DEPARTMENT OF HEALTH & HUMAN SERVICES

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BEFORE THE
SUBCOMMITTEE ON LABOR STANDARDS
HOUSE COMMITTEE ON EDUCATION AND LABOR

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I am Mr. Ronald Coene, Acting Director of the National Institute for Occupational Safety and Health (NIOSH). I am accompanied by Dr. John Froines, Deputy Director of NIOSH, Dr. James Merchant, Director of NIOSH's Division of Respiratory Disease Studies, and Dr. Kenneth Bridbord, Director of NIOSH's Office of Extramural Coordination and Special Projects. Drs. Merchant and Bridbord are widely recognized experts in the fields of occupationally-related respiratory disease and cancer, respectively.

As you know, NIOSH is the single national research agency mandated to conduct research on occupational safety and health. Established by the Occupational Safety and Health Act of 1970, NIOSH is part of the Centers for Disease Control of the Public Health Service, within the Department of Health and Human Services. Its mandate is to conduct research, to develop recommendations for occupational safety and health standards, to provide technical assistance to employees and employers, and to conduct training and education programs. NIOSH has similar responsibilities to protect the health of miners under the Federal Coal Mine Health and Safety Act of 1969 as amended by the Federal Mine Safety and Health Amendments Act of 1977.

According to the Occupational Safety and Health Act, NIOSH recommendations for standards are to "describe exposure levels that are safe for various periods of employment, including but not limited to the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience." (PL 91-596, Section 20(a)(3)).

NIOSH is a public health agency. Its recommendations for standards are based on health considerations. Although it does provide information on technological feasibility of implementing its health recommendations, the agency is not charged with performing analyses of economic impacts of recommended standards. Thus, our testimony will focus on health effects.

The committee has centered specific attention on OSHA's carcinogen and cotton dust standards. I will turn to these subjects now.

OCCUPATIONAL CANCER

Cancer has long been a dreaded disease throughout the world. In the United States alone over 600,000 new cancer cases develop annually, and over 370,000 persons die from cancer each year--over 1000 every day. One in four persons in this country will suffer from cancer during his or her lifetime.

The National Center for Health Statistics has estimated that by 1977 the Nation was spending $5.5 billion each year on hospital care and physicians' services for cancer patients. Expected earnings of people who died of cancer that year had a value of $14.6 to $18.5 billion. Additional costs, such as outpatient therapy and other treatment-related fees, may raise the direct annual expenditures for cancer well into the tens of billions of dollars. In addition to these direct expenditures there are indirect costs, such as the estimated 1.8 million work-years lost annually to the national economy and to family income by unemployed or underemployed cancer victims. The General Accounting Office has estimated that the annual cost of cancer is at least $15 billion, of which $3-5 billion is attributable to direct care and treatment and the remainder to the loss of earning power and productivity.

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

In the 1960's and 1970's the following associations were identified or strengthened: skin cancer with exposure to ultraviolet radiation; a general increase of cancer with employment in chemical laboratories; bladder cancer with the leatherworking industries; lung cancer with employment in coke ovens (workers exposed to coal tar pitch combustion products); and lung cancer with industries involving exposure to bis-chloromethyl ether. In 1974 came the startling revelation that such a commonly used chemical as vinyl chloride caused excesses of angiosarcoma of the liver, and possibly lung cancer and brain cancer. These are examples of recognized occupational cancers; the list continues to grow (see, e.g., Table 1).

Current estimates of the number of cancers due to occupational factors vary widely. The World Health Organization estimates that between 80 and 90 percent of all cancer is environmentally related (including exposures to toxins and lifestyle factors such as smoking and alcohol). Others have suggested that between one and five percent of cancers are related to occupational factors, based on assessments derived from past occurrence.

In 1978, scientists from the National Cancer Institute, the National Institute of Environmental Health Sciences and NIOSH developed a model to estimate the fraction of future cancers in the United States that may be related to occupational factors. Their conclusion was that at least 20 percent of future cancers could be occupationally related. These figures are controversial--they are based necessarily on broad assumptions--and more research is continuing which will help more precisely define this estimate.

The effort is complicated. Many factors may be involved in causation of the disease, and the latency period (the time between exposure and the onset of disease) may be as long as 40 years. The multiplicity of factors which may contribute to cancer allows prevention strategies to address both lifestyles and toxic exposures.

