STATEMENT OF

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It is a pleasure to appear before you today to discuss the role of the National Institute for Occupational Safety and Health (NIOSH) in conducting research on how to determine whether illness and injury are job-related. Accompanying me today is Dr. James A. Merchant, Director of the NIOSH Division of Respiratory Disease Studies.

Occupational Exposures and Disease

Since passage of the Occupational Safety and Health Act of 1970, there has been increasing awareness of the magnitude and severity of occupational safety and health problems. There also has been increasing recognition of the role that chemical and physical agents play in the etiology of disease. Despite the corrective measures initiated as a result of this Act, large numbers of workers in the United States continue to be exposed to one or more potentially harmful chemical substances and physical agents.

In an effort to document the extent of worker exposure to chemical substances and physical agents, NIOSH conducted the National Occupational Hazard Survey (NOHS) between 1972 and 1974. The Institute surveyed nearly 5,000 workplaces selected to provide a cross section of industry in the United States. Information was collected on each plant's major product or service, number of employees, available illness and injury statistics, and medical care services. The number of workers in each job category potentially exposed to chemical and physical agents was also recorded.

The results of the survey show that one in four American workers, approximately 20 million, are potentially exposed either full or part-

time to hazardous substances regulated by the Occupational Safety and Health Administration (OSHA). As many as 50 million persons in the United States, or nearly one quarter of the U.S. general population, have been exposed to one or more OSHA-regulated hazardous substances during their working lifetimes. Some of these substances have no known chronic effects. However, a number of these regulated substances have not been adequately studied for the possibility of such effects.

The magnitude of occupational illness affecting workers is difficult to determine because such diseases are too often improperly diagnosed. This is partly because physicians are rarely trained to take occupational histories. Unlike many infectious diseases, occupational diseases are not required to be reported by physicians and health departments. A NIOSH pilot study, conducted in two States in 1972, discovered that 90 percent of the occupationally-related medical conditions observed by the investigators had not been reported on workers' compensation claims or OSHA reporting forms.

Thus, we do not know the full extent of occupational disease suffered by American workers today. We do know, however, that too many workers continue to be exposed to well-known hazards, such as lead, mercury, and silica, and suffer from diseases that have been known for centuries to be of occupational origin. At the same time, we are just beginning to learn about the health effects of chemicals that have been developed in recent years and continue to be introduced into commerce at the rate of several hundred per year.

Most of the research conducted in the past has been on the effects of exposure to single chemical agents. However, most occupational exposures are to multiple chemicals. There is some reason to believe that the chemical interaction may cause a more serious health problem than the single chemical exposure. Workers are also exposed to chemical and physical hazards in the general environment and as a result of smoking and consumption of alcohol and drugs. Clearly the interactions between disease -producing factors found in and out of the workplace are complex. There are probably at least three different categories of occupational disease: (1) those that are caused solely by occupational factors; (2) those in which occupation is one of the causal factors; (3) and those in which occupation affects the course of a preexisting disease.

Occupational Disease Standards

In spite of the complex issues involved, we believe it is possible to develop reasonable diagnostic criteria for most known occupational diseases. In the NIOSH publication "A Guide to the Work-Relatedness of Disease" we suggest an approach that might be used as the basis for developing such criteria. This approach requires answering two important questions: 1. Does the worker have evidence of disease compatible with effects of occupational exposures? 2. Has the worker received sufficient exposure to cause the disease? When the necessary evidence is presented in a logical sequence, the major issues are identified and the basis for any presumption defined, it should be possible to make an equitable decision.

Much of the research we do at NIOSH is to develop associations between disease and occupation. Evidence of this association is obtained by epidemiologic studies documenting that groups of workers and other human populations exposed to a particular agent tend to have significantly greater than normal risk of contracting certain diseases. Evidence is also obtained by laboratory studies on experimental animals showing that healthy animals exposed to certain chemical and physical agents develop certain diseases. Evidence of disease in the individual may be established by analyzing an employee's medical, personal, family, and occupational history and conducting a thorough physical examination, including laboratory tests.

