UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PENNSYLVANIA POWER & LIGHT COMPANY	)	Docket Nos. 50-387 O.L.
AND	)	50-388 O.L.
ALLEGHENY ELECTRIC COOPERATIVE, INC.	)	
(Susquehanna Steam Electric	)	
Statio nits 1 and 2)	)	

AFFIDAVIT OF JOHN C. LEHR

I, John Lehr, being duly sworn, depose and state:

1. I am Senior Environmental Engineer in the Environmental Engineering Branch, Office of Nuclear Reactor Regulation; U.S. Nuclear Regulatory Commission, and give this Supplemental Affidavit in response to "Applicants' Motion for Summary Disposition of Modified Contention 2 (Chlorine)", filed September 9, 1981, and the documents attached thereto, including the affidavit of James Rios. A copy of my professional qualifications is attached.

2. I have read the Applicants' Motion, the Statement of Material Facts, and the Affidavit of James Rios, as described above and I support the conclusions reached in those documents.

3. My Affidavit addresses the formation and discharge of chloro-organic compounds, principally trihalomethanes, and the potential effects on public health resulting from the use of chlorine in the treatment of natural waters in the Susquehanna Steam Electric Station. The principal use of chlorine is to control the biofouling of heat exchange surfaces in the circulating water system. Other uses of chlorine at power plants, including the Susquehanna Steam Electric Station, are comparatively minor and are not addressed. My Affidavit also addresses the information presented in the Applicants' Motion and attached documents as described above, filed September 9, 1981, as it compares to information resulting from similar tests and measurements conducted under an NRC sponsored study.

4. The information presented by the Applicants in their Affidavit of September 9, 1981, that describes the use of chlorine at the Susquehanna Steam Electric Station is consistent with that presented previously to the staff by the Applicants.

The Susquehanna Steam Electric Station will use gaseous chlorine in the main circulating water system to control biofouling of the system's heat exchange surfaces. There are several design and operating features at the station that will affect the use of chlorine at this facility. A mechanical system that circulates sponge rubber balls through the condensers while they are in operation will frequently remove much of the biological growth from the condenser tube walls. Periodic chlorination will be used to supplement the mechanical cleaning system for the condenser and to control biofouling on other system surfaces, such as in the cooling

tower, where use of a mechanical system is not possible. Application of chlorine to the circulating water system will be from a point upstream, but close to the first points of use (i.e., the condensers) and automatic analyzers will be used to stop the application of chlorine when the minimum effective concentration for biofouling control is achieved in the system. Finally, the amount of active chlorine in the blowdown from the circulating water system will be reduced to below detectable levels by a dechlorination system automatically activated during chlorination of the circulating water system. These features will tend to minimize (1) the amount of chlorine introduced into the circulating water system and (2) the amount of active chlorine discharged to the Susquehanna River.

5. For the active chlorine that is discharged in the cooling tower blowdown, the National Pollutant Discharge Elimination System permit[1] issued for the Susquehanna Steam Electric Station specifically limits the amount of discharge of free available chlorine in the station cooling tower blowdown to a daily maximum of 2.27 kg (5 lbs), with a daily average limit of 0.91 kg (2 lbs). When free available chlorine is present in the station cooling tower blowdown, the concentration is limited by the permit to a daily maximum of 0.5 mg/l, with a daily average concentration limit of 0.2 mg/l. Finally, the permit prohibits discharge of chlorine from any unit for more than two hours in any one day and prohibits discharge of chlorine from more than one unit at the site at the same time.

6. The Applicants have conducted a pilot plant study to describe the formation of trihalomethanes and other chloro-organic compounds when concentrated Susquehanna River water is chlorinated. The results of this study are

within the range of values found during an on-going NRC study[2] on the products of low level chlorination. This study of natural waters from 10 locations in the United States (8 fresh water and 2 salt water) sampled the waters raw and after treatment with chlorine for chlorination products. In the raw water samples for the fresh water locations, chloroform was the only measurable trihalomethane with concentrations ranging from below detectable limits to 0.6 μg/l. The Applicants' measurement of chloroform in raw Susquehanna River water was 0.13 μg/l, which is within the range of values found in the NRC sponsored study. Applicants' study also detected another trihalomethane, Bromodichloromethane, in this raw water. The NRC sponsored study did not detect this compound in its samples.