Cancer's long latency period may be preventing us also from knowing now the real prevalence of work-related cases of the disease. Production and widespread use of many carcinogenic and otherwise hazardous substances began significantly only after World War II and has reached very high levels only since the early 1960's (Figure 1). The cancer-causing potential of some chemicals may not be known for many years.

The International Agency for Research on Cancer (IARC), part of the World Health Organization, has identified about 350 specific chemicals as suspect human carcinogens, based on studies in experimental animals and limited human observations. Fewer than 50 have been evaluated as cancer hazards through epidemiologic studies; in fact less than 10 percent of the chemicals in commerce have been minimally tested. To some, the lack of firm data exonerates individual chemicals as causes of cancer. Prudent public health practice, on the other hand, dictates reductions in exposures to suspect substances.

Statistics can tell us the amount of chemicals produced or consumed; they cannot tell us how much we are exposed to or how many of us are exposed. But it is reasonable to assume that with increased production and use, more people come into contact with carcinogens at more points along the line of production, use and disposal. Although industries are certainly cleaner today, other problems such as the effectiveness of protective clothing and equipment continue.

We have developed a number of tables to illustrate the potential magnitude of the occupational cancer problem. Table 1 shows the types of cancers that may result from exposures in a variety of industries, based on recent data. Table 2 gives estimates of workers potentially exposured to 12 industrial carcinogens. These estimates are based on NIOSH's 1974 National Occupational Hazard Survey (NOHS) of 5000 workplaces and 900,000 workers. Table 3 shows certain occupational groups in which cancer rates seem to be excessive, but in which a specific agent has not been identified.

OSHA Carcinogen Standard

As the first generic step in reducing exposures to occupational carcinogens, OSHA issued in January 1980 the carcinogen standard. It establishes a process for identifying and classifying potential carcinogens based on the nature and extent of scientific evidence, according to scientific principles established in the policy. It also provides for priorities-setting and subsequent regulation. NIOSH has provided research expertise and technical assistance in the development of the standard.

Drawn from a larger candidates list, the priority list is divided into two categories. A substance is to be treated as a Category I potential carcinogen if it meets the definition of a carcinogen in humans or in an adequate long-term bioassay of a single mammalian species where certain requirements are met. Category II potential carcinogens are those that meet the requirements of Category I but where the evidence is found to be only suggestive, or where there is not evidence of concordance with a long-term bioassay test. Priorities for rulemaking take into account factors such as the number of employees exposed to the substance and the apparent potency of it.

NIOSH is currently in the second round of reviews for the OSHA carcinogen standard. The first review in 1980 consisted of a technical review of over 100 chemicals to evaluate them for entry on the OSHA candidate list. OSHA has now asked NIOSH to give in-depth review of a number of priority chemicals proposed for Categories I and II. We expect to complete this review in May.

The cancer policy was designed to provide a consistent framework under which the the most harmful substances would be addressed first. Under the past substance-by-substance approach, a number of regulations have been promulgated by OSHA regulating substances as carcinogens (Table 4). The policy was designed to conserve public, scientific and judicial resources, and through prescribed timetables to reduce exposures to substances known or strongly suspected to cause cancer. Basic scientific principles established under the policy are not to be at issue in rulemakings, except in exceptional circumstances. I would note again that prudent public health dictates reduction in exposures to suspect substances.

OTHER OCCUPATIONAL HAZARDS

The heavy attention on occupationally-related cancer should not obscure the fact that workers are also at risk of contracting a wide variety of non-malignant occupational diseases and disorders. Workplace exposure to toxic chemicals and hazardous substances and physical agents (such as noise) may affect workers' skin, their respiratory and nervous systems, and their ability to produce healthy, normal children.

Large numbers of workers are exposed to many potentially hazardous substances and physical agents. According to data from the 1974 NIOSH National Occupational Hazard Survey, over four million workers are potentially exposed to continuous noise, and about 1.5 million each to benzene and lead. Extrapolating from overall NOHS data, we can conclude that 20-30 million workers are potentially exposed to products that contain one or more OSHA-regulated substances. About 70 percent of these substances are trade name products.

Occupational Respiratory Disease

There are three important routes by which industrial substances can enter the worker's body: inhalation, skin contact, and ingestion. Inhalation is by far the most important of the three. Of the estimated 400,000 cases of occupational disease reported each year, more than half are respiratory diseases. Inhalation of toxic chemicals and other hazardous substances in the workplace can lead to irritation, inflammation, allergic reactions, edema, emphysema, fibrosis, or cancer. Coal worker's pneumoconiosis; asbestosis; byssinosis (or brown lung); and silicosis are the most important non-malignant occupational respiratory diseases.

