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STAFF EX 11
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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U.S. Nuclear Regulatory Commission
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U.S. Nuclear Regulatory Commission
Washington, DC 20555

In the Matter of
ARIZONA PUBLIC SERVICE COMPANY, ET AL.
(Palo Verde Nuclear Generating Station, Units 2 and 3)
Docket Nos. STN 50-529 and STN 50-530

Dear Administrative Judges:

Enclosed is the testimony of Dr. Robert B. Samworth which the Board requested be filed by May 30, 1985.

Sincerely,

Lee Scott Dewey

Lee Scott Dewey
Counsel for NRC Staff

Enclosure: As stated

cc: Arthur C. Gehr, Esq.
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NUCLEAR REGULATORY COMMISSION

Docket No. _____ Official Exh. No. _____
In the matter of _____
Staff _____ IDENTIFIED _____
Applicant _____ RECEIVED _____
Intervenor _____ REJECTED _____
Cont'g Off'r _____
Contractor _____ DATE _____
Other _____ Witness _____

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ARIZONA PUBLIC SERVICE COMPANY, ET AL.	)	Docket Nos. STN 50-529 STN 50-530
	)	
(Palo Verde Nuclear Generating Station, Units 2 and 3)	)	

NRC STAFF TESTIMONY OF ROBERT B. SAMWORTH
ON THE RATE OF EMISSION OF DRIFT
FROM THE PALO VERDE COOLING TOWERS

Q1. Please state your name and position.

A1. My name is Robert B. Samworth. I am the Leader of the Environmental Engineering Section within the Division of Engineering, Office of Nuclear Reactor Regulation, USNRC.

Q2. Do you have a Professional Qualifications Statement?

A2. A copy is attached to this testimony.

Q3. What is the purpose of your testimony?

A3. To consider what the proper cooling tower drift rate should be for the PVNGS cooling towers. Specifically, I shall compare the drift rate utilized in Staff's environmental impact assessment, namely

0.0044% of the circulating water flow rate, with the results of the Environmental Systems Corporation (ESC) study which have been cited by the Applicant's witnesses in their testimony. The ESC Study measured a drift rate of 0.0002% of the circulating water flow rate under one of its sampling methods.

Q4. Why did the staff use a drift rate of 0.0044% of circulating water flow to perform the environmental assessment?

A4. This was the rate, which according to Staff's environmental report (ER-OL 3.4-3), was the design value for the system and it is the rate which is specified by the tower manufacturer, the Marley Company.

Q5. Were you concerned whether the Marley rate of 0.0044% could be met?

A5. No. The value was within the range used for other projects and within the range of measured values for operating cooling towers. I believe this is a reasonable value even though this rate was questioned by the Intervenor's consultant, Dr. Michael W. Golay, in his comments that were supplied in January 1984.

Q6. Have you read the testimony of Applicant's witness, Dr. Morton I. Goldman, which was recently filed in this proceeding regarding the cooling tower drift rate?

A6. Yes.

Q7. Are you aware of the drift rate which he has recommended?

A7. Yes. Dr. Goldman cites the study performed by ESC as determining that the drift rate of the Palo Verde cooling towers will be 0.0002%.

Q8. Have you reviewed the ESC study?

A8. Yes, I reviewed it briefly when it first came in to NRC in September 1983.

Q9. What is your opinion of the study?

A9. It is a good study. ESC used two different techniques (sensitive paper and isokinetic sampling) to measure drift rate on three cells of one cooling tower at Palo Verde. In my opinion, the results provide reasonable satisfaction that the manufacturer's design drift rate will be met. The study also demonstrates the difficulties of measuring drift as evidenced by the fact that the results of the two sampling methods utilized in this study varied significantly.

Q10. Do you think the results of the ESC Study relied upon by Dr. Goldman (i.e. the 0.0002% drift rate) should be used for estimating the impact of drift from the PVNGS cooling towers?

A10. Although the ESC Study gives confidence as to the conservativeness of the manufacturer's design rate, there are some shortcomings to the study itself which indicate to me it is better to rely upon the manufacturer's rate. The Study was conducted under a limited set of conditions. For example, Table 1, which is attached to my testimony, summarizes selected data from the ESC study. The actual collection of the data was done in a four-day period. Although one cell was measured twice, the study design did not allow computation of a confidence interval for the drift rate. The station was not producing electricity and, as a result, the water temperature was at about 15°C (59°F) during the studies. During actual operation the water temperature will range as high as 48°C (118.8°F). Similarly air temperature during the study period was in the range of 21°C to 24°C (70° to 75°F) whereas ambient temperature at the site ranges seasonally from 7°C (19°F) to 47°C (116°F). (See ER-OL § 2.3). Another limitation of the study was that the quality of the circulating water during the study was not typical of what will exist during station operation.

