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	)	
Station, Units 1 and 2)	)	

AFFIDAVIT OF JOHN C. LEHR

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

Q: By whom are you employed, and describe the work you perform?

A: I am employed by the Environmental Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. A copy of my professional qualifications is attached to the affidavit.

Q: Have you read "Applicants' Motion for Summary Disposition of Contention 2 (Chlorine)", filed November 6, 1980, and the documents attached thereto, including the affidavit of James Rios?

A: Yes.

Q: Would you describe the scope of the subject matter addressed in your affidavit?

A: I have been asked to evaluate the potential health effects of chlorine. The major use of chlorine in the Susquehanna facility will be to control biofouling of the heat exchange surfaces in the main circulating water system. The build up of organisms on heat transferring surfaces can adversely affect the condenser heat transfer rate and thus the plant efficiency and can adversely affect the performance of cooling towers. In extreme cases, massive build up of organic materials in the cooling tower can lead to failure of cooling tower fill. There are other comparatively minor uses of chlorine at the facility, such as disinfecting the potable water supply and the sewage effluent. Thus, I have not addressed the use of chlorine for disinfection of sewage or for production of potable water.

Q: Will the Susquehanna Steam Electric Station use chlorine for biofouling control?

A: Yes. According to the application filed with the U.S. Environmental Protection Agency for a permit under the National Pollutant Discharge Elimination System (NPDES),[1] the station will utilize gaseous chlorine for biofouling control.

Q: What effect will the presence of acid mine drainage in the Susquehanna River have on the use of chlorine for biofouling control?

A: Acid mine drainage will tend to decrease the biological productivity of the receiving water through direct toxic action on the biota and through indirect actions, such as depletion of dissolved oxygen to the extent that the organisms could no longer survive. Therefore, the biotic content of the plant's influent water would tend to decrease under the conditions described in CAND's response to NRC's discovery requests. Thus, if the conditions alleged by CAND came into existence, these conditions would tend to decrease the need to chlorinate.

Q: What effect will the presence of toxic chemicals in the Susquehanna River have on the use of chlorine for biofouling control?

A: Without additional specific information on the particular toxic chemicals alleged to be present, the Staff cannot make a judgment as to the need to alter the chlorination level proposed by Applicants. The Staff does note, however, that chlorination is not generally used as a mechanism for the removal of toxic chemicals from water.

Q: Does this use represent a pathway for chlorine to the offsite environment?

A: Yes. By far the most significant liquid pathway to the offsite environment for chlorinated water is the cooling tower blowdown. The principle

form of chlorine present in the plant blowdown will be chloride ion. This is because elemental chlorine and its reaction products, hypochlorous acid and hypochlorite ion, react very rapidly with substances in the cooling water to form chloride compounds, chloramines, and other chlorine-containing compounds such as trihalomethanes. The applicant has indicated in the NPDES application that a dechlorination system using sulfur dioxide will be employed for treatment of cooling tower blowdown. That system will reduce these active chlorine chemical species to below detectable limits (i.e., less than 0.05 mg/l maximum).

Q: Are any of the chemical forms in the cooling tower blowdown of public health significance?

A: Yes. It is possible that the action of chlorine on organic substances in the influent cooling waters may result in the formation of chlorinated organics in the plant discharge that will not be removed by the dechlorination system. (Of the three types of compounds mentioned earlier, chloramines will be removed by the dechlorination system. There is no perceived threat to public health from chlorides at the levels likely to be discharged.) Studies conducted on raw waters treated with chlorine for disinfection[2] and studies on cooling tower waters and once through waters treated with chlorine for biofouling control[3] have revealed the subsequent presence of trihalomethanes in the treated waters. In a summary of studies, EPA reports[4] that trihalomethanes, listed as toxic under the Clean Water Act, were found in greater amounts in a power

plant effluent than in the influent in at least one reported study of recirculating cooling systems.