It is difficult to determine how many workers are at risk of contracting occupational respiratory diseases. At minimum, the task requires accurate estimates of the number of workers employed in individual industries and accurate characterization of their working environments. These figures are difficult to discern from the limited data sources available in the United States. However, based on NOHS and other data, and making the broad assumption that all production workers in a given industry are potentially at risk, NIOSH estimates that 38 million working Americans are exposed to respiratory disease hazards.

Accurate statistics for occupational disease incidence are even more difficult to obtain than estimates for populations at risk. While we have reasonably good estimates of the prevalence of coal workers' pneumoconiosis, our estimates for other diseases depend on epidemiologic studies which are not always representative of the whole industry under investigation. However, such studies have allowed general estimates for the prevalence of silicosis, asbestos-related diseases, respiratory cancers, and byssinosis.

Cotton Dust

Byssinosis, or brown lung disease, is an acute and chronic airways disease that occurs in cotton workers. It was first described by Ramazzini early in the eighteenth century. Since then extensive research on the disease has been conducted abroad and more recently in the United States.

In the United States, over 300,000 workers are significantly exposed to cotton dust and many more are potentially at risk. At least 35,000 workers are permanently disabled. Those exposed work primarily in the textile industry, but also in cotton ginning and warehousing, classing offices, cotton seed oil and delinting mills, bedding and batting manufacturing, and cotton waste utilization industry.

Although the agents which cause byssinosis have not been chemically defined, it is known that they occur in the plant fragments rather than in the cotton lint. Several theories on etiological agents and their mechanisms of action have been put forward. It is now apparent that there are likely several individual etiological agents and a complex series of cellular, pharmacological and physiological events occurring in both the acute and chronic forms of the disease.

Early pathological observations described non-specific chronic bronchitis and emphysema, which was more severe in those working at dusty jobs. Cor pulmonale, failure of the right side of the heart caused by lung disease, was judged the cause of death in several of these cases. More extensive recent studies of lungs of those with byssinosis have found pathological evidence of chronic bronchitis to be the major lesion.

Depending upon individual susceptibility and other risk factors such as smoking, the acute effects of cotton dust exposure may first occur within months or after many years of dust exposure. Individuals with a history of asthma will often experience a severe asthma attack with first exposure to cotton dust. These individuals, therefore, often move out of jobs involving cotton dust exposure. Researchers have also noted that workers with poorer health tend to give up mill work for jobs in less dusty areas. This so-called "healthy worker effect" may confound efforts to estimate the true seriousness of the disease.

The health effects of cotton dust manifest in two inter-related forms. Early in the course of the disease, only acute dust effects are observed.

These consist of a sensation of chest tightness which characteristically occurs on Monday following a weekend away from dust exposure. This tightness, sometimes described as "heaviness" or as a "chest cold," usually begins two or three hours after exposure. Often associated with this chest tightness is a cough and sometimes shortness of breath. Although a good deal of individual variability is recognized, strong group correlations have been found between Monday chest tightness and decreased lung function over the Monday work shift.

With longer exposure to cotton dust, chest tightness and decreased lung function over the work shift may be observed on other workdays. At this point, lung function away from dust exposure is usually decreased and the disease has entered the chronic stage. Among those severely affected, chest tightness and shortness of breath occurs every workday with relief occurring only on weekends and holidays. Objective measurements of lung function in these individuals often shows a drop in lung function over the work shift of 20 percent or more.

