UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Philadelphia Electric Company	)	Docket Nos. 50-352
	)	50-353
(Limerick Generating Station,	)	
Units 1 and 2)	)	

AFFIDAVIT OF MAYNARD E. SMITH AND DAVID SEYMOUR
IN SUPPORT OF A MOTION FOR SUMMARY DISPOSITION
REGARDING CONTENTION V-4

Messrs. Smith and Seymour being duly sworn according to law come forth and say:

1. My name is Maynard E. Smith. I am President and Principal Consultant for Meteorological Evaluation Services, Inc. ("MES") located in Amityville, New York. I obtained a Master of Science in meteorology in 1942 and have been engaged in the practice of professional meteorology since that time. A copy of my professional qualifications is attached hereto and incorporated by reference herein. MES, under my direction, has provided meteorological consulting services for the Limerick Generating Station since 1970.

2. MES services have included advice on site selection, the location and choice of meteorological instruments and

facilities, processing and analysis of the data and the preparation of the meteorological portions of the studies and documents necessary for the licensing of the Limerick Generating Station.

MES, under my supervision, prepared the following portions of the Limerick Generating Station FSAR and EROL:

FSAR		EROL	
Sections	2.3.1	Sections	5.1.4
"	2.3.2	"	5.2.2
	2.3.3	"	2.3.1
	2.3.4	"	2.3.2
	2.3.5		

In addition, as more fully described below, MES, under my direction, has conducted extensive studies related to the effects of the operation of cooling towers. In those studies we used carburetor-equipped aircraft extensively to obtain data on cooling tower plume behavior.

3. My name is David E. Seymour. I am presently a Consultant Meteorologist to MES, Inc. I obtained a Bachelor of Science degree from Purdue University in Professional Pilot Technology and obtained a Master of Science degree in meteorology from Rutgers University in 1976. I have provided consulting services to MES, Inc. on a number of airborne field evaluations. These have included atmospheric diffusion studies and evaluation of stack and cooling tower plume behavior. I have conducted extensive airborne cooling tower plume research, and was responsible for the training of 12 other commercial pilots involved in MES

cooling tower research programs. I have also been responsible for airborne photography and aircraft procurement and maintenance for numerous aircraft involved in MES studies. I am presently a commercial airline flight officer. I am also a director of a glider pilot ground school in Rochester, New York. I am qualified as a commercial pilot in single and multi-engine land, glider and instrument aircraft. I am also a flight instructor for glider, advanced and instrument ground training. A copy of my professional qualifications is attached hereto and incorporated by reference herein.

4. We have been asked by the Philadelphia Electric Company to respond to the contention V-4 which was submitted by the Air and Water Pollution Patrol ("AWPP"). This contention reads as follows:

> "Neither Applicant nor Staff have considered the potential for and import of carburetor icing of aircraft flying into the Limerick cooling tower plume(s)."

We have prepared, reviewed and concur in all sections of this affidavit; however, certain sections were either prepared primarily by one individual, or one of us is more knowledgeable about the details. Such sections are shown in Table 1. In addition to the sections of the EROL and FSAR listed in paragraph 2 above, we have utilized section 3.4.3 of the EROL as input to our analysis.

5. We have carefully examined and analyzed the contention of the Air and Water Pollution Patrol. Our consideration of the contention utilizes our extensive experience with

regard to meteorology, cooling tower technology and aircraft operations, and has included examination of the literature and documents on the subject, review of the experience and field data developed in research studies of such plumes, and a computer modeling study of the expected behavior and persistence of the Limerick plumes.

6. Our conclusion is that these plumes will not add to the frequency or the severity of carburetor icing potential. The most important reason for our conclusion is that the temperature and moisture conditions in cooling tower plumes are only slightly different from those in the ambient air, despite the impressive appearance of the plumes on certain occasions. We also find that it would be extremely difficult for an aircraft to remain in the plume from the Limerick cooling towers for a sufficient time to develop significant carburetor icing, even if the equipment built into the aircraft for dealing with icing were not used. The dimensions of the plumes would seldom allow more than a few minutes of flight time in the plumes, and even when they are more extensive, staying in a plume long enough to provide a chance for enhanced icing would be a difficult deliberate maneuver on the part of the pilot.

PERTINENT STUDIES AND RESEARCH ON COOLING TOWER PLUMES

7. One of the most important factors in assessing the AWPP contention is to determine how the temperature and moisture conditions in cooling tower plumes differ from those in the ambient air. Both from the impressive appearance of the plumes and a casual consideration of the large amounts of water vapor released, one would anticipate that the conditions in such plumes would be quite different from the

surrounding atmosphere. This is not the case, however, because the very rapid mixing that occurs with the ambient atmosphere dilutes the excess heat and moisture within a short distance. In responding to discovery requests, AWPP has emphasized that 35 million gallons of water vapor per day would be released from the Limerick towers. Compared with the amount of water vapor naturally present in the air with which the tower release mixes, this is not a significant amount. Typically, in an hour the cooling tower water vapor would mix into 10,000 million cubic meters of air (a section 10 Km long, 1 Km deep and 1 Km wide). Typically also, this air would contain about 2 1/2 thousandths of a gallon of water vapor in each cubic meter. Therefore, the 1.3 million gallons per hour released from the tower would be mixed with 25 million gallons of natural water vapor, hardly a major addition.

Pennsylvania State University Study

8. The most informative study available on the temperature, humidity and turbulent structure of cooling tower plumes is especially appropriate since it was conducted in Pennsylvania on hyperbolic cooling towers. The Pennsylvania State University (Thomson et al., 1981) made a large number of aircraft flights through the cooling tower plumes from the Keystone power plant in western Pennsylvania for the express purpose of determining what in-plume conditions were like, and how they differed from those in the ambient air. The Pennsylvania State research team found that very close to the towers (i.e. with the aircraft traversing the plume within a quarter of a mile) both temperature and humidity conditions varied sharply as the aircraft traversed the

plumes, with both quantities exceeding ambient levels significantly for very short periods. The variability was attributed to the fact that the plumes, although often appearing to be quite dense and solid, actually consist of puffs of excess moisture and temperature. Beyond a quarter of a mile, it became difficult to distinguish the temperature in the plume from that of the outside air, as shown in Figure 1, and the humidity difference dropped to 0.25 gm/kg or less as shown in Figure 2. This is a very small excess; the natural atmosphere, when saturated, contains about 3.5 gm/kg at 30°F and this figure increases to 22 gm/kg at 80°F. Thus, even though a plume may remain visible for a considerable distance, the conditions within it become essentially those of the surrounding air after a very short distance.