Once it has been established that an employee has a medical condition that may be occupationally-related, it is necessary to determine his previous exposure history. Ideally, the best way to confirm worker exposure is to identify substances used and obtain actual measurements, such as air samples, noise levels or radiation doses obtained at the worker's job stations. Exposure can sometimes be estimated by evaluating work histories and work practices, including use of personal protective equipment. With such information, diseases can be shown to be occupationally-related. I will discuss four examples in some detail to illustrate how the relationship between occupational exposure and disease can be established.

Asbestos

Exposure to asbestos is perhaps the most serious known occupational health problem in the United States. An estimated 8 to 10 million

Americans are currently exposed or have been exposed to asbestos in the workplace. Two very serious conditions, asbestosis and mesothelioma, are associated with this exposure. Asbestosis is a lung fibrosis, and mesothelioma is cancer in the membrane that lines the chest and abdominal cavities. Exposure to asbestos has also been related to significant increases in lung cancer and cancers of several other organ systems.

Asbestosis develops gradually, usually over a period of 10 to 30 years of exposure. Massive exposures may occasionally cause development to occur more quickly. Asbestosis can have a severe impact on the cardiovascular system, resulting in heart failure and death. There are well-established X-ray and lung function tests for diagnosing asbestosis.

Mesothelioma is a rare malignancy with a long latency period. As much as 40 years may elapse between initial exposure and development of the tumor. The disease begins in the membrane surrounding the abdominal organs and is usually accompanied by abdominal swelling and pain. The malignant tumor may also occur in the chest cavity, causing chest pain and breathlessness, and may eventually result in death.

Association between lung disease and occupational exposure to asbestos has been demonstrated in a number of epidemiologic studies. In one study, asbestosis was 11 times more common among pipe coverers in new ship construction than in a control group. In a study of cause of death in 17,800 insulation workers, 17 percent of all deaths were caused

by mesothelioma or asbestosis. Lung cancer accounted for 23 percent of all deaths, a rate 5 times that in the general population.

Epidemiologic experience is also available to correlate development of mesothelioma and exposure to asbestos. In a study of 532 asbestos insulators workers from 1943-1968, 14 deaths from mesothelioma were reported. No deaths from mesothelioma would be expected in the same number of individuals in the general population.

Because asbestos is widespread in the environment (over 3,000 products contain the substance), it is sometimes difficult to determine whether a disease arising from asbestos is occupational in origin. A confirmed history of occupational exposure is necessary to link the onset of disease with workplace exposure. It must also be recognized that cigarette smoking greatly increases the risk of lung cancer in those exposed to asbestos.

However, occupationally-related asbestos disease is a clear example of a case in which extensive epidemiologic evidence has established the connection between disease and workplace exposure. Moreover, the diagnostic criteria for asbestos disease are well established. Consequently, once diagnosis reveals asbestosis, mesothelioma, or lung cancer, and occupational exposure has been established, the disease can be presumed to be work-related.

Cotton Dust

Over 300,000 Americans are exposed to cotton dust in the workplace and it has been estimated that at least 35,000 American textile workers are permanently disabled as a result of their exposure. Prevalence of

byssinosis is particularly high among cotton mill workers involved in breaking down, opening, and carding cotton. These are operations in which dust levels have traditionally been high.

Because of the manner in which the disease presents in its early and intermediate stages, the association between workplace exposure and development of symptoms is relatively easy to establish. Cotton dust produces an acute airway reaction resulting in chest tightness and shortness of breath which becomes more severe as the work week progresses. Workers experience some relief over the weekend.

Byssinosis was originally thought to be related to asthma, a disease which is not necessarily occupationally related. However, there are clear-cut ways to distinguish the two. Byssinosis develops gradually, while asthma develops soon after exposure to an antigen.

Although the early stages of disease are reversible if exposure to cotton dust ceases, extensive exposure can cause permanent, irreversible airway obstruction. In workers with advanced disease, symptoms of shortness of breath and tightness in the chest are severe every day. Therefore, workers with chronic symptoms may not experience relief over a weekend, and byssinosis cannot be ruled out once significant occupational exposure has been established.

Numerous epidemiologic studies of cotton workers have been conducted in the United States and abroad. These studies have revealed byssinosis in 20-40 percent of the cotton preparation workers and 5-15 percent of the workers in yarn processing and weaving operations. Studies have shown that smoking is a significant risk factor in

byssinosis. Studies also show that prolonged exposure to cotton dust contributes to airway obstruction in lungs. If objective evidence of such obstruction is found in a worker with significant exposure to cotton dust, the disease can be presumed to be work-related.