The principle health effect of the trihalomethanes and the halomethanes involves their suspected carcinogenicity. These compounds have been evaluated by EPA[5] in order to establish criteria for the protection of human health. A maximum level of 6 μg/l in raw and finished waters "could be considered acceptable for bromomethane, chloromethane, dichloromethane, tribromomethane and bromodichloromethane",[5] exclusive of contribution to total exposure from air and food. Furthermore, EPA has proposed a water quality criterion of 2 μg/l for this group of halomethanes, based on the structure and biological activity of chloroform, as (1) providing an adequate margin of safety in the absence of sufficient data for quantitative risk assessment, and (2) taking into account the fact that exposure to halomethanes also occurs through foods and via inhalation.[5]

Q: Can you estimate the likely levels of trihalomethanes to be produced at the Susquehanna Steam Electric Station?

A: A quantitative estimate of trihalomethane concentrations in the plant discharge has not been made by the applicants. The specific water chemistry that will exist under operating conditions, with concentrated river water in the treated plant system cannot be predicted accurately. Active chlorine behavior is dependent on this chemistry. Thus, the

conditions in the blowdown are largely unknown at this time. However, some insight may be obtained from an NRC sponsored study,[6] which examined the products of low level chlorination (i.e., in the range used in power plant cooling water chlorination, 2-5 mg/l residual chlorine at one hour contact time) of various natural waters in the United States. Chloroform was found to be the principal trihalomethane product of freshwater chlorination, with concentrations of haloforms found in these studies ranging from 2 to 55 μg/l. Chloroform production in chlorinated freshwater samples ranged from 2 μg/l to 25 μg/l.

Significantly, in a study of chlorinated closed cycle cooling systems at Oak Ridge National Laboratory, Jolley, et al.[3] showed a volitization loss of chloroform and other trihalomethanes to the atmosphere in samples collected from cooling tower basins. At a calculated applied chlorine residual of 2 mg/l, the chloroform concentration was seen to drop from 38 μg/l to 6.2 μg/l 2 hours after chlorine addition.

Q: Have trihalomethanes been found in treated U.S. water supplies?

A: Yes. In a study[7] of 80 U.S. cities, a number of trihalomethane compounds were found in drinking water. Chloroform was always found to be the major trihalomethane present.

Q: How do the concentrations of chloroform in these public water supplies compare with the values cited for protection of public health and with

those noted in association with chlorination of recirculating cooling waters?

A: The average value of chloroform in the sampled public water supplies was 21 μg/l, with 10% of the samples exceeding 100 μg/l. In the EPA Interim Primary Drinking Water Regulations,[8] EPA has established that total trihalomethanes in community drinking water systems serving 75,000 or more individuals not exceed 100 μg/l. These values are considerably above the value cited for protection of public health in the water quality criteria and range from comparable to well above those associated with the reported values in chlorinated surface- and cooling tower waters.

Q: Given that the data presently available indicate that chlorination of raw surface waters in a recirculating cooling system will lead to the discharge of potentially carcinogenic compounds to the environment, do limitations on the discharge of these compounds exist in the applicable EPA Effluent Guidelines?

A: No. Limitations on chlorinated organics are not now a part of the applicable effluent guidelines or new source performance standards for the steam electric generating point source category.

In the EPA Proposed Pretreatment and New Source Rules for the Steam Electric Power Generating Category,[9] organic and inorganic priority

pollutants, including the trihalomethanes chloroform, dichlorobromomethane and dichloromethane, were cited as being present in cooling tower blowdown due to chlorination of circulating water. 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 technologies known to the Agency.

Q: Are means available that will provide for the protection of public health with regard to the potential presence of these compounds in the Susquehanna River downstream of the Susquehanna Steam Electric Station?

