UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
James P. Gleason, Chairman
Frederick J. Shon
Dr. Oscar H. Paris

In the Matter of	
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. (Indian Point, Unit No. 2)	Docket Nos. 50-247 SP 50-286 SP
POWER AUTHORITY OF THE STATE OF NEW YORK (Indian Point, Unit No. 3)	April 12, 1983

CON EDISON'S TESTIMONY OF DR. PETER C. FREUDENTHAL ON COMMISSION QUESTION 6

ATTORNEY FILING THIS DOCUMENT:

Brent L. Brandenburg

CONSOLIDATED EDISON COMPANY
OF NEW YORK, INC.
4 Irving Place
New York, New York 10003
(212) 460-4600

Q: Please state your name and business affiliation?

A: My name is Dr. Peter C. Freudenthal. I am Director of Air & Noise Programs for Consolidated Edison Company of New York, Inc, Exhibit (PCF-1) presents my curriculum vitae and a partial list of studies that I have authored.

Q: What is the purpose of your testimony?

A: My testimony addresses the environmental consequences of natural gas-fired and oil-fired internal combustion engine cogeneration that might be used to replace all or a portion of the electric load now served by Indian Point. I understand that Dr. Barry Commoner and Mr. Richard Schrader will testify that a considerable portion of the output of the Indian Point plants could be replaced by natural gas-fired internal combustion engine cogeneration in Con Edison's service area.

Q: Have you conducted studies to quantify the environmental consequences of on-site cogeneration in New York City?

A: Yes. I have conducted several in-depth analyses to evaluate the environmental consequences of alternative ways to provide energy to congested urban areas such as New York City. These analyses include computer simulations of the

dispersion of pollutants over New York City and detailed wind tunnel simulations of dispersion of pollutants from low-level sources in mid-town Manhattan. I have also reviewed the EPA's estimates of emission rates from stationary internal combustion engines and the New York State and City environmental regulations that are applicable to internal combustion engine cogenerators.

Q: Have these studies led you to any general conclusions regarding on-site cogeneration?

A: Yes. To the extent fuel must be burned to provide electric and/or steam energy to an urban area, it is clearly preferable to burn the fuel in large central stations, such as Con Edison's steam and electric generating facilities located in New York City, that are equipped with stacks meeting GEP (good engineering practice) guidelines. I would discourage on-site electric and/or steam generation from cogeneration facilities in buildings with roof-top chimneys, particularly from facilities using internal combustion (IC) engines since the impact on air quality from such facilities per unit of steam or electricity generated is far greater than the air quality impact from an equivalent amount of steam or electricity generated at large central generating stations.

The use of internal combustion engines with roof-top chimneys is of particular concern with respect to oxides of nitrogen (NO_x) emissions, regardless of whether the engines are oil- or gas-fired. A proliferation of these types of fuel-burning equipment in an urban area such as New York City will cause ambient nitrogen dioxide (NO_2) levels to rise and may cause the national ambient air quality standard (NAAQS) for NO_2 to be exceeded.

Q: Please explain the relationship between NO_x emissions and ambient NO_2 concentrations.

A: The oxides of nitrogen that are emitted as a result of combustion consist mainly of nitric oxide (NO), but also include some NO_2 and N_2O. The NO that is emitted oxidizes in the atmosphere to form NO_2. Since NO_2 is the most toxic of the oxides of nitrogen, the NAAQS is based on that particular species.

Q: Has EPA developed emission factors for stationary IC engines?

A: Yes.

Q: Can these emission factors be expressed in term of electricity generation?

A: Yes. Exhibit (PCF-2) presents the EPA emission factors in terms of grams of emission per kilowatt hour of generation. For comparison, this exhibit also presents emission factors for a typical oil-fired Con Edison power plant. Obviously, power generation at a nuclear plant such as Indian Point releases none of these combustion product pollutions into the atmosphere.

Exhibit (PCF-2) shows that IC engines release 11 to 20 times more NO_x per kilowatt hour than an oil burning power plant. Similarly, they release much more NO_x than an on-site oil-fired boiler producing steam or hot water. The NO_x emissions are greatest from a natural gas-fired, spark ignition internal combustion engine. Therefore, this type of engine presents a greater threat to urban air quality than the oil-fired diesel engine.

