Interrogatory No. 24[1], the Attorney General indicated that the basis for Contention Basis A.7 is "Appendix 3 (at 3-8) of NUREG-0654, FEMA-REP-1, Rev. 1" which states:

> "The maximum sound levels received by any member of the public should be lower than 123 dB, the level which may cause discomfort to individuals."

4. The VANS siren is a dual siren system rated at 134 dB(C). This sound level is produced along the siren system centerline at a distance of 100 feet from the siren. It also necessarily follows, that for sirens elevated above ground level this sound level is produced at a distance 100 feet from the siren at the height of the siren centerline above ground level (e.g., 134 dB(C) at 100 feet, 45 feet above ground level). Since there are no permanent structures (except at the staging areas themselves) at or within 100 feet of the preselected siren locations [See Affidavit of Richard J. Faix at ¶¶ 12, 13] it is not possible for any member of the public to be subjected to a sound pressure level of 134 dB(C) (unless of course, they were elevated, by some means to a height of 45 feet above ground level).

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[1] "Massachusetts Attorney General's Response to First Set of Interrogatories Regarding the Massachusetts Attorney General's Amended Contention on Notification System," dated July 12, 1988.

5. I have evaluated the data measured on the ground near the prototype dual and the single sirens to establish a near field directivity model for the dual in a vertical plane. Utilizing this model, I have determined that with the siren 25 feet above ground level, the maximum sound level at 5 feet above the ground (i.e., at ear level) is 131 dB(C) which occurs about 90 feet from the siren. With the siren at the normal operating height of 45 feet above ground level, the maximum level at 5 feet above the ground is 124 dB(C) which occurs about 200 feet from the siren.

6. If the siren is activated at the 25 foot height, it will be in the process of being elevated to 45 feet. The siren elevates from 25 feet to 45 feet in less than 60 seconds. As the siren elevates, the sound pressure levels on the ground decrease (e.g., the sound pressure level at 90 feet from the siren decreases from 131 dB(C) to 122 dB(C) and the sound pressure level at 200 feet decreases from 127.5 dB(C) to 124 dB(C); in less than 60 seconds).

Basis A.8: Sound Irregularities

7. In response to Interrogatory No. 25,[2] the Attorney General further defined gaps in sound coverage as nulls or "irregularities where the sound emitted by one speaker

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[2] "Massachusetts Attorney General's Response to First Set of Interrogatories Regarding the Massachusetts Attorney General's Amended Contention on Notification System," dated July 12, 1988.

effectively cancels out the sound emitted from another speaker." The Attorney General goes on to claim that "with a multiple speaker system like the multicellular device to be implemented by the Applicants, acoustical interference among the various speakers will result in a high degree of sound irregularity." In this response the Attorney General further states that "the likelihood of an acoustic null, where there is a total absence of output to the listener, is greatest where two loudspeakers are used, such as the system proposed for the VANS vehicles."

8. Irregularities due to sound cancellation are theoretically possible only for stationary, pure tone, point sources in a laboratory environment.

9. For the dual siren system, which is a real, non-idealized source of finite size; the theoretical difference between interference nulls and peaks (i.e., sound irregularity) is far less than for idealized point sources. In real world applications even this theoretical acoustic phenomenon is overcome by atmospheric effects at typical listening distances. Therefore, this effect is practically speaking not significant for the Seabrook siren system nor was it observed during testing of the siren.

10. Furthermore, for a rotating siren such as the dual system, angular irregularities are immaterial. As the siren rotates, a listener at any point in space will experience a varying sound level ranging from a maximum value

that occurs when the siren is pointing generally in his or her direction to a minimum value that occurs when the siren is pointing away. In between these two extremes, the sound level at typical listening distances will vary in a complex way, depending more on atmospheric turbulence than on the presence of interference peaks and nulls. Thus, angular irregularities in sound emission that may occur close to a siren have no relevance to the effective siren coverage of a rotating siren. No "gaps in the coverage" of the dual sirens are anticipated since, due to rotation, they will each be capable of radiating a broad siren tone pattern whose axis of symmetry slowly rotates over 360 degrees ensuring coverage at all angles. Furthermore, the Mass AG withdrew,[3] in response to Interrogatory No. 27, the assertion that "the oscillation of the speaker assembly will cause gaps in coverage when the siren is used in its tone alert mode."

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[3] "Massachusetts Attorney General's Response to First Set of Interrogatories Regarding the Massachusetts Attorney General's Amended Contention on Notification System," dated July 12, 1988.