9. This Pennsylvania State study is directly comparable to the Limerick Generating Station situation since the experiments were done under nearly identical climatic conditions.

American Electric Power Study

10. During the 1970's the American Electric Power Service Corporation supported an extensive study of cooling tower plumes, conducted by MES. The objectives of this program were to determine whether such plumes had any significant environmental effects, and how they behaved with respect to their height above ground and persistence downwind. These tests involved the use of light aircraft of the same type that is of concern to the AWPP. In all, over 340 experiments were completed, as shown in Figure 3. The total water vapor emissions from the Amos and Gavin Plants are in the same range as the total that will come from the two towers at Limerick.

11. The key point is that, of these 340 individual tests, visible plumes ten miles and longer were observed only six times, and of these six cases, three were at temperatures well below 20°F, which is, as discussed below, too cold to have created any serious carburetor icing hazard. Thus, as we will show later, the pilots found plumes with the adequate length and temperature criteria for potential carburetor icing less than 1% of the time, in a program designed to document long plumes.

12. No icing problems were ever reported during all of this flying even though light, carburetor-equipped aircraft flown by local pilots employing normal procedures were used extensively.

COMPUTER MODELING STUDY

13. We have conducted a computerized modeling study of the behavior of the Limerick cooling tower plumes, using the Electric Power Research Institute's SACTI program. This computer code uses the plant thermal output and the cooling tower water vapor and air volume releases at maximum power as input data, treating the two towers simultaneously. It combines this information with data from the Limerick meteorological tower facility and with data on above-ground meteorology to develop a series of seasonal and annual distributions of pertinent information about the plume behavior and effects.

14. The SACTI computer code is a "state-of-the-art" program in that it predicts the behavior of plumes such as those of the Limerick Generating Station as faithfully as is

possible at the present time. We can say from our direct experience with the American Electric Power field studies that the heights and frequencies of lengthy plumes calculated for Limerick are in accord with our expectations.

15. The modeling study shows that the length of the plumes would be expected to reach or exceed ten miles in less than 4% of the cases, and the maximum frequency of these long plumes would be toward the west (0.6%). The code predicts that the Limerick plumes will always reach a height of at least 1,000 feet above ground before leveling off, if they have not dissipated before reaching that altitude.

CARBURETOR ICING PHENOMENA

16. The conditions responsible for carburetor ice formation are well understood and have been extensively documented. In carburetor-equipped aircraft, the fuel enters the airstream at the throttle valve. The vaporization of the fuel, combined with the rapid expanison of air as it passes through the carburetor, causes a cooling of the mixture. The water vapor content of the intake air may condense, and if the temperature in the carburetor reaches 32°F or below, the moisture will be deposited in the fuel intake system as frost or ice. This ice may reduce or block the passage of the fuel/air mixture to the engine and cause engine failure. Due to the venturi effect of a partially closed throttle valve, this occurs most often when the throttle is partially or fully closed and the temperature of air passing downstream of the throttle valve may drop as much as 60°F.

17. On very dry days, or when the temperature is well below freezing, the moisture content of the atmosphere is

generally too small to cause icing. But if the temperature is between 20°F and 90°F, and moderate humidity or visible moisture is present, there is a potential for carburetor ice. A full discussion of the conditions under which carburetor ice develops is given in a Johns Hopkins University publication from the Chalk Point Cooling Tower Project (JHU 1977). Figure 4, reproduced from the Johns Hopkins report, is a chart showing the meteorological conditions during which carburetor icing is possible. This chart shows that serious icing may occur with temperatures ranging from 20 to 90°F even at moderate humidities. However, it does not occur at temperatures below 20°F.

18. It is also important to recognize that this icing is not an instantaneous process. Figure 5 is reproduced from a study by Gardner and Moon (1970) which documented ice buildup as a function of time during conditions favorable for carburetor icing. Based upon the plots presented in this figure, Gardner and Moon concluded that approximately 8 minutes of flying time under adverse conditions without carburetor heat would be required to create medium to heavy carburetor ice (i.e. ice that would represent a significant hazard to aircraft).

PLUME TRAVERSE TIME VERSUS ICE BUILDUP

19. For the purpose of developing an extremely conservative analysis, we have assumed: 1) that the pilot inadvertently flies through the plume without carburetor heat, 2) that his air speed is 100 mph, and that he is descending with a partially closed throttle (see following table), 3) that the visible cooling tower plume actually does present an icing hazard significantly different from the ambient air,

and 4) that it would take at least 8 minutes for a significant icing problem to develop.

Flight Speeds and Related Parameters of Typical Single-Engine Light Aircraft

	Flight Speeds (mph)	(ft/sec)	Time to Travel One Mile (sec)	Distance Traveled in Eight Minutes (miles)
Climb	70	102	52	9.3
	80	117	45	10.7
Cruise or	100	147	36	13.3
Descent	130	191	28	17.0

20. If the pilot were to fly across the visible plume at any angle, it is doubtful he would remain in the plume long enough to accumulate any detectable icing. Figure 6 is an illustration showing two possible flight paths through the visible plume, one flying directly perpendicular across the plume, and the other in a flight path coincident with the plume trajectory, providing the maximum possible in-plume exposure. Cooling tower plumes are almost never more than one mile wide, and even flying at an oblique angle at a typical speed, an aircraft traversing the visible plume would only be in the plume on the order of two minutes.

21. In the second example, we have assumed that the pilot would be flying along the plume axis, descending with a nearly closed throttle at a rate which matched the slope of the plume. He would have to stay in the plume for more than 10

miles for serious icing to be encountered. Furthermore, he would be approaching the tower structure itself while in the cloud during the latter part of his approach, an unlikely maneuver in itself.

22. It is also possible that the pilot might follow a similar path in the opposite direction during climb, when he would be moving more slowly. However, under these conditions the aircraft throttle would be open, and the risk of icing would be much smaller.

