Statement of

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Before the
Subcommittee on Labor Standards
House Committee on Education and Labor

June 7, 1979

I am Dr. Anthony Robbins, Director of the National Institute for Occupational Safety and Health (NIOSH). I am accompanied by Mr. Richard Lemen, Assistant Branch Chief, Industry-wide Studies Branch, NIOSH, and Dr. Aaron Blair, Staff Fellow, Environmental Epidemiology Branch, National Cancer Institute. We are here today to discuss occupationally-related cancers.

Cancer has long been a dreaded and deadly disease throughout the world. In the United States alone over 600,000 new cancer cases will occur and over 370,000 persons will die from cancer each year. One in four persons in this country will suffer from cancer during their lifetime. The World Health Organization estimates that 80 to 90 percent of all cancer is environmentally related. A recent HEW report estimates that at least 20 percent of all cancers may be attributed to occupational exposure either directly or indirectly.

We can expect occupationally related cancers to continue to increase. This is in part because they are associated with exposures in the petrochemical industry, which has expanded rapidly during the last 30 years. Many occupational cancers become manifest in humans from 20 to 40 years after first exposure. It is the responsibility, not only of public health agencies, but also of industry to identify methods of preventing these occupational cancers.

Knowledge of environmental and occupational cancer is not new. It dates back more than 200 years when scrotal disease in chimney sweeps was first described by Treyling in 1740 and later recognized in 1775 by Percivall Pott to be a malignant disease. These classic descriptions

were the first to demonstrate a high cancer incidence in a worker population. Pott wrote, "the fate of these people seems singularly hard; in their early infancy, they are most frequently treated with great brutality and almost starved with cold and hunger; they are thrust up narrow and sometimes hot chimnies where they are bruised, burned and almost suffocated and when they get to puberty became particularly liable to a most noisome, painful and fatal disease." In 1788, the British Parliament, stimulated by the reports of Pott and others, passed laws which reduced the exploitation of children and established regulations regarding protective clothing and hygiene. These events marked the first legislative action toward the prevention of an occupationally induced cancer. Scrotal cancer is not limited to chimney sweeps alone. It was shown in 1871 to be associated with paraffin workers; in 1910 with tar workers and with mule skinners in 1928, as well as among other workers exposed to mineral oils. Although it had long been suspected that the scrotal cancer was a result of soot or other carcinogens collected on the scrotum, it was not until 1922 that this was confirmed experimentally when skin cancer was reproduced in mice by an extract of soot.

Similar coal combustion by-products to those experienced by the chimney sweeps are still present in American industry today. Thousands of workers in the steel industry alone still inhale this very same class of substances. These steelworkers have died at rates of lung cancer ten times greater than steelworkers not exposed to such products.

In the 1600's, a "mountain disease" was known to be common among the miners of the Erz Mountains of Central Europe. The disease was not recognized as lung cancer until the late 1800's when it was associated with radioactivity found within these mines. These exposures still exist and account for a three-fold risk of lung cancer among uranium miners.

Why does the study of occupational exposures continue to be a particularly good way to learn about environmentally caused cancer? This generalization about occupational health applies to diseases other than cancer. Good epidemiology is possible for occupational diseases. In the first place, it is usually possible to know with some precision the population that was exposed. Records tend to be available and this is different than other environmental situations. Second, it is often possible to know the exposure or dose received by the population. . . either measurements were made at the time; a similar environment continues to exist and can be measured, or exposure estimates can be made by reconstructing the earlier work environment. Again, this is better than what can usually be done in other environmental settings. Finally, the most important advantage of occupational health studies is that when associations between exposure and disease are made, future problems are by definition preventable. It may be difficult, it may be expensive, it may not be of such gravity that it is worth preventing, but any workplace exposure can be prevented. Preventing one exposure

may also prevent others, as when one ventilation system prevents exposure to many carcinogens.

The number of recognized occupational cancers is long and continues to grow. In the 1920s it was known that benzene exposure could increase the risk of leukemia. In the 1930s and 1940s it was shown that inorganic arsenic, iron, asbestos, nickel and chromium all were associated with increases in various types of cancer, including skin, lung, and nasal cancers. Among the associations found in the 1950s are bladder cancer with specific aromatic amines, skin cancer, lung cancer, bone cancer and leukemia with ionizing radiation.