Louis C. Sutherland

STATE OF CALIFORNIA

Los Angeles, ss.

September 15, 1988

The above-subscribed Louis C. Sutherland appeared before me and made oath that he had read the foregoing affidavit and that the statements set forth therein are true to the best of his knowledge.

Before me,

OFFICIAL SEAL
MARY D MC GOVERN
NOTARY PUBLIC - CALIFORNIA
LOS ANGELES COUNTY
My comm. expires AUG 2, 1990

Notary Public
My Commission Expires: Aug 2, 1990

LOUIS C. SUTHERLAND

POSITION: Deputy Director and Chief Scientist

JOINED WYLE: 1964

PRINCIPAL DUTIES AND RESPONSIBILITIES:

Overall technical direction of Wyle Research, providing specific technical guidance and consulting in applied acoustics, environmental noise, and noise control.

BACKGROUND:

Wyle Laboratories, El Segundo, CA. Research and consulting in the evaluation, prediction, and measurement of community and aircraft noise, human response to noise, sound propagation, structural dynamics, and related areas in the environmental sciences. Principal investigator on diverse projects such as a pilot study for a national survey of outdoor noise environments, cost-effectiveness evaluation of community noise countermeasures, airport noise reduction at the nation's airports, evaluation of human response to impulse noise, measurement of sound absorption in air, vibroacoustics of space vehicle structures, and psychoacoustic studies for response of humans to low-frequency noise and vibration. Editor for a comprehensive engineering design manual for NASA on sonic and vibration environment problems for ground facilities.

The Boeing Company, Seattle, WA (3 years) - Research Specialist, Acoustics and Vibration Group. Technical supervisor on all acoustic and vibration environment problems for Dyna-Soar, Saturn C-3, and high acceleration booster concepts (Hi-Bex). Acoustic modeling and development of B-52 jet engine noise suppressor.

University of Washington, Department of Speech, Seattle, WA (3 years) - Research Engineer. Design of electroacoustic equipment used in speech and hearing research and testing.

EDUCATION:

M.S., Electrical Engineering, University of Washington, 1954.
B.S., Electrical Engineering, University of Washington, 1946
Post-Graduate Studies, University of Loughborough.

PROFESSIONAL MEMBERSHIPS:

Acoustical Society of America (Fellow), Member of S1-2 Working Group on Sound Propagation; Chairman 12-9 Committee on Annoyance Response to Impulsive Noise.
Institute of Electrical and Electronics Engineers, Acoustics, Speech, and Signal Processing Society.
American Institute of Aeronautics and Astronautics
Society of Automotive Engineers, A-21 Committee on Aircraft Noise; Co-Chairman, Noise Metrics Subcommittee
U.S. Representative, ISO Working Group on Sound Propagation
Registered Professional Engineer, State of California
Member, Institute of Noise Control Engineering

PUBLICATIONS:

Over 100 technical papers, reports, and presentations

WYLE LABORATORIES

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(Seabrook Station, Units 1 and 2)	(On-Site Emergency Planning and Safety Issues)

CERTIFICATE OF SERVICE

I, Jeffrey P. Trout, one of the attorneys for the Applicants herein, hereby certify that on September 17, 1988, I made service of the documents listed below by depositing copies thereof with Federal Express, prepaid, for delivery to (or where indicated, by depositing in the United States mail, first class postage paid, addressed to) the individuals listed below:

1. Applicants' Motion for Summary Disposition on Amended Contention on Notification System of Attorney General for the Commonwealth of Massachusetts;

2. Memorandum in Support of Applicants' Motion for Summary Disposition on Amended Contention on Notification System of Attorney General for the Commonwealth of Massachusetts;

3. Statement of Material Facts Not in Dispute;

4. Affidavit of Travis N. Beard;

5. Affidavit of Sebastian N. Caruso;

6. Affidavit of Gary J. Catapano;

7. Affidavit of Edward W. Desmarias;

8. Affidavit of Richard J. Faix;

9. Affidavit of George A. Harper;

10. Affidavit of Lawrence M. Jacobson;

11. Affidavit of Donald E. Johnson;

12. Affidavit of David N. Keast;

13. Affidavit of Edward D. Lieberman;

14. Affidavit of Joseph Story II;

15. Affidavit of Eric Stusnick; and

16. Affidavit of Louis C. Sutherland.

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Adjudicatory File
Atomic Safety and Licensing
Board Panel Docket (2 copies)
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Jeffrey P. Trout

(*=Ordinary U.S. First Class Mail.)