PROBABILITY OF PLUMES EXTENDING TEN MILES OR MORE

23. The chances are very small that a pilot could encounter a plume having the right temperature and moisture conditions for icing, and of sufficient length so that he could inadvertently fly in the core of the plume for eight minutes or more. We have already discussed the computer modeling study that showed less than 4% of the plumes reaching or exceeding ten miles in length. Furthermore, the American Electric Power program, in which we were seeking long plumes, showed only six plumes out of 340 tests extending to ten miles or more, and of these, three were too cold to have presented an icing problem.

24. The AWPP contention has also stressed the possibility of icing in the invisible plume extending downwind after the liquid droplets evaporate. However, this cannot be accepted as a significant increment to icing problems because the Pennsylvania State program has shown that conditions more than 1/4 mile downwind of a tower are virtually identical to those in the ambient air, whether inside or outside of the visible plume.

PILOT TRAINING

25. The fact that we do not see any significant increase in the potential for carburetor icing as a result of the cooling tower operation does not mean, of course, that carburetor ice will not occur in the Limerick area. However, carburetor ice is a routine phenomenon that all pilots are trained to deal with.

26. Pilots are taught about the risk of carburetor ice in ground school and are trained from their first flights to use carburetor heat, an anti-icing device that preheats the air before it enters the carburetor. This preheating is used to melt any ice or snow entering the intake, to melt any ice that may have formed in the carburetor passages (provided the accumulation is not too great), and to keep the fuel/air mixture above the freezing point to prevent formation of ice. A pilot's first indication of carburetor ice is a drop in engine RPM for aircraft with fixed pitch propellers, and a drop in manifold pressure for aircraft equipped with variable pitch propellers. Aircraft with fuel injection or turbine engines do not experience carburetor ice.

27. The vast majority of small airplanes flying at relatively low altitude (below 10,000 feet) are carburetor-equipped and have carburetor heat controls. Pilots are trained to check these controls during the preflight check, and to apply heat at the first indication of carburetor ice and during operations when the throttle is closed or nearly closed. Carburetor heat is not used in normal flight as it tends to reduce the output of the engine.

28. Pilots who are not instrument rated, equipped, and on an instrument flight plan must avoid flying in or near the visible cooling tower plume because it appears as a cumulus-looking cloud. VFR (Visual Flight Rule) pilots are to avoid clouds by at least 2,000 feet horizontally and they must also remain at least 1,000 feet above and 500 feet below clouds in the Limerick area. While on a few occasions during the year the operation of the Limerick cooling towers may cause slight deviations in approach, departure or flight paths for VFR pilots, this situation is no different than that which would be encountered by such pilots having to avoid natural cloud formations. IFR (Instrument Flight Rule) aircraft could enter the plume, either purposefully or inadvertently, but as previously discussed, their residence time in the plume would be brief. Also, their aircraft must have carburetor heat controls to be instrument-equipped.

MISCONCEPTIONS

29. Several misconceptions about cooling tower plumes and carburetor icing continue to appear in the AWPP contention, requests for and responses to discovery. Three of these are important enough to discuss in detail.

Large Water Vapor Emissions Do Not Cause Moisture Buildup Over a Period of Days

30. It is very easy for someone who has not had direct experience with large, hyperbolic cooling towers to visualize a situation in which the winds are calm, the air almost completely stagnant, and the moisture released from the

towers constantly adds to the atmospheric humidity. This sort of thing can actually happen if moisture is released without buoyancy very close to the ground surface. The fact that the plumes from the large towers are visually impressive under certain conditions makes it even easier to conjure up a scenario of this type.

31. However, there is no question that plumes from the large hyperbolic towers do not cause any such buildup of local moisture. First of all they originate far above the ground, at altitudes where completely calm winds are almost never found. The moisture is therefore transported away from the source; sometimes slowly, but there is transport. Secondly, when stagnant conditions exist close to the ground and the winds are very light, the great buoyancy of the cooling tower plumes carries the moisture far above the top of the tower, usually to several thousand feet above the terrain. Thus, the cooling tower plumes are completely divorced from the low-level conditions, rising high above the local stagnation and drifting off at the speed of the winds aloft (Figure 7).

The Roxborough Incinerator is Not Comparable to the Limerick Generating Station Cooling Towers

32. We have investigated the Roxborough incinerator, mentioned in the AWPP contention as having been observed causing a condensed water vapor cloud along the Schuylkill Expressway. This plant is a small incinerator in which a water spray is used to reduce the effluent temperature to levels commensurate with the design of the electrostatic precipitator. It is in no way comparable to the Limerick cooling towers.

33. Furthermore, we have obtained the meteorological data from the National Weather Service for April 9, 1982, the day on which AWPP alleged that the incinerator produced local fog. These data clearly indicate that snow and fog were observed most of the day at the Philadelphia International Airport, and it is very likely that the fog along the Schuylkill River was entirely natural.

Wind Shear, Turbulence and Generation of Thunderstorms

34. AWPP has raised the question of whether the operation of the Limerick cooling towers could initiate thunderstorms which could be a hazard to aircraft. This phenomenon has never been observed in any field study of cooling tower plumes, and a comprehensive study of this question by Hanna and Gifford (1975) shows that 10 or 15 plants of the size of the Limerick Generating Station would have to be clustered in a small geographical area for such an effect to be possible. AWPP has also implied that the rising plume from the towers could create turbulence and wind shear. Studies reported by Hosler (1974) of Pennsylvania State University demonstrate that, based upon numerous traverses of cooling tower plumes, nothing more than light turbulence and slight updrafts were encountered. This is confirmed by MES experience during the American Electric Power studies.

CONCLUSIONS REGARDING CARBURETOR ICING

35. Experimental measurements, modeling studies, practical considerations and extensive pilot experience prove conclusively that cooling tower plumes, visible or invisible, present no special carburetor icing hazard to aircraft. Conditions in the plume at distances of a quarter mile or

more from the towers are insignificantly different from those in the ambient air as far as temperature and humidity are concerned.

36. This is not to say that some determined aviator, failing to turn on carburetor heat and deliberately flying back and forth in the core of a tower plume, might not encounter carburetor ice. It is to say, however, that anyone performing such a maneuver would encounter virtually the same carburetor icing if he were flying near the plume rather than within it.