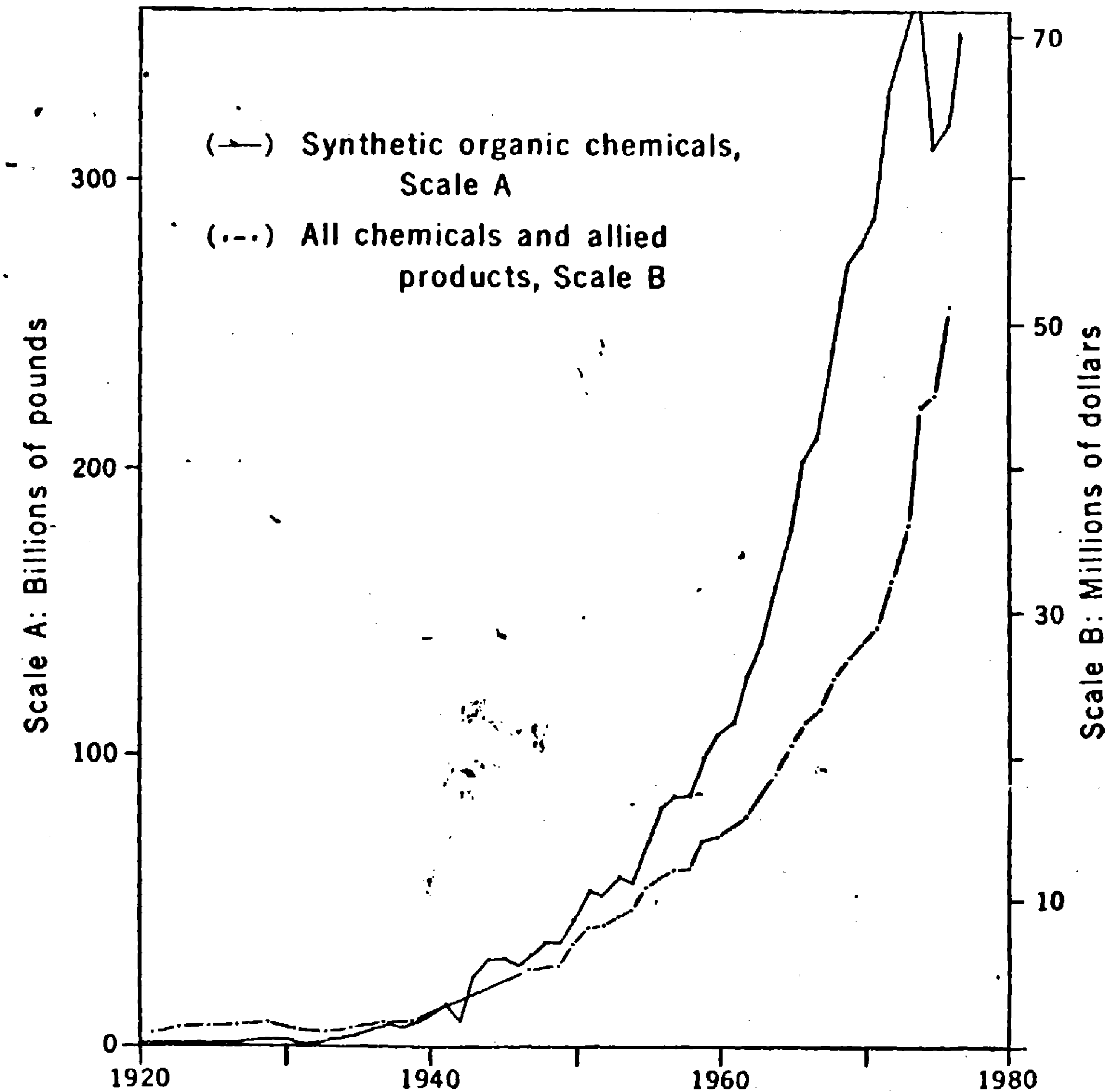
Epidemiologic studies have taught us a great deal about the health effects of cotton dust exposures. Assessment of duration of exposure to cotton dust has shown that a significant number of workers became symptomatic within the first five years of employment. Early mortality studies also reveal marked excesses in death rates in higher age groups, particularly for bronchitis and pneumonia and particularly among those exposed at dustier jobs. More contemporary studies of cotton dust textile worker mortality have been difficult, but increases in respiratory deaths with increasing duration of cotton dust exposures have been observed.

NIOSH has recently completed a review of Social Security disability data for textile workers. As previously reported, consistent increased rates of disability claims for respiratory disease, especially among those working in dustier areas, were observed. These results are consistent with those reported by Bouhuys. In an important and unique study of a textile mill community, Dr. Bouhuys found that of those retiring before age 65, 18 percent gave chest symptoms as the primary reason. Significantly higher proportions of textile workers compared to non-textile worker controls were found to be severely impaired. Based on this data, Dr. Bouhuys has been able to estimate that there are at least 35,000 men and women, within or retired from the U.S. cotton textile industry, suffering from severe lung impairment associated with their work.