Upon chlorination of these raw waters to 2-5 mg/l total residual chlorine, a one-hour contact period and subsequent dechlorination to remove all detectable residual chlorine, the range of values of trihalomethanes from the NRC study is as shown in Table 1. The range of the results is higher than the Applicants' range. However, the samples in the NRC study were not aerated during their chlorine exposure period as the samples in the Applicants' study were. A study by Jolley, et al[3] showed a volatilization loss for chloroform and other trihalomethanes to the atmosphere in samples collected from cooling tower basins in chlorinated closed cycle cooling systems. For chloroform, this loss was about 84%. If this loss is applied to the NRC study values (see Table 1), the results provide closer agreement with those observed in the Susquehanna pilot plant study.

Additional preliminary information[4,5] has recently become available from the NRC sponsored study in the form of measures of trihalomethane concentrations in intake and discharge samples collected from operating nuclear power plants. The plants sampled both have closed cycle cooling systems, one with a natural draft cooling tower (as does the Susquehanna Steam Electric Station) and one with mechanical draft cooling towers. The cooling water systems of both plants were chlorinated to 3-5 mg/l total residual chlorine. Dechlorination was not practiced at either plant, although blowdown was held up in the mechanical draft cooling tower equipped plant until the residual chlorine concentration fell below 0.05 mg/l. This resulted in an extensive period of aeration (i.e., 8-12 hrs typical) at this plant, while the natural-draft cooling tower plant had a residence time for chlorinated waters of 30 minutes. The results are shown in Table 2. The discharge samples show chloroform and total trihalomethane concentrations on the order of, but less than, those found in the Applicants' study.

Based on the results of the NRC sponsored study and the study at Oak Ridge National Laboratory, I conclude that the Applicants' estimates of concentrations of trihalomethanes likely to be produced at the Susquehanna Steam Electric Station are reasonable.

7. There are no limitations on chlorinated organics in the applicable effluent guidelines or new source performance standards for the steam electric

generating point source category. In a summary of studies, EPA reports[6] that trihalomethanes were found in greater amounts in a power plant effluent than in the influent in at least one reported study of recirculating cooling systems. Specific limitations on these pollutants were excluded from EPA rules on the bases that:

> Sufficient protection is already provided by the Agency's guidelines and standards under the Act; and the pollutant is present in amounts too small to be effectively reduced [by the steam electric power generating industry] by technologies known to the Agency.

8. Trihalomethanes have been found in treated finished U.S. water supplies[7]. Chloroform was always found to be the major trihalomethane present. The average value of chloroform found in a survey of public water supplies in 80 U.S. cities was 21 μg/l, with 10% of the samples exceeding 100 μg/l. The U.S. Environmental Protection Agency has established in the interim primary drinking water regulations established under the Safe Drinking Water Act that total trihalomethanes in community drinking water systems serving 75,000 or more persons not exceed 100 μg/l. The Applicants' esimated concentrations of chloroform and of total trihalomethanes likely to be discharged from the Susquehanna Steam Electric Station before mixing with the river waters are 2.02 μg/l and 2.34 μg/l, respectively. These concentrations are an order of magnitude below the average value found in city drinking water systems and about 2% of the allowable limit in drinking water supply systems covered by the EPA regulation, respectively.

9. The water quality criteria for chloroform and for total trihalomethanes approved by EPA for surface waters, such as the Susquehanna River, is 1.9 μg/l.* The calculated concentration of total trihalomethanes discharged from the Susquehanna Steam Electric Station after mixing in the 7-day 10-year low flow of the river is 0.45 μg/l, less than one quarter of the criterion. The calculated concentration of discharged chloroform after mixing in the same low flow is 0.19 μg/l, an order of magnitude below the criterion.

10. Based on the staff's and Applicants' estimates of trihalomethane concentrations, relative to applicable EPA limitations to protect public health, likely to exist in the Susquehanna River as a result of operation of the Susquehanna Steam Electric Station, I conclude that the use of chlorine for biofouling control at the site will not result in significant impact to public health.

---

* Water quality criteria established by EPA under Section 304(a)(1) of the Clean Water Act of 1977 must state the maximum concentrations consistent with the protection of human health and aquatic life, without consideration of cost or feasibility associated with meeting the criteria. Trihalomethane concentrations in community drinking water systems are also controlled under the Safe Drinking Water Act. This Act requires EPA to establish national interim primary drinking water regulations which protect public health to the extent feasible, using technology, treatment techniques, and other means determined to be generally available. The term "feasible" is defined by the Act to take cost into consideration. This difference in the bases for the two controls on trihalomethanes in water accounts for the different identified criteria concentrations.

I hereby certify that the above statements are true and correct to the best of my knowledge and belief.

John C. Lehr

Subscribed and sworn to before me
this 1st day of October, 1981

Notary Public
MY COMMISSION EXPIRES JULY 1, 1982

References

1. Commonwealth of Pennsylvania Department of Environmental Resources Bureau of Water Quality Management; Water Quality Management Permit-Part 1; Authorization to Discharge Under the National Pollutant Discharge Elimination System Permit No. PA-0047325; July 31, 1979.