Q: Since Exhibit (PCF-2) indicates that there will be no SO_2 emissions from a gas-fired IC engine, would the replacement of the electric load supplied by Indian Point Unit 2 with such engines effect a reduction in urban SO_2 levels?

A: To the extent that gas-fired IC cogenerators replace space heating from on-site oil-fired boilers, they will reduce ambient SO_2 levels. In this regard I note that there are a large number of residential and commercial buildings in New York City that presently use natural gas as boiler fuel for space heating. To the extent that a gas fired IC engine replaces space heating in gas heated buildings there would be no decrease in SO_2 emissions. However, with respect to buildings that currently use oil heat, the reduction in SO_2 emissions from such replacement will be much smaller than the increase in NO_x emissions from the IC engines. Therefore, the net effect will be a deterioration of air quality.

Q: Does the Clean Air Act or the State or City Air Pollution Control Codes require emission controls for IC engines powered cogenerators?

A: The Clean Air Act's new source performance standards do not apply to such equipment and New York State's air pollution regulations do not require controls or limit NO_x emissions from such facilities. The City's Air Pollution Control Code only limits NO_x emissions from large boilers and contains no provision limiting emissions from such IC engines. There are requirements under the prevention of significant deterioration (PSD) provisions of the Clean Air Act which would apply to

large cogeneration facilities that emit more than 250 tons of NO_x a year. Cogenerators using IC engine equipment with a capacity of less than 2.5 MW generally would not be subject to the PSD requirements.

With respect to cogeneration facilities that are subject to PSD requirements, such facilities would have to employ best available control technology (BACT). What, if any, emission reduction would constitute BACT is not clear. Informally, EPA staff has indicated that a 40 percent reduction of NO_x might be possible. But even assuming this were the case, NO_x emissions would still be a significant problem.

Q: Does the New York State Department of Environmental Conservation require installation or operating permits for oil or natural gas-fired cogeneration facilities installed in New York City?

A: No. Such fuel burning equipment using natural gas or distillate oil are specially exempt from DEC's licensing requirements, and there are no State environmental performance standards for these devices.

Q: Does the New York City Air Pollution Code require installation and operating permits for oil or gas fired IC engine cogenerators?

A: Permits are required for oil fired IC cogenerators and for natural gas-fired IC cogenerators larger than 350,000 Btu/hour heat input.

Q: Have you quantified the increase in ambient pollution levels that would result from a proliferation of on-site IC engine cogenerators in New York City?

A: Yes. As part of my testimony in New York State Public Service Commission Case 27574, I presented a dispersion analysis of the air quality impact of 1086 MW of diesel cogeneration in New York City. That analysis assumed that under a stipulated set of economic assumptions, diesel cogenerators would be installed at 395 buildings, mostly located in Manhattan. The modeling included as input data, the specific location of each potential cogenerator as well as its building size and pollution emission rate.

This dispersion analysis indicated extensive areas in New York City, principally in Manhattan, in which there would be substantial increases in ambient NO_2 concentrations. The

predicted maximum increase in annual NO_2 levels was calculated to be 104 $\mu g/m^3$. Disregarding background, this concentration slightly exceeds the 100 $\mu g/m^3$ primary national ambient air quality standard for NO_2. When the predicted NO_2 increases are added to the current level of NO_2 monitored in New York City, that is between 63 and 65 $\mu g/m^3$, the NO_2 ambient standard would be violated over widespread areas of Manhattan.

Q: Would your study of diesel cogeneration be applicable to gas-fired IC engine cogenerators?

A: Yes. Had the same 395 sources that I modeled for PSC Case 27574 been assumed to convert to natural gas IC engine cogeneration, I would have predicted NO_2 increases approximately 16 percent greater than I calculated assuming oil-fired diesel engines.

Q: Based on your study in Case 27574, can you make a quantative estimate of the air quality impact from the replacement of Indian Point 2 with on-site cogeneration facilities in New York City?