September 22, 1983

MARTIN E. LEONARD
Notary Public, State of New York
No. 30-7495035
Qualified in Suffolk County
Commission Expires March 30, 1984

NOTARY

MAYNARD E. SMITH

DAVID E. SEYMOUR

NOTARY

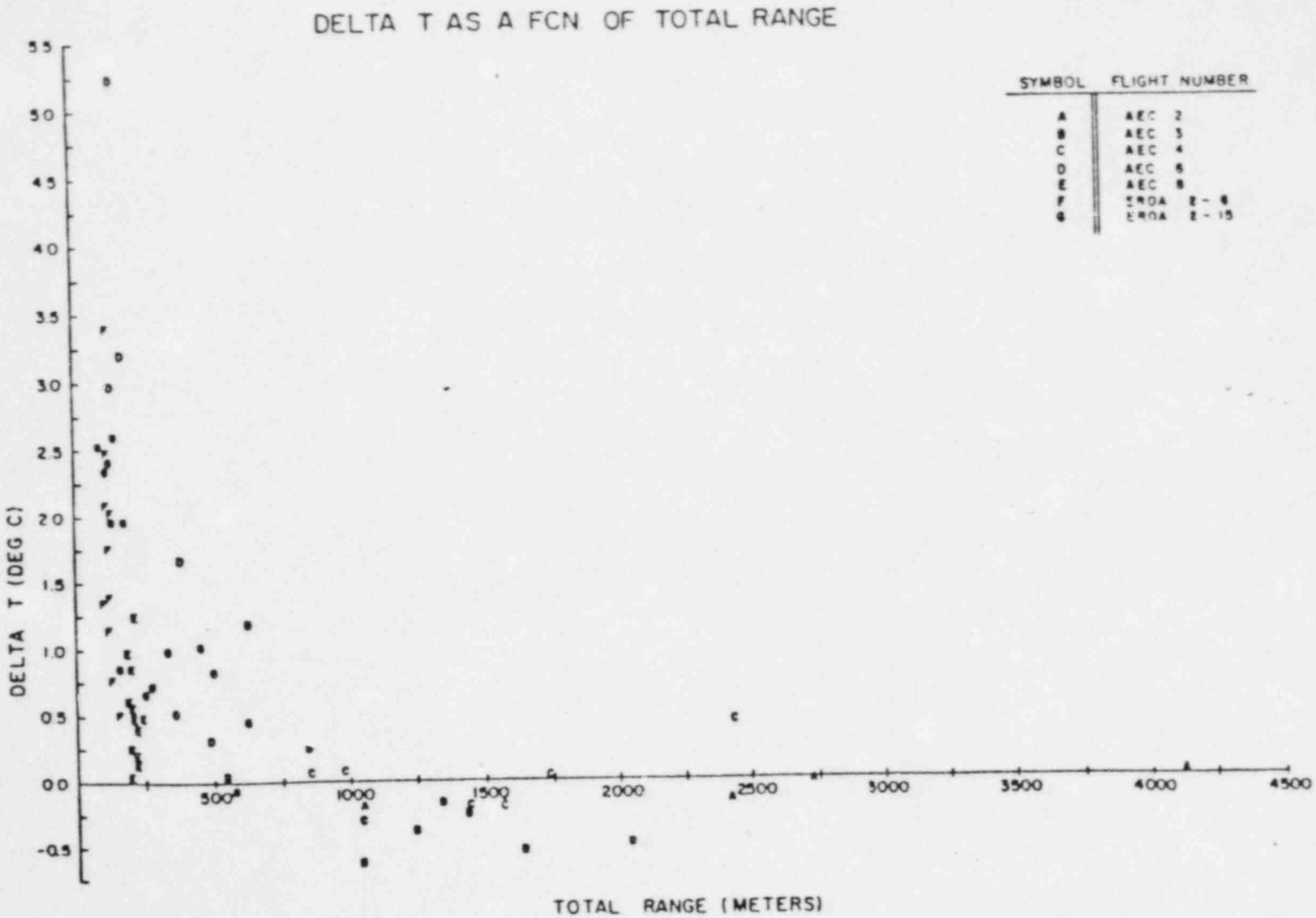
Mr. Seymour has concurred in the affidavit but was unavailable to sign it. A fully executed copy will be substituted when available.