A: Yes. There are several process changes that can be made at water treatment plants that are capable of reducing the amount of trihalomethanes that occur in finished drinking water. The exact process changes, or chemical treatments to be employed would vary according to the specific characteristics of the influent water, plant design and desired level of trihalomethanes in the effluent as compared to that in the influent. Recent studies at operating treatment plants[10, 11] indicate that the point of disinfection (with chlorine) in the plant, increasing the amount of pretreatment of raw water prior to disinfection, changing the disinfectant, use of ammoniation, and treatment of raw water for removal of trihalomethane precursors, are effective in reducing

the amounts of trihalomethanes produced. Also, steps such as use of activated carbon, aeration and coagulation are effective for removal of trihalomethanes after they are formed in the processed water. A study reported by Blanck[10] indicated reductions of up to 59-90% in trihalomethanes in finished water supplies can be achieved by these methods.

Q: What effect would the use of chlorine for biofouling control at the Susquehanna Steam Electric Station have on public health?

A: The use of chlorine at the plant for biofouling control would likely result in the release of trihalomethanes, principally chloroform, in amounts at the plant discharge that are on the order or less than those that have been found to be present in drinking water supplies to U.S. cities.[7] The trihalomethane content of the discharge may be below the maximum contaminant level by EPA under the Safe Drinking Water Act. The discharge flow of the plant is a small fraction of the river flow under normal conditions, which will serve to reduce the concentrations even further prior to the withdrawal of river water for treatment for potable use downstream. In addition, means have been shown to be readily available that are capable of greatly reducing the trihalomethane content of water delivered to customers.

In the development document for the proposed EPA effluent limitations for the steam electric point source category,[12] the non-water quality aspects of chlorination and subsequent dechlorination of cooling tower

blowdown have been evaluated and are "not expected to result in any non-water quality environmental effects" (Section VIII).

Based on the above mentioned considerations, I conclude that the use of chlorine for biofouling control at the site will not result in a significant impact with respect to public health.

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

John C. Lehr

John C. Lehr

Subscribed and sworn to before me this
2nd day of December, 1980

Elizabeth Ann Tipton

Notary Public

My Commission expires: July 1, 1982

References

1. Pennsylvania Power and Light Company; National Pollutant Discharge Elimination System Application for Permit to Discharge Wastewater; June 14, 1978.

2. M. D. Arguello, et al "Trihalomethanes in Water: A Report on the Occurrence, Seasonal Variation in Concentrations, and Precursors of Trihalomethanes"; Journal AWWA, September 1979.

3. R. L. Jolley, et al; "An Experimental Assessment of Halogenated Organics in Waters from Cooling Towers and Once Through Systems", in Water Chlorination Environmental Impact and Health Effects Volume 2; ed. by R. J. Jolley, H. Gorchev and D. H. Hamilton, Jr.; Ann Arbor, Mich., Ann Arbor Publishers, Inc., 1978.

4. EPA Proposed Pretreatment, New Source Rules for the Steam Electric Power Generating Category; 45FR68328, October 14, 1980; U.S. Environmental Protection Agency.

5. Water Quality Criteria: Request for Comments; 44FR43678, July 25, 1979; U.S. Environmental Protection Agency.

6. R. M.Bean, et al; Analysis of Organohalogen Products from Chlorination of NaturalWaters Under Simulated Biofouling Control Conditions; NUREG/CR-1301; U.S. Nuclear Regulatory Commission, June 1980.

7. U.S. EnvironmentalProtection Agency; "Preliminary Assessment of Suspected Carcinogens in Drinking Water", Report to Congress, Washington, D.C., 1975.

8. Interim Primary Drinking Water Regulations: Control of Organic Chemical Contaminants in Drinking Water; 44FR68623, November 29, 1979; U.S. Environmental Protection Agency.

9. U.S. Environmental Protection Agency; "Proposed Pretreatment, New Source Rules for the Steam Electric Power Generating Category; 45FR68238, October 14, 1980.

10. C. A.Blanck; "Trihalomethane Reduction in Operating Water Treatment Plants"; Journal AWWA, September 1979.

11. D. T. Duke, et. al.; "Control of Trihalomethanes in Drinking Water"' Journal AWWA, August 1980.

12. U.S. Environmental Protection Agency; Development Document for Effluent Limitations Guidelines and Standards for the Steam Electric Point Source Category (Proposed); EPA 440/1-80/029-b; September 1980.

