

November 2, 1984

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	
and NORTH CAROLINA EASTERN	)	Docket No. 50-400 OL
MUNICIPAL POWER AGENCY	)	
	)	
(Shearon Harris Nuclear Power	)	
Plant)	)	

AFFIDAVIT OF M. READA BASSIOUNI  
ON EDDLEMAN 57-C-3

County of Suffolk	)	
	)	ss.
Commonwealth of Massachusetts	)	

M. READA BASSIOUNI, being duly sworn, deposes and says:

1. I am the founder and Principal Technical Consultant of Acoustic Technology, Inc. ("ATI"). My area of specialization is the design and implementation of prompt notification warning systems in accordance with NUREG-0654/FEMA-REP-1, Appendix 3 and FEMA-43. Under my direction, ATI has provided technical services to more than 20 nuclear utilities. A current statement of my professional qualifications and experience is attached hereto. My business address is ATI, 22 Union Wharf, Boston, Massachusetts 02109. I have personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in response to Eddleman Contention 57-C-3.

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2. Carolina Power & Light Company contracted with ATI to analyze and evaluate the acoustic coverage of the siren notification system designed to be installed within the plume exposure pathway Emergency Planning Zone ("plume EPZ" or "EPZ") of the Harris Nuclear Power Plant. As principal consultant for ATI, I am preparing a report which documents the analysis of the warning system design to meet the guidance set forth in FEMA's regulations at 44 C.F.R. § 350; in NRC's regulations at 10 C.F.R. § 50.47(b)(5) and Part 50, Appendix E, § IV.D.3; in NUREG-0654, Criterion E.6 and Appendix 3; and FEMA-43, the "Standard Guide For The Evaluation of Alert and Notification Systems for Nuclear Power Plants" (September 1983).

3. NUREG-0654 and FEMA-43 are the basic guidelines for use by a nuclear licensee in the design of a prompt notification system for alerting the public within the EPZ. These guidelines address the licensee's options for methods of alerting, such as outdoor warning sirens, tone alert radios, and automatic telephone dialers. Federal guidance does not require redundant notification systems for the general public (i.e., siren systems to alert the public when it is outdoors, combined with tone alert radios or automatic telephone dialers to alert the public when it is indoors).

4. The federal guidance does not specify criteria for nighttime alerting. However, it does establish design criteria for public alert systems based on population

density and ambient background noise -- specified as the average measured outdoor daytime (period between 7 am and 10 pm) ambient sound levels. (One reason that daytime ambient is specified rather than nighttime ambient is because the ambient noise level during the daytime is substantially higher than the level at nighttime). According to the federal guidance, a siren system may be designed so that the siren sound level either provides 60/70 dBC acoustic alert coverage (depending on the population density of the area) or provides 10 dBC above the average outdoor daytime ambient sound level.

5. The siren system design within the Harris EPZ consists of 62 high-power electromechanical sirens (rated 125 dBC at 100 feet) strategically placed throughout the EPZ to provide optimal alert coverage to inhabited areas. Twenty-six of the sirens are to be located in Chatham County, six are to be located in Harnett County, six are to be located in Lee County, and twenty-four are to be located in Wake County.

6. Evaluation of the acoustic coverage for the siren warning system was accomplished by using a computer model developed by ATI,<sup>1/</sup> and field measurements of the ambient sound levels. The acoustic coverage of the siren system design was predicted for daytime summer average meteorological

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<sup>1/</sup> The utilized computer model has proven to be extremely accurate through extensive field testing.

conditions, as specified by FEMA-43. The computer model analysis demonstrates that the siren system has been designed to provide the required 60 and 70 dBC public alert coverage for most inhabited areas within the EPZ. (Apex and Fuquay-Varina are covered by 70 dBC contours.)

7. An ambient background noise survey was conducted within the Harris EPZ in July 1984 to document the average measured outdoor ambient sound level in areas located outside the 60 dBC contours, in order to assess the siren system's ability to meet the 10 dB above ambient criterion in areas not covered by 60/70 dBC coverage. The ambient background noise survey was conducted in accordance with the procedures prescribed in FEMA-43. Each inhabited area not covered by a 60 dB signal was investigated individually. Outdoor daytime ambient sound levels were measured in the range of 24 dB to 39 dB. Therefore, the average measured outdoor daytime ambient sound level for regions outside the 60 dBC coverage was conservatively established as 40 dB, and the 50 dBC acoustic coverage of the sirens was computed. This analysis clearly demonstrates that the entire Harris EPZ is covered by a 50 dBC siren contour. Accordingly, all areas outside the 60 dBC contours meet the 10 dB above ambient criterion.

8. In summary, the proposed siren locations within the Harris EPZ were evaluated based upon applicable federal guidance. An actual ambient background noise survey and a

computer analysis of siren sound propagation were performed. The results of this study indicate that the proposed siren warning system design complies with the NUREG-0654/FEMA-43 guidelines (and the applicable federal regulations) to alert essentially 100% of the population within the plume EPZ within 15 minutes.