Toluene Diisocyanate (TDI)

Workplace exposure to toluene diisocyanate (TDI), a liquid used in manufacturing polyurethane, has been known for almost 30 years to cause both respiratory and dermatologic conditions. TDI vapor is a potent respiratory irritant and sensitizer from which severe respiratory symptoms can develop on exposure to very low cencentrations. Some workers may become sensitized to the substance and may develop asthma after being exposed, even to very low concentrations of TDI. Higher ambient TDI levels result in more workers becoming sensitized.

The irritating effects of TDI include inflammation of the mucous membrane lining the nose, inflammation of the larynx, bronchi, and, in severe exposure, inflammation of the bronchioles. Usually the respiratory signs and symptoms subside when exposure ceases. However, progressive lung disease may develop after continued exposure. Cigarette smokers and those with chronic lung disease show greater impairment.

Skin contact with liquid TDI causes inflammation which can lead to chemical dermatitis. Liquid TDI in the eyes causes severe irritation, and a chemical conjunctivitis with swelling of the cornea can result from exposure to the vapor.

It is estimated that at least 100,000 American workers are exposed to TDI. Rubber workers, foundry workers, plastic foam workers, and spray painters are only a few of the many occupational groups with potential exposure.

Epidemiologic studies have shown that primary irritant effects of TDI are dose-related. However, once workers are sensitized to TDI, there appears to be little or no dose-response relationship and any further exposure may be extremely dangerous.

In the early years of industrial use of TDI, when its hazards were not fully appreciated, relatively high environmental levels of TDI were encountered and very high proportions of the exposed workers were affected. With the development of mechanization and better hygiene controls, ambient TDI levels have been significantly reduced and both the incidence and severity of primary respiratory irritation in workers have declined.

Historically, the association of clinical findings and occupational exposure to TDI has not been difficult to establish. Confirmed history of occupational exposure in conjunction with respiratory or dermatologic symptoms indicate the disease is workplace related.

Dibromochloropropane (DBCP)

DBCP is a pesticide that has been used in this country since 1955. It is estimated that between 1,600 and 2,900 production employees in manufacturing and formulating facilities have been recently exposed to the chemical. Although a research paper written in 1961 noted

testicular atrophy in animals exposed to as little as 5 parts per million (ppm), no occupational standard was developed at that time.

Human health effects were not noted until 1977, after a small group of workers began to wonder if their occupational exposure was related to their infertility. Because of the workers' persistence in pursuing this question, NIOSH conducted a health hazard evaluation at the plant, which confirmed that the workers had a high incidence of infertility. Since these workers may also have been exposed to ethylene dibromide and carbaryl, which are known to cause reproductive effects in animals, NIOSH examined workers exposed to each of these chemicals but not to DBCP. The workers without DBCP exposure were found to have sperm counts in the normal range. The reduced sperm counts of the workers correlated well with the number of months the employee had been exposed to DBCP, indicating a possible dose-response relationship.

Further literature searches revealed that a National Cancer Insitute (NCI) study showed DBCP to be an animal carcinogen, and studies from other laboratories showed it to be a relatively potent mutagen. A registry of workers exposed to DBCP has been started to determine whether the testicular toxicity is reversible and to determine if there are any additional long-term human effects.

The Occupational Safety and Health Administration (OSHA) concluded that employee exposure to DBCP presented a grave danger of sterility as well as cancer. OSHA published an emergency temporary standard of 10 parts per billion for DBCP in September 1977 and held public hearings in

December. A final standard of 1 part per billion was issued in March 1978.

These are only a few of the substances known to cause occupational disease. A recent HEW paper suggests that 20 to 38 percent of all cancers may be at least in part related to occupational factors. Through recent observations about the effects of pesticides, such as Kepone and dibromochloropropane (DBCP), and other substances such as lead, we have begun to learn about how occupational exposures affect the reproductive capacities of both men and women. Although the relationship between skin diseases and the workplace has long been recognized, occupational dermatoses continue to be a major problem. The heart, liver, kidneys, and nervous system are known to be affected by various workplace exposure.