Moreover, the study was not free of defect. The wind speed during the four days of data collection ranged from a low of about 6 miles per hour during the study of cell I to a high of about 38 miles per hour during the sampling of cell N. Although there are possibly other varying factors, it appears that wind speed may have affected the amount of drift recorded since lower drift rates were detected during the periods of higher wind flow.

A further problem appears to be that the two sampling methods utilized in the study (the isokinetic and the sensitive paper technique) are generally believed to be capable of measuring drift rate results that are within ± 15% of the true value. However, the values yielded by the two techniques in the study at Palo Verde differed by a factor of about 6 (i.e. the isokinetic sampling technique gave an average estimate of drift rate which is six times the estimate by the sensitive paper technique.) I also note that in his testimony Dr. Goldman did not use the conservative isokinetic value but rather has based his analysis on potential agricultural crop damage on the sensitive paper technique which gave a lower value.

Q11. Is the drift rate indicated by the sensitive paper technique a reasonable rate?

A11. The Applicant's witness, Mr. Karl R. Wilber, has reported in his testimony (at p. 9 and Exhibit W-8) drift rate measurements at other cooling towers. None of the values for these other towers was as low as the value for Palo Verde. Moreover, as he notes, the 0.0002% value has only been measured in laboratory environments where essentially ideal conditions existed.

In contrast to the values in the ESC Study and for the cooling towers cited by Mr. Wilber, Table 2, which is attached to my testimony, shows drift rate values which have been used for assessing impact at nuclear power stations. Although these are design values and not measured values (as is the case of the ESC Study and the cooling towers cited by Mr. Wilber), the values reported at these stations are considerably higher than the value for Palo Verde in the ESC report using the sensitive paper method.

Q12. Based upon the information presently available, what are your conclusions regarding the drift value which should be used for predicting deposition rates at Palo Verde?

A12. I would recommend that the initial assessment of impact for the Palo Verde cooling towers be based on the more conservative manufacturer's drift rate of 0.0044%. The ESC Study is useful in demonstrating that the manufacturer's design rate will be met and that any estimate of dritt based on this value will not underestimate impact.

Personal Qualifications Statement

Robert B. Samworth, Ph.D.
May 29, 1985

Robert B. Samworth is employed by the U.S. Nuclear Regulatory Commission as the Leader of the Environmental Engineering Section, Environmental and Hydrological Engineering Branch, Division of Engineering, Office of Nuclear Regulation. He has held that position since 1976.

As the Section Leader, major portions of environmental impact statements are prepared under his supervision. Included are essentially all sections on non-radiological impacts to aquatic and terrestrial resources. Specifically among impacts for which his section is responsible is the assessment of the effects of cooling tower drift.

Dr. Samworth is the senior staff expert on environmental engineering questions and is highly qualified for this responsibility through education and training. He holds a B.S. degree in Civil Engineering from the University of Delaware, an M.S. degree in Sanitary Engineering from the Johns Hopkins University, and the Ph.D. degree in Civil Engineering from Cornell University.

Dr. Samworth joined the regulatory staff in October, 1972, as an environmental engineer during the period of the NRC's initial NEPA reviews of nuclear power plant license applications. He performed reviews related to impacts of power plant operation on water quality and water use and provided Environmental Impact Statement input for several projects prior to assuming the responsibilities of Section Leader. He participated in the development of review procedures as set forth in the Environmental Standard Review Plans, revisions to Regulatory Guide 4.2, and revisions to NRC's regulations for environmental reviews found in 10 CFR Part 51.

Prior to joining NRC he was the Chief of the Grants, Research, and Statistics Branch with the Department of Environmental Services of the Government of the District of Columbia. There he was responsible for evaluating new technology for achieving department objectives in water supply, wasterwater collection and treatment, and solid waste collection and disposal. He served as liason between laboratory scientists and design engineers in the design of the treatment processes employed at the District's new wastewater treatment plant.