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M. Reada Bassiouni

Sworn to and subscribed before me this \_\_\_\_ day of October, 1984.

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Notary Public

My Commission Expires:



Resume of:

Dr. M. Reada Bassiouni  
Principal Consultant

Education

Syracuse University, Syracuse, New York -  
Ph.D. in Mechanical Engineering, Major: Acoustics (1976)

Syracuse University, Syracuse, New York -  
Selected courses in Business Administration

Carleton University, Ottawa, Ontario, Canada -  
M.E. in Mechanical Engineering (1972)

Alexandria University, Alexandria, Egypt -  
B.S. in Mechanical Engineering (1969)

Technical Societies

National Forensic Center -  
chosen as an expert in acoustics, noise and vibration  
control

Institute of Noise Control Engineering (INCE) - member

American Society of Testing Materials (ASTM) - member

American Society of Mechanical Engineers (ASME) - member

Acoustical Society of America (ASA) - member

Detailed Experience Record

1980-  
Present

ACOUSTIC TECHNOLOGY, INC.  
BOSTON, MASSACHUSETTS

Founded Acoustic Technology, Inc. (ATI) and is the principal technical consultant in acoustics, vibration, and noise control for utilities, manufacturers, and agencies. His area of specialization has been design and implementation of prompt notification warning systems required by NUREG-0654/FEMA REP-1, Appendix 3. As an acoustic expert, he has witnessed and conducted various siren performance tests in conjunction with determining the actual siren acoustic capabilities for utilities and siren manufacturers. Under his direction ATI developed a computer model for prediction of siren acoustic coverage for varying meteorological and ground conditions.

Also, he has had an active role in field testing installed warning systems including documentation and testifying results for the NRC. Under his technical direction ATI has provided consulting services to the following nuclear utilities:



ACOUSTIC TECHNOLOGY INC.

1. Arizona Public Service Company  
Palo Verde 1, 2, 3, Nuclear Generating Stations
2. Cincinnati Gas & Electric Company  
Wm. H. Zimmer Nuclear Power Station
3. Florida Power & Light Company  
Turkey Point Power Plant  
St. Lucie Power Plant
4. GPU Nuclear Corporation  
Three Mile Island Nuclear Power Station
5. Jersey Central Power & Light  
Oyster Creek Nuclear Generating Station
6. Louisiana Power & Light  
Waterford-3 Nuclear Station
7. Mississippi Power & Light  
Grand Gulf Nuclear Station
8. Omaha Public Power District  
Fort Calhoun Nuclear Power Station
9. Public Service Electric & Gas Company  
Salem Nuclear Generating Station
10. Rochester Gas and Electric Corporation  
R.E. Ginna Nuclear Power Station
11. Sacramento Municipal Utility District  
Rancho Seco Nuclear Generating Station
12. South Carolina Electric & Gas Company  
V.C. Summer Nuclear Power Station
13. Toledo Edison Company  
Davis-Besse Nuclear Power Station
14. Virginia Electric & Power Company  
Surry Station  
North Anna Station
15. Gulf States Utilities Co.  
River Bend Station
16. Public Service Indiana  
Marble Hill Nuclear Generating Station
17. Duquesne Light Company  
Beaver Valley Nuclear Power Station



ACOUSTIC TECHNOLOGY INC.

18. Philadelphia Electric Company  
Limerick Generating Station
19. Duke Power Company  
Catawba Nuclear Station
20. Indiana & Michigan Electric Company  
Donald C. Cook Nuclear Station
21. Illinois Power Company  
Clinton Power Station
22. Carolina Power & Light Company  
H. B. Robinson Plant  
Brunswick Steam Electric Plant  
Shearon Harris Nuclear Power Plant

Additionally, Dr. Bassiouni has been called upon as an expert witness by many legal firms. He has had extensive experience in analyzing hearing damage claims and OSHA violations which require testing and measurements of high noise levels and determination of their effects on humans. He has also conducted acoustic analyses of tape recordings to identify recorded voices and tape tampering. Dr. Bassiouni has prepared and reviewed environmental noise impact statements. His activities include computer analysis and advanced field measurements. He has performed evaluations of airport noise impacts due to changes in air traffic volume.

1976-1980

**STONE & WEBSTER ENGINEERING CORPORATION (S&W)  
BOSTON, MASSACHUSETTS**

- a. Acoustic Specialist for the Prompt Notification System required by NUREG-0654/FEMA REP-1 Appendix 3. Responsible for computer modelling and ambient noise surveying and support of siren system design.
- b. Noise control engineering for nuclear and fossil-fueled power projects to meet the Occupational Safety and Health Act (OSHA) criteria, property line sound level regulations imposed by local regulatory agencies or individual plant criteria selected to prevent noise complaints from the community.
- c. Acting as a consultant to diagnostic vibrations and noise measurements to evaluate equipment performance deviation for existing plants.
- d. Preparing noise control specifications for new equipment, limiting the noise to allowable levels such that the resultant sound level in the plant area does not exceed the OSHA regulations.