A: Since I have no idea where the gas-fired cogenerators replacing Indian Point would be installed, I cannot use these

calculations to quantify their impact. However, qualitatively, I conclude from these calculations that on-site gas-fired IC engine cogeneration in an urban area such as New York is likely to significantly degrade air quality and may cause the ambient standard for for NO_2 to be contravened.

Q: Would the Clean Air Act impose sanctions on the Metropolitan New York City area if the NO_2 ambient air quality standard were contravened?

A: Yes. Part D of the Clean Air Act provides that in non-attainment areas, no permit to construct or to modify a major stationary source may be issued unless that source:

- applies "lowest achievable emission rate" air pollution controls;

- has obtained greater-than-equivalent reductions in emissions from existing sources to offset both emissions and ambient impacts of the new facility;

- has demonstrated that all major stationary sources owned or operated by the same owner or operator as the applicant are subject to emission limitations and

are in compliance, or are on a schedule for compliance.

The uncertainty and cost of compliance with these provisions would effectively preclude industrial and economic growth in the Metropolitan Area. It would also preclude planned projects such as refuse recovery.

Q: Does that conclude your testimony?

A: Yes.

CURRICULUM VITAE

PETER C. FREUDENTHAL, Ph.D.
9 Edgewood Road
Allendale, NJ 07401
Telephone (201) 327-2017

EDUCATION: PhD Environmental Health Science - New York University Honor Graduate MS Sanitary Science (Radiological Health) - New York University 1963 BS Pharmacy - Columbia University 1960 BA Meteorology - New York University 1954 Executive Program in Business Administration - Columbia University 1972.

EXPERIENCE: CONSOLIDATED EDISON COMPANY OF NEW YORK

1970-Present Director Air & Noise Programs 1977 - Present
Manages Department responsible for all air quality and noise policies and programs. Developed and implemented Company strategy to obtain fuel sulfur variances. Led utility industry programs relating to EPA ambient standards rulemaking. Directed air and noise studies and preparation of Environmental Impact Statements relating to coal reconversion and on-site cogeneration.

Chief Air Quality Engineer 1971 -1976 Responsible for developing and auditing Company air pollution control programs. Principal air quality witness at public hearings.

Division Engineer, Air Quality 1970 - 1971 Organized Company's first section with formal responsibility for air quality analysis and control. Prepared air quality portions of the first utility related environmental impact statement.

1976-1975 LONG ISLAND UNIVERSITY GRADUATE DEPARTMENT OF MARINE SCIENCE

Adjunct Associate Professor.

1966-1970 U.S. ATOMIC ENERGY COMMISSION, HEALTH & SAFETY LABORATORY

Environmental Scientist

1963-1970 NEW YORK UNIVERSITY MEDICAL CENTER, INSTITUTE OF ENVIRONMENTAL MEDICINE

Assistant Research Scientist

1955-1968 U.S. AIR FORCE & AIR FORCE RESERVE
Meteorologist (Major).

PROFESSIONAL AFFILIATIONS

AIR POLLUTION CONTROL ASSOCIATION
Utilities Committee (1971 - 76), Chairman (1973 - 75)
Meteorology Committee (1972-Present), Vice-Chairman (1975-77), Chairman (1977-79)
Biomedical Committee 1979 - Present

UTILITY AIR REGULATORY GROUP
Health & Welfare Effects Committee (Chairman 1976 - Present)

NEW YORK POWER POOL
Air Subcommittee (Chairman 1976 - 1979)

AMERICAN METEOROLOGICAL SOCIETY
Air Pollution Meteorology Committee (1972 - 75)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

NEW YORK ACADEMY OF SCIENCE
Vice Chairman, Environmental Section (1980 - Present)

PUBLICATIONS IN:

Journal of the Air Pollution Control Association
Bulletin of the American Meteorological Society
Journal of Geophysical Research
Atmospheric Environment
Transactions of the New York Academy of Medicine
U.S. Atomic Energy Commission Reports

Technical Papers and Publications
by
Peter C. Freudenthal, Ph.D.

Freudenthal, P.C., "Size Distribution of Radioactive Particles over the Ocean," Presented at the Annual Meeting of the American Chemical Society (1968).

Kneip, T. J., Eisenbud, M., Strehlow C. D., and Freudenthal, P. C., "Airborne Particulates in New York City," Journal of the Air Pollution Control Association Vol. 20, pp. 144-149 (1970).