TABLE 1

RESPONSIBILITY FOR AFFIDAVIT PARAGRAPHS

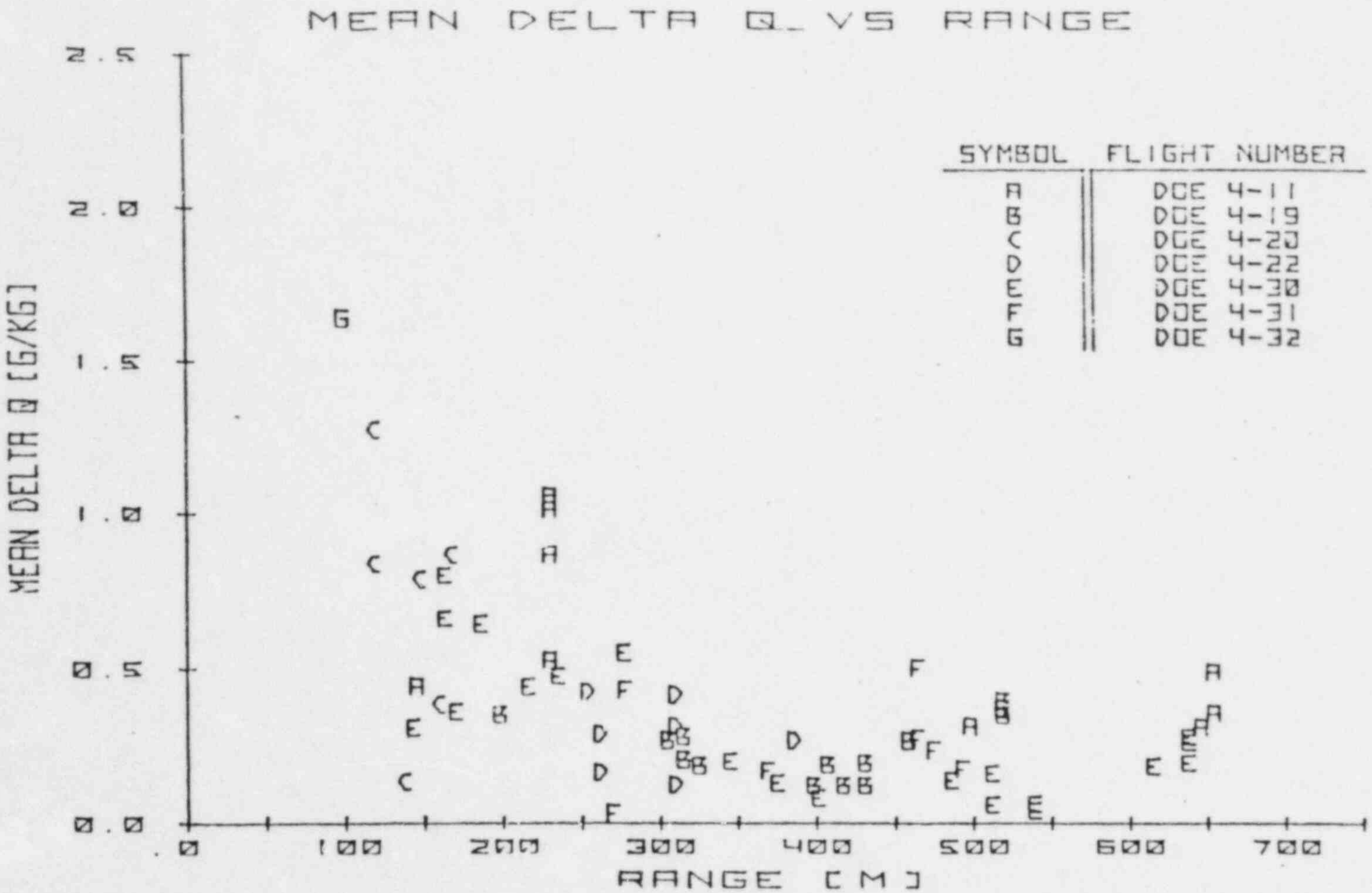
Smith & Seymour	Smith	Seymour
4	1	3
5	2	16
6	7	17
12	8	18
19	9	25
20	10	26
21	11	27
22	13	28
34	14	
35	15	
36	23	
	24	
	29	
	30	
	31	
	32	
	33	

FIGURE 1



(Figure 5.1 of the Penn. State study. DELTA T is the difference between the temperature in the plume and that in the ambient air. Range refers to the overall distance from the tower to the point of measurement.)

FIGURE 2



(Figure 5.29 of Penn. State study. DELTA Q is the difference between the specific humidity in the plume and that of the ambient air. Range refers to the overall distance from the towers to the point of measurement.)

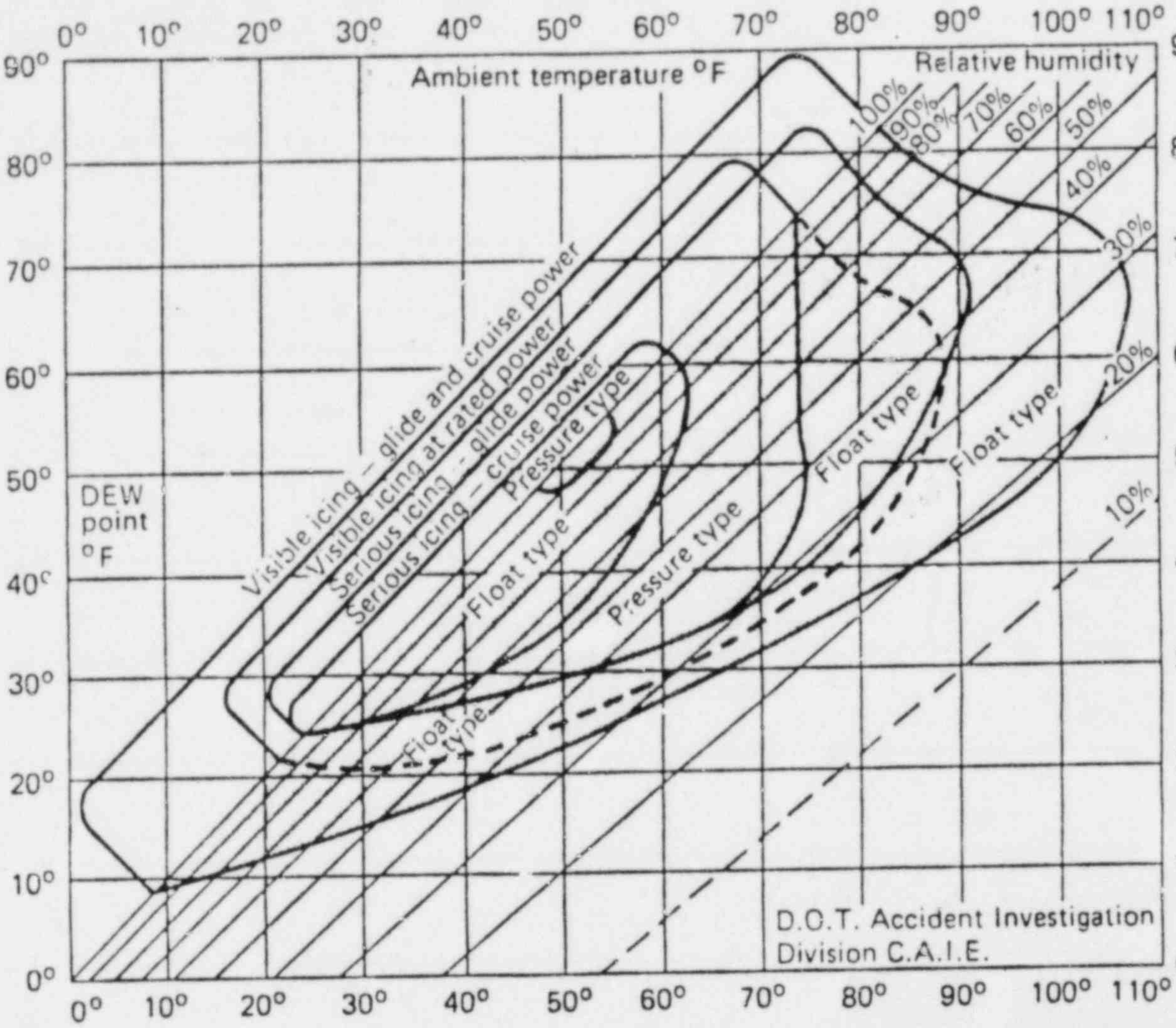
FIGURE 3

COMPARISON OF NATURAL DRAFT COOLING TOWER EMISSIONS FROM THE LIMERICK GENERATING STATION AND THE AEP PLANTS AND SUMMARY OF FLIGHT TESTS

Plant	Average Water Vapor Releases (gpm)	No. of Flight Tests
Amos	19,000	147
Big Sandy	6,300	3
Gavin	20,800	7
Mitchell	8,600	86
Muskingum	3,800	100
Limerick	22,350 (total for both units)	-

*Number of flights made withlight aircraft in the AEP studies, 1974-1978.