In the 1960s and 1970s the following associations were demonstrated: nasal cancer with the wood working industry; skin cancer with the use of ultraviolet radiation; prostatic and lung cancer with the smelting of cadmium; reticuloendothelial and lymphoid malignancies with the use of anesthetic gases; all types of cancer with employment in chemical laboratories; nasal, sinus, and bladder cancers with the leather working industries; lung cancer with employment in coke ovens (workers exposed to coal tar pitch combustion products); oral cancer with wool textile industry, and lung cancer with industries involving exposure to chloromethyl ether. Then came the startling revelation in 1974 that such a commonly used chemical as vinyl chloride caused excesses of angiosarcoma of the liver, lung cancer and brain cancer. These examples are only some of the recognized occupational cancers and the list continues to grow.

Because of varying latency periods, of differences in individual susceptibilities, and of the highly mobile nature of our society, occupationally or environmentally related cancers frequently do not cluster in time or place and consequently go undetected. These complicating factors mean that studies correlating cancer with an occupational risk require sophisticated epidemiologic techniques which examine all available data. Despite the importance of these sophisticated techniques, we usually first learn about new occupational health problems from workers, company officials, union representatives, or local physicians.

One such example is the recognition of the cancer risk associated with vinyl chloride production. We were alerted to this problem by an astute physician who saw two cases of angiosarcoma of the liver. Because this was a rare tumor, he tried to find out what these two individuals had in common. When he found that both were vinyl chloride workers he brought this information to the attention of the company and to NIOSH, which began a massive investigation of vinyl chloride exposed workers throughout the United States. The NIOSH study showed that vinyl chloride workers, especially those involved in maintenance and cleaning of the reactor mixing vessels, were at an increased risk not only of angiosarcoma of the liver but also of lung cancer and brain cancer.

NIOSH and the Occupational Safety and Health Administration (OSHA) are currently conducting an investigation of a problem in Texas City, Texas that was brought to our attention by a worker. A worker with a

brain tumor called OSHA on the advice of a medical student friend to report that he and two coworkers at the Union Carbide plant in Texas City all had brain tumors. Subsequently we have assembled a list of eleven workers who have died with brain tumors in the last ten years. They had all been employed in this one plant of about 2500 workers. As we have searched the records of the Texas Health Department, the M.D. Anderson Cancer Hospital, and the local physicians, we have found other brain tumors in the area. It is this kind of study that will provide leads for new occupational associations with cancer.

Occupational cancer often occurs in one organ system with one particular cell type being predominant. One example is workers exposed to bis-chloromethyl ether (BCME), an alkylating agent used as an intermediary in many chemical reactions. Animal studies conducted at New York University showed that the skin painting on mice and subcutaneous injections in rats resulted in the development of papiloma and squamous cell carcinoma. Because BCME was more likely to be a respiratory than a skin irritant, several animal inhalation experiments were undertaken which showed an increased risk of squamous cell carcinoma of the lung and cancer of the nasal passages.

As a result of these findings, government, academic, and industry representatives met in 1972 to address the future research and regulatory actions on bis-chloromethyl ether. Two courses of action were pursued by NIOSH. The first was a rapid investigation of health and environmental conditions of plants producing alkylating agents and

using manufacturing processes involving BCME as a contaminant. The second, in cooperation with a local county health department in California, was an epidemiologic study of a local chemical facility. The study showed that workers in this facility suffered not only from an excess of lung cancer but largely from a specific rare type of lung cancer, oat cell carcinoma. This observation has been confirmed in several other studies of BCME workers throughout the world, each showing an increased risk of lung cancer of one predominant type, oat cell carcinoma. Examples of other specific cell types clustering among similarly exposed workers can be an indication of a common etiology. Cigarette smokers, for example, tend to develop squamous cell carcinoma of the lung. When other cell types occur, it speaks against smoking as the primary cause of the lung cancer.

Unfortunately, the survival rates for various cancers, with a few exceptions, have remained almost unchanged from one decade to the next. For lung cancer, one of the most common and fatal types of cancer among men, and an increasing cancer risk to women, the prognosis remains exceptionally poor. Fewer than five percent of the victims survive five years after diagnosis.

It is evident that cigarette smoking has a direct link to lung cancer. We also know that workers who smoke cigarettes and are exposed to cancer-causing substances in the workplace often experience an even greater risk to cancer. Uranium miners and asbestos workers have a phenomenally high risk of developing lung cancer if they are also

smokers. The relation of disease to smoking has often been used as an excuse not to eliminate the occupational cause. The prevention strategies are different and separate, and employer responsibility for carcinogen exposure must not be clouded with the broader social issue of marketing tobacco products to the general public.