2. NUREG/CR-1301 "Analysis of Organohalogen Products from Chlorination of Natural Waters Under Simulated Biofouling Control Conditions"; R. M. Bean, D.C. Mann, R. G. Riley, U.S. Nuclear Regulatory Commission, June 1980.

3. "An Experimental Assessment of Halogenated Organics in Water From Cooling Towers and Once-Through Systems" in Water Chlorination Environmental Impact and Health Effects; R. L. Jolley, W. W. Pitt, F. G. Taylor, Jr., S. J. Hartmann, G. Jones, Jr., and J. E. Thompson; 1978.

4. "Quarterly Progress Report Covering Period January 1 through March 31, 1981, Biocide By-Products in Aquatic Environments"; R. M. Bean, D. C. Mann, D. A. Neitzel; April 1981.

5. "Quarterly Progress Report Biocide By-Products in Aquatic Environments - April 1 - June 30, 1980"; R.M. Bean, D.C. Mann, D.A. Neitzel.

6. EPA Proposed Pretreatment, New Source Rules for the Steam Electric Power Generating Category; 45 FR 68328, October 14, 1980; U.S. Environmental Protection Agency.

7. "Preliminary Assessment of Suspected Carcinogens in Drinking Water", Report to Congress, Washington, DC, 1975; U.S. Environmental Protection Agency.

TABLE 1

Trihalomethane Concentrations in U.S. Freshwater Samples[1]

	Unchlorinated Samples	Chlorinated Samples	
		Actual	84% Reduction[2]
Chloroform	n.d. - 0.6	2.0 - 24.7	0.3 - 4.0
Bromodichloromethane	n.d.	tr - 10.3	0 - 1.7
Dibromochloromethane	n.d.	tr - 5.8	0 - 0.9
Bromoform	n.d.	n.d. - tr	n.d.

1 - Values in μg/l. From reference 1.

2. Based on observed reduction in reference 2.

m.d. - not detected

tr - trace

TABLE 2

Trihalomethane Concentrations at Operating Nuclear Power Plants (Preliminary Information)[1]

	Intake		Discharge	
	Plant A[2]	Plant B[3]	Plant A	Plant B
Chloroform	n.d.	0.2	0.38 - 0.68	0.7
Bromodichloromethane	n.d.	n.d.	n.d.	0.7
Dibromochloromethane	n.d.	n.d.	n.d.	0.7 - 0.8
Bromoform	n.d.	n.d.	n.d.	0.2 - 0.3

1 - Values in μg/l. From references 3 & 4.

2 - Plant with mechanical draft cooling towers.

3 - Plant with natural draft cooling tower.

n.d. - not detected

PROFESSIONAL QUALIFICATIONS

JOHN C. LEHR

U.S. Nuclear Regulatory Commission

I am currently employed as Senior Environmental Engineer in the Office of Nuclear Reactor Regulation, Division of Site Safety and Environmental Analysis, in the Environmental Specialists Branch. I have the responsibility for the independent review and analysis of the proposed site, alternative sites, site selection methodology, station construction, and design and operation of those features of nuclear power plants as they may affect natural water resources, existing water quality and use, water quality and usage goals as established by the responsible agency and other impacts on the aquatic environment. In this capacity, I have prepared the abiotic aquatic impact sections for NRC environmental impact statements (EIS) on numerous construction permit and operating license applications. For operating license applications, I have provided the technical specifications in the area of water quality and chemical discharge limitations and monitoring requirements. I have provided the technical expertise in the NRC overview function of contractor prepared EIS's in the area of abiotic aquatic impact assessments, including the need for mitigative actions and establishment of coordination with state and regional EPA offices. In the above capacities, I have been responsible for the water quality related aspects of NRC licensing actions for over 70 applications. I have also been responsible for the water quality related sections of several NRC NEPA alternate site investigations of proposed nuclear power plants, including the Seabrook Units 1 and 2 plant.

I have acted as a consultant to other NRC branches and provide analyses of water quality problems through technical assistance requests, particularly to the Division of Operating Reactors on matters pertaining to assessment of chemical effluent impacts and changes in abiotic effluent limitations and water chemistry monitoring programs for operating plants.

I have served as the coordinator and principal investigator in an in-house study to determine actual releases of residual chlorine from operating nuclear power plants. In addition, I am the Division technical representative on several inter-office NRC Research Review Groups. As such, I am responsible for defining and coordinating research needs in the area of abiotic aquatic environmental concerns and for providing the technical guidance for on-going research programs in this area. Examples of research activities governed by these review groups are asbestos in cooling tower waters, residual chlorine and chlorination by-products in power plant discharges in fresh and marine waters and investigation of the occurrence of pathogenic organisms in power plant cooling waters.