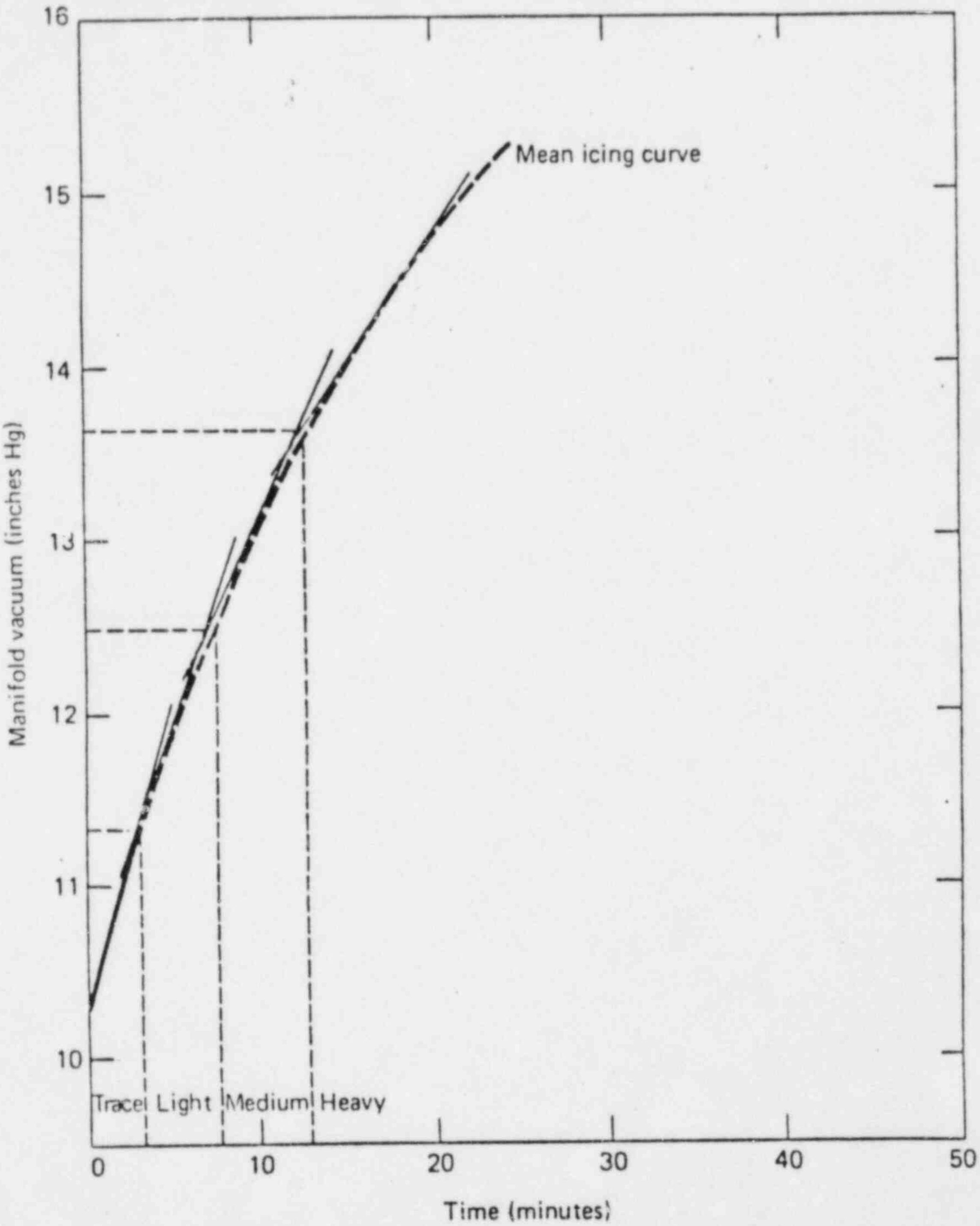
Figure 4



Icing probability curves showing conditions which are known to be favorable in the formation of induction system icing in typical light aircraft installations. Icing conditions within the limits of the "visible icing" curves may become "serious" after 15 minutes continuous operation in such conditions.

Aircraft Carburetor Icing Probability Curves, Canadian Department of Transportation (D.O.T.)