Before that he was employed as a Public Health Engineer with the Tennessee Valley Authority where he conducted research concerning environmental problems associated with power generation at steam- and hydro-electric generation facilities.

TABLE 1. Summary of Palo Verde Cooling Tower Test Results From the ESC Study.

Sample Date	Time Interval	Tower Cell	Air Temperature		Wind		Mass Drift Rate	
			Dry Bulb deg C.	Wet Bulb deg C.	Speed mph	Direction degrees	SP g/s	IK g/s
May 7	14:05-16:05	I-1	22.4	14.1	9	230-360		
	19:10-21:10	I-2	22.7	13.7	3	270-290	1.51	8.4
May 8	14:55-16:40	K-1	30.8	17.9	16	210-200		
	17:35-19:20	K-1-R	29.0	14.0	17	210-205		
May 9	09:45-11:30	K-2	24.4	13.7	16	200-180	1.82	11.9
	12:05-13:50	K-2-R	29.9	14.1	24	210-220	2.28	10.6
	16:32-18:15	P-1	32.0	14.7	29	230-240		
May 10	08:50-10:37	P-2	23.2	17.2	40	200	1.10	9.83
	14:00-15:32	N-1	30.1	15.0	35	210		
	17:35-19:12	N-2	28.9	13.9	40	210	0.428	4.91

TABLE 2. Power Plant Cooling System Data

Station	Unit	Capacity Mwe	Cooling System Type	Drift Rate %	Water Source	NRC Rgn.	Date of Commercial Operation
Arkansas	2	858	NatD	0.01	Arkansas R.	4	1980
Beaver Valley	1	810	NatD	0.05	Ohio River	1	1976
Beaver Valley	2	852	NatD	0.013	Ohio River	1	E1987
Byron	1	1120	NatD	0.002	Rock R.	3	E1985
Byron	2	1120	NatD	0.002	Rock R.	3	E1986
Catawba	2	1145	CircMech	0.008	Catawba R.	2	E1986
Catawba	1	1145	CircMech	0.008	Catawba R.	2	E1985
Farley	2	814	MechD	0.1	Chatahoochee R.	2	1981
Farley	1	804	MechD	0.1	Chatahoochee R.	2	1977
Fermi	2	1093	NatD	<0.1	Lake Erie	3	1986
Grand Gulf	1	1250	NatD	0.008	Mississippi	2	1987
Grand Gulf	2	1250	NatD	0.008	Mississippi	2	E1992
Harris(Shearon)		915	NatD	0.002	Cape Fear R.	2	E1986
Hatch	2	771	NatD	<0.1	Altamaha R.	2	1979
Hatch	1	757	NatD	<0.1	Altamaha R.	2	1975
Hope Creek		1067	NatD	0.00375	Delaware R.	1	E1986
Limerick	1	1065	NatD	0.03	Schuylkill R.	1	E1986
Limerick	2	1065	NatD	0.03	Schuylkill R.	1	????
Palisades		635	MechD	0.005	Lake Michigan	3	1971
Palo Verde	3	1304	CircMech	0.0044	Phoenix Sewage	5	E1987
Palo Verde	1	1304	CircMech	0.0044	Phoenix Sewage	5	E1985
Palo Verde	2	1304	CircMech	0.0044	Phoenix Sewage	5	E1986
Peach Bottom	2	1051	MechD	<0.2	Susquehanna R.	1	1974
Peach Bottom	3	1035	MechD	<0.2	Susquehanna R.	1	1974
Perry	2	1205	NatD	<0.01	Lake Erie	3	E1992
Perry	1	1205	NatD	<0.01	Lake Erie	3	E1986
Prairie Island	1	503	MechD	<0.2	Mississippi R.	3	1973
Prairie Island	2	500	MechD	<0.2	Mississippi R.	3	1974
Rancho Seco		873	NatD	<0.01	Folsom South Canal	5	1975
River Bend		934	CircMech	0.01	Mississippi	4	E1986
Sequoyah	2	1148	NatD	0.01	Tennessee R.	2	1982
Sequoyah	1	1128	NatD	0.01	Tennessee R.	2	1981
Susquehanna	1	1052	NatD	0.002	Susquehanna R.	1	E1987
Vogtle	1	1100	NatD	0.008	Savannah R.	2	E1987
Vogtle	2	1100	NatD	0.008	Savannah R.	2	E1992