Experimental evidence has been unable to show a level of exposure to a carcinogen below which there is not some increased risk of cancer. This has forced government to consider new and more effective ways to encourage and enforce prevention. OSHA is attempting to simplify the process of identifying and categorizing carcinogens. OSHA's generic cancer policy will establish in advance the criteria for carcinogens and will help us define what we at NIOSH must learn about chemicals in the workplace. In addition to cooperating with OSHA, NIOSH will be increasing its efforts to make information available to workers, management, physicians and industrial hygienists to optimize voluntary efforts at cancer control. We are increasing our efforts to look at control technologies and thus reduce exposures in the workplace.

We are also considering the issue of substitution. For example, the textile industry uses about 100 benzidine-based dyes which can be metabolized in the body to benzidine, a known carcinogen. One of the large and progressive firms in the textile field, Burlington Industries, has already decided to abandon the use of benzidine dyes. NIOSH is now rushing to evaluate metabolism and the possible carcinogenicity of substitute dyes. As NIOSH continues to develop a strong scientific

basis for decisions in the control of occupational cancer, we strongly believe that it is primarily the industries' responsibility to test and to know the hazards associated with each and every chemical, substance or process they use.

NIOSH research is used by both the Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) in their regulatory activities. In addition, through the efforts of the National Toxicology Program, cancer research conducted by NIOSH, the National Institute of Environmental Health Sciences (NIEHS), the National Cancer Institute, the Food and Drug Administration, and the Environmental Protection Agency are available to all government regulatory agencies.

The Toxic Substances Control Act requires that new substances introduced into commerce are adequately tested so that they do not contribute to the risk of occupational cancers. The legacy of past exposures is not going to disappear tomorrow or ten years from now. It can be reduced 20 to 30 years from now, only if a major preventive effort in the United States is aimed at protecting the worker and minimizing or eliminating exposures to hazardous chemicals, substances, and processes in the work environment.

Compensation to the cancer victim or to their families may help with the financial burden of the disease. However, providing the association between occupational exposure and cancer is often a difficult task in an individual case. Compensation can be considered

only an interim measure designed to aid the families of the victims and help them to meet the future. The only moral approach to the control of occupationally induced cancer is through adequate pre-testing of substances and ultimately preventing exposure to all cancer-causing substances.

Mr. Chairman, this concludes my prepared testimony. We will be pleased to attempt to respond to any questions you or members of your Subcommittee may have.

Historical Prospective and Chronology of Selected Occupational Cancers

A. Early Reports

1. 16th Century "Mountain Disease" Erz Mountains of Central Europe
2. 19th Century Association of "Mountain Disease," with Radiation Induced Lung Cancer
3. 1775 - Sir Percivall Pott - Scrotal Cancer in English Chimney Sweeps
4. 1895 - L. Rehn-German dye workers, aromatic amines and bladder cancer

B. Chronology of Selected Agents and Manufacturing Processes Associated with Human Cancers Since 1900

1. 1920 - Benzene and Leukemia
2. 1930 and 1934 - Inorganic Arsenic, Skin and Lung Cancer
3. 1934 - Iron (Haematite miners) and Respiratory Cancer
4. 1935 - Asbestos and Lung Cancer
5. 1937 - Nickel Smelting of Sulfide Ore, Nasal Carcinoma and Lung Cancer
6. 1948 - Chromium and Lung Cancer
7. 1954 - Benzidine and Bladder Cancer
8. 1954 - B-naphthylamine and Bladder Cancer
9. 1956 - Uranium (miners) and Lung Cancer
10. 1957 - Copper Smelters and Lung Cancer
11. 1958 - Ionizing Radiation, Induced Skin Cancer, Lung Cancer, Bone Cancer and Leukemia
12. 1960 (1943) - Asbestos Exposure and Mesotheliomas
13. 1964 - Ultraviolet Rays and Skin Cancer
14. 1967 - Wood Workers and Nasal Cancer
15. 1968 - Cadmium, Prostatic Carcinoma and (1976) Lung Cancer
16. 1968 - Anesthetics and Reticuloendothelial and Lymphoid Malignancies
17. 1969 - Chemists and Cancer (all types)
18. 1970 - Leather (workers), Nasal and Sinuses Cancer and Urinary Bladder Cancer
19. 1971 - Coke Oven Workers and Lung Cancer
20. 1972 - Wool Textile Workers and Oral Cancer
21. 1973 - Chloroethers (BCME) and Lung Cancer
22. 1974 - Chlorinated Hydrocarbons and Hepatocarcinoma (PVC)
23. 1974 - Hypoxia (caisson workers) and Bone Cancer
24. 1975 - Lead Workers and Respiratory and Gastrointestinal Cancer
25. 1977 - Beryllium and Lung Cancer