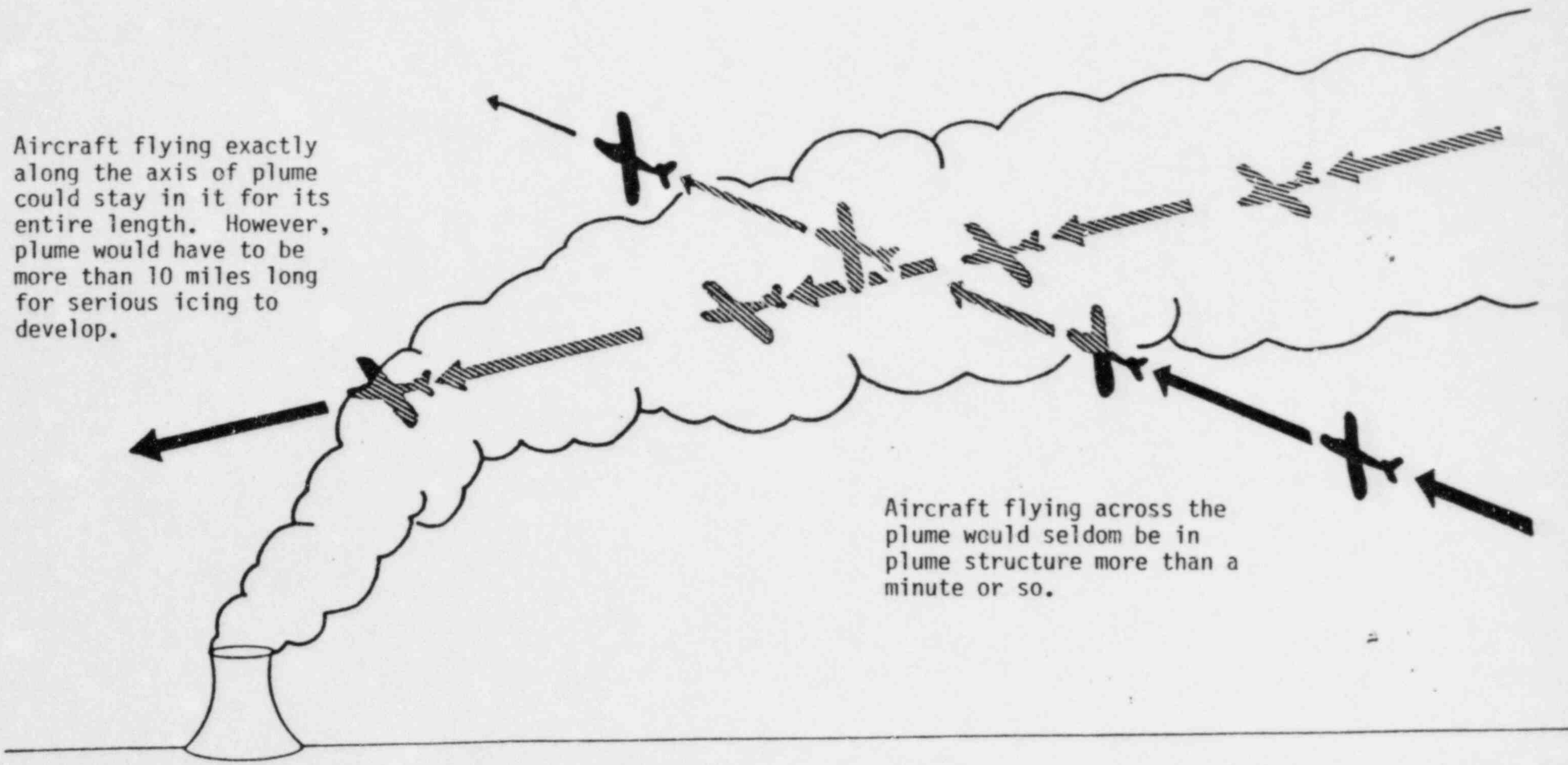
Figure 5



Mean Baseline Carburetor Icing Curve Fitted with Straight Line Segments Representing the Various Icing Phases

FIGURE 6

AIRCRAFT FLYING THROUGH COOLING TOWER PLUME



Field tests have repeatedly shown that temperature and humidity conditions within the plume are almost identical to those outside it.

Also, plumes of 10 or more miles in length, having temperature and humidity conditions conducive to icing occur less than 1% of the time.

FIGURE 7

Plume Rise Above Natural Fog
7:55 a.m.
January 17, 1975

This photograph, taken during the AEP cooling tower flight study (AEP, 1975) shows the typical behavior of plumes from large hyperbolic towers during stagnant, foggy surface weather conditions.

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Thomson, D.W., de Pena R.G., and Pena J.A., Environmental Measurements of Power Plant Cooling Tower and Stack Plumes, Dept. of Meteorology, Penn. State Univ., (1981).

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Hanna S.R. and Gifford F.A.: Meteorological Effects of Energy Dissipation at Large Power Parks, Bulletin, AMS, V56, No. 10, Oct., 1975, pp. 1069-1076.

Hosler C.L.: Cooling Tower Plume and Air Navigation Pepco Douglas Point, Appendix A, Appl. Answers to the U.S. Marine Corps' Interrogatories dated Oct. 30, 1974, Docket Nos. 50-448 and 50-449, Atomic Safety & Licensing Board, 12/20/74.

MAYNARD E. SMITH

Education:

University of Chicago, Additional work on general circulation, single-station analysis, 1942

New York University, MS, Meteorology, 1942

Princeton University, BA, Economics, 1941

Experience:

Meteorological Evaluation Services, Inc., Amityville, New York, 1968 to Present, President, Principal Consultant

Mr. Smith has provided consulting assistance to a number of industrial and governmental organizations since the early 1950's. In 1968, Smith-Singer Meteorologists, Inc. was founded and Mr. Smith became President. The Company's name was changed to Meteorological Evaluation Services, Inc., in 1977.

The Company provides advice and assistance in meteorological and air pollution problems, including atmospheric diffusion studies, design and evaluation of stacks and abatement facilities, processing and analysis of meteorological and air pollution survey data, evaluation of wind loads on structures and the preparation of environmental reports. It also conducts a variety of applied research projects, such as field evaluations of cooling tower plumes and building downwash, and the analysis of large-scale pollution patterns.

Brookhaven National Laboratory, Upton, New York, 1948-1972, Leader, Meteorology Group

The original objectives of the Meteorology staff centered on understanding and forecasting the dispersion conditions affecting the reactor cooling air. Following solution of these problems in 1952, the activities were redirected toward basic research in low-level diffusion and deposition. Prominent aspects of this program have been detailed investigations of diffusion from elevated sources, studies of the low-level wind speed structure, and the development of specialized meteorological and sampling equipment. The study of particulate deposition over grids of samplers in the open terrain and in forests was also important.

Significant by-products of these studies have included instruments, techniques and procedures for applying the results to practical problems in air pollution, not only in the atomic energy field but for industry in general.

MAYNARD E. SMITH

American Airlines New York, 1945-1948, Supervisor of Meteorological Staff, New York Region

Staff provided terminal and route weather forecasts for operations in the Northeastern United States.

United States Air Force, 1941-1945, Major

Research in upper atmospheric analysis and forecasting. Development of new weather service for the 12th Army Group in Europe to provide meteorological data and forecasts for a variety of ground-force activities.

Professional Organizations and Committees:

American Meteorological Society

Air Pollution Control Association

American Meteorological Society/Environmental Protection Agency Steering Committee on Atmospheric Diffusion Modeling, 1981- .

Invited Participant & Panel Chairman, AMS-EPA Workshop on "Quantifying and Communicating Uncertainty in Regulatory Air Quality Modeling," Woods Hole, MA, Sept., 1982.

