FILE NAME: American Cyanamid (AMCY)

DATE: 1998 Jan 12

DOC#: AMCY025

DOCUMENT DESCRIPTION: Unpublished Consultant Report

PENDERGRASS

ASSOCIATES Occupational and Environmental Health Management

January 12, 1998

RE: Asbestos Cases, Court of Common Pleas,
Allegheny County, Pennsylvania

I have been requested by Pennsylvania Electric Company and Duquesne Light Company to provide information concerning the historical development of knowledge about potential health hazards to workers exposed to asbestos. I have also been asked for my opinion as to actions by electric generating companies with regard to asbestos handling and timing of these actions.

My comments and opinions are based on the review of the literature, materials that have been provided, my education and more than 45 years of experience in industrial hygiene in the electric utility, chemical, petrochemical and manufacturing industries and the federal government. I am a Certified Industrial Hygienist, a Certified Safety Professional and a Registered Professional Engineer. I served as Assistant Secretary of Labor for the Occupational Safety and Health Administration from 1986 to 1989.

Persons responsible for controlling the use of asbestos could not be expected to take precautions or remedial action until they were aware of the potential problem. It was only in 1971, when the first OSHA asbestos standards were promulgated, that companies such as electric public utilities were made aware of the "asbestos problem." The electric utilities were merely good faith purchasers of asbestos-containing materials that not only were thought to be safe but were highly recommended.

Ill health from exposure to asbestos is directly related to the amount of asbestos inhaled over a period of years. The size and the type of asbestos fibers are also

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critical in evaluating the risk of acquiring the diseases associated with exposure. Health scientists have determined that asbestos fibers, to be toxicologically significant, must be longer than five microns (one micron is about 25 thousandth of an inch) and have a length to width ratio of 3 to 1 or greater. The biological process between body tissue and asbestos is still being studied. Human experience and animal studies have demonstrated that in most cases the physiological changes attributable to asbestos exposure require long term, years, of exposure to concentrations in excess of the response threshold.

Historically, from the production of novelty fabrics for royalty in the Middle Ages, the use of asbestos grew and even enjoyed the status of legal requirement for some applications. By the 1930's, 40's and 50's asbestos was routinely and widely used in numerous areas including construction, shipbuilding, electrical and heat insulation, coatings, and brake linings. Asbestos was inexpensive, readily available and adaptable to many uses. Consequently, there was no apparent reason to seek substitute materials.

In 1959, Oliver Bowles, in the monograph ASBESTOS A Material Study, U.S. Bureau of Mines Information Circular 7880, made the following observation:

ESSENTIALITY OF ASBESTOS

> The United States has developed the greatest asbestos-products industry in the world. The value of such products manufactured in 1953 was $345 million and in 1954, $323 million. These products are not only vital to building construction and industry but are absolutely essential to certain other important fields of use. For example, virtually all brake lining and clutch facings of automobiles, trucks, or other mobile equipment used in peace or war consist essentially of asbestos. Hence a shortage of asbestos used in friction materials would tend to immobilize highway transport. Also, there is no known substitute for asbestos used in steam packings. Accordingly, a shortage of such products would interfere seriously with many lines of industrial activity. Satisfactory replacements for the amosite variety mined only in South Africa for felted insulation or marine turbines can be obtained only at exorbitant prices. Crocidolite (blue asbestos), mined in

Africa and Australia, is regarded as a necessary constituent of asbestos-cement pipe.

For many years, asbestos was the material of choice for insulation in the hot operations in power plants, schools, hospitals, shopping malls, apartment houses, nursing homes and private dwellings. No one had suggested that any other material should be considered. The experience with asbestos in schools helped to convince the EPA that its earlier approach to asbestos in schools was incorrect. Today, the Environmental Protection Agency recommends that asbestos-containing insulation currently in place and non-friable be managed rather than completely removed.

Understanding the health effects of exposure to asbestos resulted from a slowly developing knowledge about asbestosis. Occupational physicians, industrial hygienists and industrial toxicologists were aware of the disease asbestosis, a disease recognized as a unique pneumoconiosis caused by the inhalation of asbestos fibers over a prolonged period. In 1934, a government report from England stated that asbestosis was a disease of the past because of the success of controls.

In 1938, Dr. Dreessen suggested, as a result of a U.S. Public Health Service study, that a threshold exposure limit of 5,000,000 particles per cubic foot of air seemed to prevent asbestosis. Very soon after the Dreessen report, World War II production efforts began in the shipyards. Amosite asbestos was specified by the U.S. Navy for all ships. Dr. Philip Drinker, inventor of the iron lung and a professor of industrial hygiene engineering at Harvard, was commissioned by the Navy to study asbestos levels in the shipyards and to make recommendations for necessary controls. Dr. Drinker concurred with Dr. Dreessen that the exposure limit of 5,000,000 particles of asbestos per cubic foot of air was thought to be protective of the workers.

By 1938, the concept of worker exposure limits had been developing for several years. That year, a group of industrial hygienists, who worked for governmental agencies, agreed to a standardization of recommended exposure limits based on work place exposures averaged over 8 hours per day, five days a week for a working lifetime (40 years). These agreed-to exposure limits were believed to represent a lifetime dose that would not adversely affect the well-being of the workers.