Freudenthal, P. C., "Strontium 90 Concentrations in Surface Air: North America versus Atlantic Ocean from 1966 to 1969," Journal of Geophysical Research, Vol. 75, pp. 4089- 4096 (1970).

Freudenthal, P. C., Aerosol Scavenging by Ocean Spray, Report HASL-232, U.S. Atomic Energy Commission, Health and Safety Laboratory (1970).

Freudenthal, P., "High Collection Efficiency of the Aerotec-3 Cyclone For Submicron Particles," Atmospheric Environment, Vol. 5, pp. 151-154 (1971).

Singer, I. and Freudenthal, P. C. "State of the Art of Air Pollution Meteorology," Bulletin of the American Meteorology Society, Vol. 53, pp. 545-547 (1972).

Freudenthal, P. C. and Hoydysh, W. G.," Dispersion of Emissions from Local Space Heating Boilers," Presented at the Annual Meeting of the Air Pollution Control Association (1973).

McCune, D. C., Silberman, D. H., Mandl, R. H., Weinstein, L. H., Freudenthal, P. C., and Giardina, P. A., "Studies on the Effects of Saline Aerosols of Cooling Tower Origin on Plants," APCA Paper 74-25.1, presented at the Annual Meeting of the Air Pollution Control Association (1974).

Freudenthal, P. C., "New York City Air Quality and the Oil Embargo," APCA Paper 75-08.5, Presented at the Annual Meeting of the Air Pollution Control Association (1975).

Egan, B. A., Freudenthal, P. C., Hoydysh, W. G., and Jepsen, A., "The ESEERCO Model for the Prediction of Plume Rise and Dipersion from Gas Turbine Generators," APCA Paper 75-49.3, Presented at the Annual Meeting of the Air Pollution Control Association (1975).

Beals, G. A. and Freudenthal, P. C., "Worst Case Meteorological Conditions for 24-Hour Concentrations from an Array of Tall Stacks," APCA Paper 77-29.4, Presented at the Annual Meeting of the Air Pollution Control Association (1977).

McCune, D. C., Silberman, D. H., Mandl, R. H., Weinstein, L. H., Freudenthal, P. C., and Giardina, P. A., "Studies on the Effects of Saline Aerosols of Cooling Tower Origin on Plants," Journal of the Air Pollution Control Association, Vol. 27, pp. 319-324, 1977.

Freudenthal, P. C., and Beals, G. A., "Modeling Botantical Injury from Saline Cooling Tower Drift," Presented at the Cooling Tower Symposium, University of Maryland (1978).

Beals, G. A. and Freudenthal, P. C., "Verification of a Climatological Equivalent of the Area Source Algorithm of the RAM Model," APCA Paper 78-40.6, Presented at the Annual Meeting of the Air Pollution Control Association (1978).

Freudenthal, P. C., "Discussion of Paper by Vaun A. Newill, R. Wyzga, and James R. McCarroll, (Costs Versus Benefits of Sulfur Oxides and Related Particulate Matter Control)" Bulletin of the New York Academy of Medicine, Vol. 54, pp. 1249-1256 (1978).

Freudenthal, P. C., Beals, G. A., and Teplitzky, A. M., "Air Quality and Environmental Noise Emissions from On-Site Diesel Engine Generators," APCA Paper 79-40.5, Presented at the Annual Meeting of the Air Pollution Control Association (1979).

Freudenthal, P. C., Hoffnagle, G. F., and Beals, G. A., "Environmental Implications of On-Site Urban Cogeneration," Presented at the 5th International Clean Air Congress, International Union of Air Pollution Protection Associations (1980).

Exhibit____(PCF-2)

EMISSION RATES(g/kwh)

	SO_2	NO_X	CO	PARTICULATES
POWER PLANT	1.76	1.31	0.19	0.20
DIESEL OIL	1.12	17.30	2.41	0.30
DIESEL DUAL FUEL*	0.11	11.00	2.68	No Data
IC ENGINE: NAT GAS	0	20.12	1.34	No Data

*Dual fuel diesels operate on approximately 90% natural gas and 10% diesel oil.