Invited Participant & Panel Chairman, EPA Workshop on "On-Site Meteorological Instrumentation Requirements to Characterize Diffusion From Point Sources," Raleigh, NC, Jan., 1980.

Invited Participant & Panel Chairman, EPA Workshop in Rough Terrain Modeling, Raleigh, NC, July, 1979.

Invited Participant, EPA Conference on Modeling Guideline, Argonne National Laboratory, February, 1977.

Steering Committee, Large Power Plant Effluent Study, Air Pollution Control Organization, Environmental Protection Agency, 1969-1973.

Chairman, Task Group, Dispersion of Airborne Effluents, American Society of Mechanical Engineers, 1966-1968.

Publications:

Mr. Smith has published approximately 100 articles in various journals, particularly the American Meteorological Society, the Air Pollution Control Association, and Atmospheric Environment. The most important are:

Recommended Guide for the Prediction of Dispersion of Airborne Effluents, Amer. Soc. Mech. Engineers (Chairman of Task Group preparing document), June, 1968.

The Influence of Atmospheric Dispersion on the Exposure of Plant to Airborne Pollutants, Phytopathological Soc. 58, (8), 10-85-88, 1968

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The Variation of Effluent Concentration from an Elevated Point Source, AMA Archives of Indus. Health 14, pp. 56-68, July 1956.

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Snowfall Observations from Natural-Draft Cooling Tower Plumes, Science, V. 193, 1239-1241, 1976.

Improvement of Ambient SO_2 Concentrations by Conversion from Low to High Stacks, Jour. APCA, V. 25, No. 6, 1975.

Transport and Diffusion Modeling, 1980. Position paper prepared at the request of the American Meteorological Society.

Atmospheric Modeling for Emergencies, Plant Operations Progress, American Institute of Chemical Engineers, Vol. 2, No. 1, 1983.

DAVID E. SEYMOUR

Education:

Rutgers University, 1972-1976, MS, Meteorology

Purdue University, 1964-1969, BS, AAS, Professional Pilot Technology

Experience.

Meteorological Evaluation Services, Inc., Amityville, N.Y., (formerly Smith-Singer Meteorologists, Inc.) 1973-Present, Consultant Meteorologist - Pilot.

Mr. Seymour has provided consulting assistance to MES Inc. on a number of airborne field evaluations. These have included atmospheric diffusion studies, evaluation of stacks, cooling tower plume behavior, and sea-breeze research.

He has conducted extensive airborne cooling tower plume research, and was responsible for the training and checking of the twelve other commercial pilots involved in the MES/AEP cooling tower research program. He has also been responsible for all airborne photography, wind aloft calculations, and aircraft procurement and maintenance for the numerous aircraft involved in MES studies and proposals since 1973.

United Airlines, Denver, Colorado, 1969-Present, Flight Officer Pilot on Caravelle and Boeing 727, 737 Aircraft. Presently Flight Officer on Boeing 727.

Glider Pilot's Ground School, Rochester, New York, 1975-Present, Director.

The ground school provides the necessary education for pilots as required by Federal Air Regulations. Mr. Seymour formed the company in 1975 and now serves as a Director.

Purdue University, West Lafayette, Indiana 1968-1969

Flight Operations Instructor for DC-6, Dept. of Aviation Technology

Flight Officer on DC-3, DC-6 Aircraft

Chief Flight Instructor - Purdue Glider Club

DAVID E. SEYMOUR

Pilot Qualifications:

Commercial Pilot: Airplane Single & Multi-engine land, Glider, Instrument, Douglas DC-3

Flight Engineer: Turbojet Powered

Flight Instructor: Glider, Advanced & Instrument Ground Instructor

Federation Aeronautique Internationale Gold Soaring Badge (USA #300) with two diamonds, 8 state soaring records

Total Flight Time: 5000+ hours (1983)

Professional Organizations:

Airline Pilots Association
Soaring Society of America
American Meteorological Society

Publications:

John E. Amos Cooling Tower Flight Program Data, December 1974 - March 1975, Available from American Electric Power Service Corporation (1975).

John E. Amos Cooling Tower Flight Program Data, December 1975 - March 1976, Available from American Electric Power Service Corporation (1976).

Cooling Towers and the Environment, Jour. APCA, Vol. 26, pp. 582-584 (1976).

The Observed Rise of Visible Plumes From Hyperbolic Natural-Draft Cooling Towers, Atmospheric Environment, Vol. 10, pp. 425-431 (1976).

Snowfall Observations From Natural Draft Cooling Tower Plumes, Science, Vol. 193, pp. 1239-1241.

Glider Pilots Ground School (1977).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
Philadelphia Electric Company	)	Docket Nos. 50-352
	)	50-353
(Limerick Generating Station,	)	
Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of:

1. Applicant's Motion For Summary Disposition Of Contention V-4 dated September 27, 1983;
2. Applicant's Statement Of Material Facts As To Which There Is No Genuine Issue To Be Heard dated September 27, 1983;
3. Applicant's Memorandum In Support Of Its Motion For Summary Disposition Of Contention V-4 dated September 27, 1983;
4. Affidavit Of Maynard E. Smith And David Seymour In Support Of A Motion For Summary Disposition Regarding Contention V-4 dated September 27, 1983;
5. Applicant's Answers To Intervenor AWPP's (Romano) First Set Of Interrogatories On Carburetor Icing Contention dated September 26, 1983 (regarding interrogatories p, q and u);
6. Letter to all parties from Mark J. Wetterhahn, Counsel for Philadelphia Electric Company, regarding site tour dated September 27, 1983;
7. Letter dated September 27, 1983 to Frank R. Romano from Mark J. Wetterhahn, Counsel for Philadelphia Electric Company,

in the captioned matter have been served upon the following by deposit in the United States mail this 27th day of September, 1983:

Judge Lawrence Brenner (2)
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docketing and Service Section
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Judge Richard F. Cole
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Judge Peter A. Morris
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Atomic Safety and Licensing Appeal Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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Friends of the Earth of the Delaware Valley
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Moylan, Pennsylvania 19065

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Jacqueline I. Ruttenberg
Keysteon Alliance
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Philadelphia, PA 19104

Ann P. Hodgdon, Esq. Elaine I. Chan, Esq. Counsel for NRC Staff Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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