In 1946, in its first publication of exposure limits, the American Conference of Governmental Industrial Hygienists (ACGIH) adopted a guideline of 5,000,000 particles per cubic foot of air for asbestos. This guideline remained unchanged until 1974 when ACGIH approved a Threshold Limit Value (TLV) for asbestos of 5 fibers per cubic centimeter of air (f/cc) with a carcinogen notation. The next change approved by ACGIH reflected the differences in health risks associated with the various forms of asbestos minerals. In 1980, the TLV's approved were 0.2 f/cc for crocidolite, 0.5 f/cc for amosite and 2.0 f/cc for chrysotile and tremolite. In 1995, the current Occupational Safety and Health Administration (OSHA) promulgated a Permissible Exposure Limit (PEL) for asbestos of 0.1 f/cc. Historically, the ACGIH TLV's have been the best available guidelines of good practice in industrial hygiene while the OSHA PEL's are the regulated levels. It is believed that exposures/doses that are less than the TLV or PEL over the 8 hours per day work exposure, 5 days a week, for 40 years will not result in ill health.

In 1955, when I was a graduate student, asbestosis was known, but was not one of the more frequently encountered occupational diseases and was not considered a high priority in industrial hygiene. Even as the use of asbestos increased, the cases of asbestosis remained rare. Prior to the early 1970's, asbestosis was a rarely diagnosed disease. This can be attributed to a number of factors including:

1. the latency period for disease development is long;
2. prior to World War II, the number of asbestos workers was relatively small;
3. the dose received by workers was below the disease threshold;
4. the type of asbestos most commonly used in the United States (chrysotile) is believed to be less hazardous than the amphiboles (crocidolite and amosite) used in England, Europe and specified by the U.S. Navy (amosite).

In evaluating asbestos levels in work areas, it is necessary to obtain air samples by either midget impinger or with filters. Analysis is by optical microscopic counting. Health risk is determined by considering the asbestos concentration (dust count in the sample), exposure time of workers (hours, days and years) and frequency of the operation. Prior to the OSHA standards, the occasions for evaluating asbestos levels were infrequent; afterwards, sampling was utilized to assure compliance with the standard.

My employment in occupational health began 1948 with the Tennessee Valley Authority (TVA), a federally-owned chemical corporation and electric utility, which used both hydroelectric and steam generating facilities to produce electricity. The construction, operation and maintenance of these steam generating plants included the use of tons of insulation materials, including asbestos. TVA had a comprehensive occupational health program for its employees. Contrary to practices in some other companies, the construction tradesmen were TVA employees and were a major segment of the occupational health programs. Even though many of these workers had been with TVA for more than twenty years, to my knowledge, there was no evidence of asbestosis among the TVA construction workers.

In 1964, Dr. Irving Selikoff and colleagues reported on their studies of insulation workers, many of whom had been shipyard workers and exposed to amosite asbestos during the World War II period. Dr. Selikoff reported that there was a link between asbestos exposure and lung cancer. Subsequent studies of the same men established that the link to cancer was actually between cigarette smoking and asbestos exposure. Currently, there is evidence that, sans cigarette smoking, exposure to low concentrations of chrysotile asbestos presents little or no risk of lung cancer.

While the Selikoff report stimulated an increased interest in worker exposure to asbestos among occupational health professionals and in the federal government regulatory agencies, most others in the industrial areas were not aware of any reason for increased concern. In power plants, asbestos had been the insulating material of choice for many years without any indication of workers' problems. This situation was due to low, essentially ambient, exposure levels under normal operating conditions. When it was necessary to remove or replace insulation for maintenance reasons, the length of exposure was relatively short. With the increased awareness levels existing today, the worker health experience remains favorable. It is not surprising that power plant management was not alerted by the Selikoff reports.

Passage of the Occupational Safety and Health Act (1970), coupled with the Selikoff reports, were great stimulants for asbestos concern. Activity by the unions and others prompted OSHA regulatory action on asbestos. Since the Emergency Temporary Standard published by OSHA in 1971, there have been many iterations of asbestos exposure levels and worker surveillance measures.

It must be remembered that the responsibility for the health and safety of workers has traditionally, and since passage of the OSH Act, has legally been the employer. Historically, OSHA has defined the employer to be the person or organization that provides the paycheck. The individuals involved in these cases are all employees of independent contractors.

It is my opinion within a reasonable degree of scientific certainty that the electrical utility companies, as consumers of asbestos-containing products, acted reasonably in utilizing such products in their facilities. When the potential health hazard of asbestos became generally known, in approximately 1971, appropriate measures were taken to control asbestos levels as required by OSHA. By the mid-1970's, electric utility management was specifying non-asbestos insulation. Replaced insulation has been non-asbestos-containing material. Both Duquesne Light and Pennelec have scheduled programs to replace asbestos insulation. Asbestos removal projects are conducted by certified asbestos contractors. When it becomes necessary to remove asbestos-containing insulation, the work is done following good practice procedures.

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