I have been designated as the in-house technical originator responsible for development of Environmental Standard Review Plans addressing staff NEPA reviews of site water quality, plant water uses, plant chemical and sanitary wastes, water quality related impacts of plant operation, abiotic aquatic monitoring and chemical treatment system alternatives. In a related activity, I have participated as a member of the Standard Environmental Technical Specifications Task Group responsible for the abiotic aquatic monitoring sections of the McGuire Units 1 and 2 and the Three Mile Island Unit 2 ETS.

I have participated in technical conferences with and coordinated water quality related activities with the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, and other Federal, State and local agencies regarding implementation of the National Environmental Policy Act, the Federal Water Pollution Control Act and its amendments, the Toxic Substances Act, the Drinking Water Act and the memoranda of understanding between the NRC and EPA and COE.

I have also developed expertise and been designated as the responsible technical specialist in the areas of sound level prediction techniques for power plants and their transmission lines and techniques for estimation of community response to environmental sound levels, as influenced by power plant construction and operation. I have been responsible for sections of NRC environmental impact statements addressing these areas for several proposed and operating nuclear power plants.

I have a Bachelor of Science degree in Mechanical Engineering from Drexel Institute of Technology (1969) and a Master of Science degree in Environmental Engineering from Drexel University (1972) specializing in water associated problems in the environment. My academic background includes studies in water chemistry, domestic and industrial waste treatment, and water resources management.

From 1969 to 1972, I was a mechanical engineer at the U.S. Army Frankford Arsenal, Philadelphia, Pennsylvania. I was assigned as Project Manager of materials handling, and pollution control efforts for the Small Caliber Ammunition Modernization Program. I participated in the development of solid and liquid waste management and noise control programs for metal parts manufacturing facilities.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY LICENSING BOARD

In the Matter of	)	
	)	
PENNSYLVANIA POWER AND LIGHT CO.	)	Docket Nos. 50-387
ALLEGHENY ELECTRIC COOPERATIVE, INC.	)	50-388
	)	
(Susquehanna Steam Electric Station,	)	
Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF RESPONSE SUPPORTING APPLICANTS' MOTION FOR PARTIAL SUMMARY DISPOSITION OF CONTENTION 2 (CHLORINE)" in the above-captioned proceeding has been served on the following by deposit in the United States mail, first class, or, as indicated by an asterisk, by deposit in the Nuclear Regulatory Commission's internal mail system, this 1st day of October, 1981:

James P. Gleason, Chairman
Administrative Judge
513 Gilmoure Drive
Silver Spring, MD 20901

Mr. Glenn O. Bright
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dr. Paul W. Purdom
Administrative Judge
245 Gulph Hills Road
Radnor, PA 19087

Jay Silberg, Esq.
Shaw, Pittman, Potts and Trowbridge
1800 M Street, N.W.
Washington, DC 20036

Bryan A. Snapp, Esq.
Pennsylvania Power & Light Company
Two North Ninth Street
Allentown, PA 18101

Dr. Judith H. Johnsrud
Co-Director
Environmental Coalition on
Nuclear Power
433 Orlando Avenue
State College, PA 16801

Mr. Thomas M. Gerusky, Director
Bureau of Radiation Protection
Department of Environmental Resources
Commonwealth of Pennsylvania
P.O. Box 2063
Harrisburg, PA 17120

Ms. Colleen Marsh
Box 538A, RD#4
Mountain Top, PA 17120

Mr. Thomas J. Halligan
Correspondent: CAND
P.O. Box 5
Scranton, PA 18501

*Dr. John H. Buck, Administrative Judge
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Mr. Thomas S. Moore, Administrative Judge
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Atomic Safety & Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Atomic Safety & Licensing Appeal Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Secretary
U.S. Nuclear Regulatory Commission
ATTN: Chief, Docketing & Service Branch
Washington, DC 20555

G. Rhodes
Resident Inspector
P.O. Box 52
Shickshinny, PA 18655

Robert W. Adler
Dept. of Environmental Resources
505 Executive House
P.O. Box 2357
Harrisburg, PA 17120

Mr. DeWitt C. Smith, Director
Pennsylvania Emergency Management Agency
Transportation and Safety Building
Harrisburg, PA 17120

Susquehanna Environmental Advocates
c/o Gerald Schultz, Esq.
P. O. Box 1560
Wilkes-Barre, PA 18703

Mary E. Wagner

Mary E. Wagner
Counsel for NRC Staff