Epidemiologic studies of textile workers currently employed have allowed critical examination of disease prevalence and important risk factors, associations, and interactions. Respirable cotton dust has repeatedly been found to be strongly correlated with byssinosis prevalence and acute changes in lung function on Monday. Based on these data, OSHA promulgated a standard setting specified permissible exposure limits. Although exposures at these levels will not prevent all early cases of byssinosis, reduction of exposures to these levels will prevent clinically significant cases of cotton dust induced chronic airways obstruction.

As a result of the cotton dust standard, changes have been made by the textile industry. We are aware of a number of small mills which are now in complete compliance with the provisions of the standard. At least one large corporation has achieved 90 percent compliance with the permissible exposure limit, through the use of new equipment which has streamlined processes and through attention to exhaust ventilation and filtration of fine dust.

FIGURE 1



(—) Synthetic organic chemicals, Scale A
(·-·) All chemicals and allied products, Scale B
Scale A: Billions of pounds
Scale B: Millions of dollars
300
200
100
0
70
50
30
10
1920
1940
1960
1980

Table 1

Recent Epidemiologic Studies Suggestive of a Relationship Between Occupation and Cancer

Type of Cancer	Occupation/Industry/Exposure	Reference
Prostate	Rubber and Tire Workers	Goldsmith, Smith and McMichael, 1980
Bowel and Rectum	Paint and Coatings Manufacturing	Morgan, Kaplan and Gaffey, 1981
Stomach, Brain, Leukemia and Multiple Myeloma	Petroleum Refining and Petrochemical Plants	Thomas, Decoufle and Moure, 1980
Respiratory System	Welders, Shipfitters and Metal-Trades Workers	Beaumont and Weiss, 1980
Soft-Tissue Sarcomas	Phenoxyacetic Acids and Chlorophenols	Hardell and Sandstrom, 1979 Honchar and Halperin, 1980
Stomach Cancer and Leukemia	Ethylene Oxide, Ethylene Dichloride	Hogstedt et al.,1979 Hogstedt, Malinqvist and Wadman, 1979
Malignant Lymphoma, Lung Cancer and Pancreas	Aluminum Reduction Plant Workers	Milham, 1979
Lymphatic Leukemia	Rubber Workers	Wolf, Andjelkovich, Smith and Tyroler, 1981
Lung/Bronchus, Esophagus and Lymphatic/Hematopoietic	Plumbers and Pipefitters	Kaminski, Geissent, and Dacey, 1980
Brain Cancer	Petrochemical Workers	Alexander et al., 1981
Choroidal Malignant Melanoma	Chemical Workers	Albert et al., 1980
Kidney and Genitals	Female Laundry and Dry Cleaning Workers	Katz and Jowett, 1981

Table 1, cont.

Type of Cancer	Occupation/Industry/Exposure	Reference
Lung and Uterine Cervical Cancers	Laundry and Dry Cleaning Workers	Blair et al., 1979
Bladder Cancer	Leather and Leather Products Manufacturing	Decoufle, 1979
Lung Cancer	Spray Painters/Zinc Chromate Primer-Paints	Dalager, 1980
Digestive Organs and Lungs	Smelter and Battery Plant Workers/ Lead	Kang et al., 1980
Lung Cancer	Manufacture and Packaging of Inorganic Arsenic Pesticides	Mabuchi et al., 1979
Respiratory Cancer	Arsenic-Exposed Workers	Pinto et al., 1978
Lung Cancer	Beryllium	Cole and Merletti, 1980
Prostate, Kidney and Lung	Cadmium	Cole and Merletti, 1980
Lung Cancer	Automobile Manufacture (Casting and Plating)	Silverstein et al., 1981

Table 2

NIOSH ESTIMATED FULL AND PART TIME POTENTIAL EXPOSURES TO 12 INDUSTRIAL IARC CARCINOGENS

Compound	NIOSH NOHS ESTIMATES OF PEOPLE EXPOSED IN U.S. — Full and Part Time Exposures	Full Time Exposures
Acrylonitrile	374,345	55,706
Carbon Tetrachloride	1,380,232	64,023
Chloroform	215,000	96,769
Ethylene Oxide	144,152	107,455
Arsenic	255,277 432,017 (arsenic oxides)	5,926 596
Asbestos	1,280,202	449,960
Benzene	1,495,706	147,604
Beryllium	855,189 (oxides)	632
Cadmium	1,376,871 (oxides)	38,433
Chromium and certain chromium compounds	1,451,631 (oxides)	59,946
Nickel and certain nickel compounds	1,369,278 (oxides)	51,840
Vinyl chloride	239,375	29,838