SUPPLEMENT TO APPLICANTS' STATEMENT OF MATERIAL FACTS

1. Acid mine drainage will tend to decrease the biological productivity of the receiving water through direct toxic action on the biota and through indirect actions, such as depletion of dissolved oxygen to the extent that the organisms could no longer survive.

2. Chlorination is not generally used as a mechanism for the removal of toxic chemicals from water.

3. The principle form of chlorine present in the plant blowdown will be chloride ion.

4. Applicants' dechlorination system will reduce active chlorine chemical species to below detectable limits (i.e., less than 0.05 mg/l maximum).

5. The action of chlorine on organic substances in the influent cooling waters may result in the formation of chlorinated organics in the plant discharge that will not be removed by the dechlorination system. Studies conducted on raw waters treated with chlorine for disinfection and studies on cooling tower waters and once through waters treated with chlorine for biofouling control have revealed the subsequent presence of trihalomethanes in the treated waters. In a summary of studies, EPA reports that trihalomethanes, listed as toxic under the

Clean Water Act, were found in greater amounts in power plant effluent than in the influent in at least one reported study of recirculating cooling systems.

6. The principle health effect of the trihalomethanes and the halomethanes in general involves their suspected carcinogenicity.

7. EPA has proposed a water quality criterion of 2 μg/l for this group of halomethanes. EPA further stated that a maximum level of 6 μg/l in raw and finished waters "could be considered acceptable for bromethane, chloromethane, dichloromethane, tribromomethane and bromodichloromethane," exclusive of contribution to total exposure from air and food.

8. An NRC sponsored study, which examined the products of low level chlorination of various natural waters in the United States, found that chloroform was the principal trihalomethane product of freshwater chlorination, with concentrations ranging from 2 to 25 μg/l. A study by R.L. Jolley showed a volitization loss of chloroform and other trihalomethanes to the atmosphere in samples collected from cooling tower basins. At a calculated applied chlorine residual of 2 mg/l, the chloroform concentration dropped from 38 μg/l to 6.2 μg/l two hours after chlorine addition.

9. In a study of 80 U.S. cities, sampled public water contained a number of trihalomethane compounds, with a mean of 21 μg/l, with 10% of the samples in excess of 100 μg/l for chloroform.

10. The EPA Interim Primary Drinking Water Regulations establish that total trihalomethanes in community drinking water systems serving 75,000 or more individuals should not exceed 100 μg/l.

11. Through a number of readily available process changes or chemical treatments, water treatment plants can reduce trihalomethane levels in finished drinking water by as much as 59 to 90 percent.

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 AND 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 ANSWER IN SUPPORT OF APPLICANTS' MOTION FOR SUMMARY DISPOSITION OF CONTENTION 2 (CHLORINE)," dated December 2, 1980, in the above-captioned proceeding, have been served on the following, by deposit in the United States mail, first class, or, as indicated by an asterisk through deposit in the Nuclear Regulatory Commission's internal mail system, this 2nd day of December, 1980:

*Charles Bechhoefer, Esq., Chairman
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Mr. Glenn O. Bright, Member
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Dr. Oscar H. Paris, Member
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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

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

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

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

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

Mrs. Irene Lemanowicz, Chairperson
The Citizens Against Nuclear
Dangers
P. O. Box 377
RD#1
Berwick, Pennsylvania 18503

*Richard S. Salzman, Esq., Chairman
Atomic Safety & Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Dr. John H. Buck, Member
Atomic Safety & Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

*Mr. Thomas S. Moore, Member
Atomic Safety & Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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

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

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

Susquehanna Environmental
Advocates
P. O. Box 1560
Wilkes-Barre, Pennsylvania 18703

Mr. Robert M. Gallo
Resident Inspector
P. O. Box 52
Shickshinny, Pennsylvania 18655

Karin W. Carter, Esq.
Department of Environmental Resources
505 Executive House
P. O. Box 2357
Harrisburg, Pennsylvania 17120

Jessica H. Laverty
Jessica H. Laverty
Counsel for NRC Staff