**ACOUSTIC TECHNOLOGY INC.**



- e. Designing and developing noise control devices for dominant noise sources within the plant.
- f. Selecting the acoustical materials to control in-plant and exterior sound levels.
- g. Measurements, predictions, and evaluation of noise control data.

Dr. Bassiouni performed work for the following clients:

- 1. Cincinnati Gas & Electric  
W.H. Zimmer Nuclear Power Station
- 2. Baltimore Gas & Electric  
Calvert Cliffs Nuclear Power Station
- 3. Occidental Petroleum  
Geothermal Power Plant
- 4. Great Northern Paper Company  
Millinocket, Maine
- 5. Atlantic City Electric Company  
Deep Water Station - Return to Coal Firing
- 6. Stone & Webster Engineering Corporation  
Reference Nuclear Power Plant (RNPP)
- 7. Texaco, Inc.  
Light Olefins Unit, Port Arthur, Texas
- 8. Sacramento Municipal Utility District (SMUD)  
Geothermal Power Plant
- 9. Virginia Electric & Power Company  
North Anna Unit Nos. 3 and 4
- 10. Duquesne Light Company  
Beaver Valley Power Station - Unit No. 2
- 11. Niagara Mohawk Power Corporation  
Nine Mile Unit 2
- 12. Power Authority of the State of New York  
Greene County Projects



ACOUSTIC TECHNOLOGY INC.

1975-1976

AVCO EVERETT RESEARCH LABORATORY, INC.  
EVERETT, MASSACHUSETTS

Senior Acoustic Scientist

Duties consisted of the following:

1. Experimental acoustic design for laser systems. Acoustic elements design and material compatibility and acoustic properties testing.
2. Design and analysis of special design acoustic mufflers and silencers.

1975

TERRY CORPORATION, a subsidiary of INGERSOLL-RAND COMPANY  
WINDSOR, CONNECTICUT

Noise Consultant

Duties consisted of the following:

1. Developed noise data for use by marketing in presenting and guaranteeing noise levels to customers.
2. Developed practical acoustic enclosure systems for use on turbine and gears.
3. Analyzed existing products (single and multistage turbines and gear units) to determine compliance with the national noise standards.
4. Ensured that OSHA noise standards were met in the new product design.
5. Reviewed new industrial noise standards applied to the company products.
6. Determined the impact of existing and proposed noise control legislation and regulations on corporate activities.

1972-1975

SYRACUSE UNIVERSITY  
SYRACUSE, NEW YORK

Mechanical and Aerospace Engineering Department

Duties consisted of the following:

1. Conducted extensive acoustic measurements using various techniques.
2. Performed supporting diagnostic techniques for the associated flow field.



ACOUSTIC TECHNOLOGY INC.

3. Acoustic data reduction methods, data analysis, and results reporting.
4. Investigated and evaluated noise reduction methods.

1971

CARLETON UNIVERSITY  
OTTAWA, ONTARIO, CANADA  
(AEROTHERMODYNAMICS DIVISION)

Research Assistant - Engineering Department

Fields: Fan and compressor acoustic design and tested acoustic liners

Instructor of Mechanical Engineering

Full and part-time Consulting Engineer in air conditioning and refrigeration systems, Alexandria, Egypt.

Publications

Authored:

1. "Outdoor Sound Propagation over Ground with Several Impedance Discontinuities"; Acoustical Society of America Paper; presented November 1982; Orlando, Florida

Co-authored the following:

1. "Prompt Siren Notification System Design" POWER ENGINEERING, March 1983
2. "Prediction and Experimental Verification of Far-field sound propagation over Varying Ground Surfaces" Internoise "83" paper.
3. "Acoustic and Flow Characteristics of Cold High-Speed Coaxial Jets," AIAA Paper No. 78-241, January 1978
4. "Supersonic Jet Noise Suppression by Coaxial Cold/Heated Jet Flows," AIAA Paper No. 76-507, July 1976
5. "Some Recent Developments in Supersonic Jet Noise Reduction," AIAA Paper No. 75-503, March 1975
6. "Potential of Coaxial Multi-Nozzle Configurations for Reduction of Noise from High Velocity Jets," Second Interagency Symposium of University Research in Transportation Noise, North Carolina University, 1974
7. "Reduction of Noise from Supersonic Jets by Coaxial Multi-Nozzle Schemes," Eighth International Congress on Acoustics, London, 1974



ACOUSTIC TECHNOLOGY INC.

8. "Quarterly Progress Reports, Nos. 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14, submitted to Office of Noise Abatement, Department of Transportation, Washington, D.C.
9. "A High-Speed High-Temperature Flow Facility" Final report under Grant SSF (70)-25, submitted to New York State Science and Technology Foundation