Table 3

OCCUPATIONAL GROUPS IN WHICH EXCESS CANCER INCIDENCE HAS BEEN REPORTED WITHOUT IDENTIFICATION OF A SPECIFIC ETIOLOGIC AGENT

Occupational Groups	Cancer Site(s)	Percent Excess Reported	Ref.
Coal Miners	Stomach	40	Rockette, H.E. 1977
Chemists	Pancreas, lymphomas	64 79	Li, F.P. et al. 1969
Foundry Workers	Lung	50-150	Koskela, Riita-Sisko et al. 1976 and Gibson, E.S. et al. 1977
Textile Workers	Mouth and pharynx	77	Moss, E. and Lee, W.R. 1974
Printing Pressmen (newspaper)	Mouth and pharynx	125	Lloyd, J.W. et al. 1977
Metal Miners	Lung	200	Wagoner, J.K. et al. 1963
Coke by-product Workers	Large intestine, pancreas	181 312	Redmond, C.K. et al. 1976
Cadmium Production Workers	Lung, prostate	135 248	Lemen, R.A. et al. 1976
Rubber Industry			
Processing	Stomach, leukemia	80 140	Monson, R.R., and Nakano, K.K. 1976
Tire Building	Bladder, Brain	88 90	Monson, R.R., and Nakano, K.K. 1976
Tire Curing	Lung	61	Monson, R.R., and Nakano, K.K. 1976
Furniture Workers	Nasal cavity and sinuses	300-400	Acheson, E.D. 1976
Shoe Workers	Nasal cavity and sinuses,	700	Acheson, E.D. 1976, and Brinton, L.A. 1977
	leukemia	100	Aksoy, M. et al. 1974
Leather Workers	Bladder	150	Cole, P., and Goldman, M.B. 1975

Table 4

SUBSTANCES REGULATED AS CARCINOGENS BY OSHA

Substance	8-hr Time-weighted Average Exposure Standard
Asbestos	2 fibers per cc (longer than 5 micrometers)
4-Nitrobiphenyl*	None
alpha-Naphthylamine*	None
Methyl chloromethyl ether*	None
3,3'-Dichlorobenzidine (and its salts)*	None
bis-Chloromethyl ether*	None
beta-Naphthylamine*	None
Benzidine*	None
4-Aminodiphenyl*	None
Ethyleneimine*	None
beta-Propiolactone*	None
2-Acetylaminofluorene*	None
4-Dimethylaminoazobenzene*	None
N-Nitrosodimethylamine*	None
Vinyl chloride	1 ppm
Inorganic arsenic	10 ug/m^3
Benzene	10 ppm
Coke oven emissions	150 ug/m^3
1,2-dibromo-3-chloropropane	1 ppb
Acrylonitrile	2 ppm

* Promulgated as one regulation

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15. Supplementary Notes the National Institute for Occupational Safety and Health

16. Abstract (Limit: 200 words) ~~This~~ testimony concerned the efforts of NIOSH in the area of cancer and respiratory disease. The number of recognized occupational carcinogenetic substances was long and continued to grow. The effort to identify these hazardous elements in the work place was complex as many of the agents work in concert with others, ~~clouding the picture of cause and effect. Individual lifestyles also played a part.~~ The long latency period of cancer in the human body has prevented us ~~also~~ from knowing ~~now~~ the real prevalence of work related cases of the disease. Very high levels of production of many of these toxic chemicals have only occurred since the 1960s. ~~While there has been a large amount of attention focused on occupationally related cancer, this should not obscure the fact that~~ workers are also at risk of contracting a wide variety of nonmalignant occupational diseases and disorders such as respiratory disease. Inhalation was by far the most important route ~~by which~~ of industrial substances ~~could~~ enter the worker's body. Such inhalation could result in irritation, inflammation, allergic reactions, edema, emphysema, fibrosis, or cancer. The most important nonmalignant occupational respiratory diseases included coal worker's pneumoconiosis, asbestosis, byssinosis, and silicosis. Offending agents include cotton dust, coal dust, asbestos (1332214) fibers, and silica (14808607) dust. Recent epidemiologic studies suggestive of a relationship between occupation and cancer were listed.

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