Clearly occupational disease is a significant health problem in this country today. Yet, a review of current State and Federal workers' compensation programs shows that most Americans suffering from well-defined occupationally-induced diseases have little recourse for compensation for disabilities acquired over a working lifetime. The cost of occupationally-induced disability is now borne largely by the affected individual worker. The burden of proving that his illness is work-related is also generally borne by the worker. A 1975 survey sponsored by the Department of Labor showed that 20 percent of occupational injury compensation cases and 72.5 percent of occupational disease compensation cases were contested by the industries on grounds that they were not work-related.

Respiratory Disease Report

As mandated by the Black Lung Benefits Reform Act of 1977, NIOSH is working with the Department of Labor on a comprehensive study of all occupationally-related respiratory diseases. To provide a thorough review of the available medical, environmental and epidemiologic data, NIOSH has enlisted the assistance of 20 recognized experts in occupational respiratory disease research. The report, which will be available in July 1979, will assess data used for determining whether a certain respiratory disease is of occupational origin. It will include sections on mineralogy, sampling, epidemiologic study design and criteria for assessing respiratory impairment. Agents will be identified as to whether they definitely, probably, or possibly cause certain respiratory diseases. Industries in which these agents are found will be identified and the populations at risk will be estimated.

Criteria for Diagnosing Occupational Disease

NIOSH has developed considerable information useful for diagnosing occupational disease in conducting our research, technical assistance and manpower development programs. We have developed recommended health standards for some of the most serious occupational health hazards including the examples we focused on today--asbestos, cotton dust, toluene diisocyanate, and dibromochloropropane. Research conducted by NIOSH each year includes about 90 field studies and about 70 studies conducted in our laboratories in Morgantown and Cincinnati. We respond to over 130 requests each year from employers and employees to determine whether substances found in the workplace have potentially toxic

effects. We are funding 11 Educational Resource Centers throughout the country. These Centers are designed to encourage school of occupational medicine, nursing, public health, and engineering to increase the supply of trained safety and health manpower available to recognize and control occupational injury and illness.

Some of the information we have developed that pertains to the diagnosis of occupational disease has been summarized in NIOSH publications, including the "Guide to the Work-Relatedness of Disease" and "Occupational Diseases: A Guide to Their Recognition." The comprehensive guide to diagnosing occupational respiratory diseases will be available this summer.

If NIOSH were to conduct research specifically for the purpose of establishing criteria for diagnosing occupational diseases, we would establish priorities, taking into consideration such factors as the number of workers affected, the seriousness of the disability and the ease of making the determination. Even if we devoted considerable resources to the effort and moved rapidly to translate existing knowledge into recommended standards, we could not develop criteria for all possible occupational diseases. Because of the large number of new chemicals introduced into commerce each year, a continuing effort would be required to keep pace with the potential health effects.

Strategies for Prevention

We have learned that achieving the goal of preventing occupational disease requires a number of different strategies. Establishing Federal exposure standards assures control of hazardous substances in workplaces

that are inspected. Such standards also encourage voluntary compliance among conscientious employers and provide workers with information about required exposure limits. Only a small proportion of workplaces are actually inspected, however, and not all employers respond to this regulatory threat.

Employers might well respond differently to a workers' compensation program that provided adequate coverage for occupational disease and related premiums to the amount of disease caused by exposures found in specific industries or establishments. For example, we are told that the strictest restraint on asbestos use in the United States is not the OSHA standard, but that asbestos users can no longer get adequate insurance coverage. Without insurance, virtually no one will use this hazardous material.

Workers compensation coverage of occupational disease should encourage prevention in other ways. It is worth noting that the control of asbestos exposure is coming now, many years after scientists recognized the hazard. It is coming because of worker and public pressure. The recognition of occupational diseases in workers' compensation programs should foster public awareness of the problem. It will mean that the medical community is asked to consider occupational causes of disease--something that is uncommon today.

Much has been said about the high costs to industry and ultimately to the consumer of instituting more stringent occupational safety and health standards. Much will be said about the costs of developing a more comprehensive workers' compensation system. However, if the total

costs of occupational diseases were clearly identified and borne by employers, we believe they would find it less costly to limit workplace exposures to levels that would protect workers.

Mr. Chairman, we will be pleased to answer any questions that you or members of your Subcommittee may have.