APPENDIX A
Sources of Data

Address and Employment Data File, MSHA

The Address and Employment Data File includes MSHA's most current information regarding operational status of commercial mines in the U.S., including address for purposes of correspondence and contact and the number of workers employed in both production and administration activities. The data are reported to MSHA by mine operators. MSHA provides the Address and Employment Data File to NIOSH on a quarterly basis.

For more information, contact: MSHA, Division of Mining Information Systems, Safety and Health Technology Center, PO Box 25367, Denver Colorado, 80225.

Annual Reports of Occupational Injuries and Illnesses, BLS

The Bureau of Labor Statistics (BLS) program of Occupational Safety and Health Statistics is mandated by the Occupational Safety and Health Act of 1970. The BLS Office of Occupational Safety and Health Statistics maintains a nationwide employer record keeping system on job related injuries and illnesses, annually compiles data from these records, analyzes the results, and reports supplementary statistics from other sources. The annual survey, done in cooperation with participating State agencies, eliminates duplicate reporting by employers and ensures maximum comparability of data.

Data are collected by mail from a sample of approximately 280,000 establishments each calendar year. Nearly all industries in the private sector (employers covered by the Occupational Safety and Health Act of 1970) are included. National estimates of incidence rates for injuries and illnesses, by industry, are developed from the collected data.

A limitation of the summary statistics is the under-count of chronic diseases. Diseases with a long latency are often not detected by the survey system. Also the annual survey excludes: the self-employed; farmers with fewer than 11 employees; private households; and employees in Federal, state, and local government agencies.

For more information refer to: Occupational Injuries and Illnesses in the United States by Industry, 1991: U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 2424, U.S. Government Printing Office, Washington, D.C. 1993.

Coal Workers' X-ray Surveillance Program, NIOSH

The Coal Workers' X-ray Surveillance Program (CWXSP) was mandated by the Coal Mine Health and Safety Act of 1969. Currently, the Division of Respiratory Disease Studies, NIOSH, administers the Program. The primary objective of the CWXSP is to screen miners for coal workers' pneumoconiosis (CWP). Miners who show signs of CWP on their chest radiographs are offered the option to transfer to an area of the mine with a respirable coal mine dust level of 1 mg/m^3 or less.

The population eligible for participation in the screening program includes all working underground coal miners, estimated at approximately 80,000 in 1991. Information collected includes a posterior/anterior chest x-ray and ancillary information: miner age, tenure, and specific job in the mine. Data has been collected since 1970.

Miners employed since 1970 must have a chest radiograph at the time of hire and again 3 years later. Subsequently, working coal miners may volunteer for radiographs at approximately 5-year intervals. The chest x-rays are taken at no cost to the miners.

The chest films are interpreted by physicians or radiologists who are certified by NIOSH as proficient in use of the International Labour Office (ILO) system for classifying radiographs of

pneumoconioses. Each film is seen by at least two readers, and a consensus rule is used to reach a final determination for each film. The CWXSP defines CWP as small opacity profusion category of at least 1/0 or large opacities (i.e., larger than one centimeter) consistent with pneumoconiosis.

The CWXSP is a unique federally mandated occupational health screening program. The large number of chest x-rays (over 350,000) collected since 1970 provide a means of monitoring the incidence and prevalence of CWP since the respirable coal mine dust standard has been in effect.

Coal miner participation rates have decreased since 1970 to less than 50% of coal miners. Recent programs have been implemented to reverse this trend. Overall crude prevalence estimates may reflect over-representation of newly employed miners. Except for the lowest tenure category, tenure specific prevalence estimates may be biased due to selective participation. Thus, CWXSP data should be used with caution in relating to the entire coal mine work force.

For more information contact: Examination Processing Branch, Division of Respiratory Disease Studies, NIOSH, 944 Chestnut Ridge Road, Morgantown, WV 26505-2888. (304) 291-4301.

Informational Reports on Mining, MSHA

The Mine Safety and Health Administration (MSHA) informational reports review occupational injury and illness experience of United States miners for each year. Data are available from 1970 to the present. Data reported by mine operators include work location, occupation, and commodity mined. Related information on employment, work time and operating activity is also presented. Estimates of the average workforce are tabulated by state and mining activity. Data reported by contractors performing certain work at mining locations are reported separately.

Data reported by mine operators is mandated by the Federal Mine Safety and Health Act of 1977. Operators subject to the Act are required to submit reports of all injuries, occupational illnesses, and related data.

Incidence rates and severity measures are not calculated for reported occupational illnesses, but reported illnesses are enumerated for each work location, commodity being mined, and State.

For more information refer to: Injury Experience in Coal Mining, 1991, U.S. Department of Labor, Mine Safety and Health Administration, Information Report, IR 1189, 1991. U.S. Government Printing Office, Washington, D.C. 20402. See analogous reports for other sectors of the mining industry.

Integrated Management Information System, OSHA

The Integrated Management Information System (IMIS) includes most of the industrial hygiene sampling data from Occupational Safety and Health Administration (OSHA) compliance inspections. The data are reported to OSHA by their field compliance officers. OSHA provides the IMIS to NIOSH on an annual basis.

For more information contact: OSHA, Office of Management Data Systems, 200 Constitution Avenue, NW, Washington, D.C. 20210.

Mine Inspection Data Analysis System, BOM

The Mine Inspection Data Analysis System (MIDAS) was developed by the Bureau of Mines to analyze the records of industrial hygiene samples collected by the Department of Labor's Mine Safety and Health Administration (MSHA).

APPENDIX A
Sources of Data

Data in MIDAS include both personal exposure samples and area samples. Personal samples measure the exposure of a person to a contaminant over a period of time, and are usually obtained by attaching a sampling device to the worker. Area samples are usually obtained by placing a stationary sampling device in a location for a period of time. The MIDAS data used in this report came from non-coal mines (also known as metal/nonmetal mines) and were obtained by MSHA field inspectors. The MSHA dust collection program is broad-based and does not focus on all specific types of dust. As a result, the asbestos samples gathered each year are neither representative of miners' exposures nor worst-case conditions.

MIDAS contains several categories of respirable dust data. This report focuses on the 35,980 records of "respirable quartz" data for the years 1982-1991. MIDAS contains an additional 33,896 records of respirable dust data for those same years with less than 1% respirable quartz. While quartz exposures are not quantified in those records, quartz overexposures would be unlikely for such a low percentage of quartz.

For more information refer to: Watts WF, Johnson RL, Donovan DJ, Parker DR. An Introduction to the Mine Inspection Data Analysis System (MIDAS). Bureau of Mines, IC 8859, 1981.

Multiple Cause of Death Data, NCHS

Since 1968, the National Center for Health Statistics NCHS) has coded all conditions listed on death certificates. The data are released annually on public use computer tapes. This allows researchers to evaluate the interaction of diseases in causing death and also is useful in determining the number of deaths in which specific diseases play a contributing role.

Previous to the availability of multiple cause of death data, cause of death studies focused on underlying cause of death. Underlying cause of death is defined as the disease or injury that initiated events leading to death. Statistics based on underlying cause of death do not fully consider the influence of diseases which contribute to cause of death.

NCHS codes all deaths in the United States (approximately two million annually) that are reported to vital registration offices. Data coded for each decedent includes residence, age, race, sex, and ethnicity (since 1984). The usual occupation and industry of each decedent are available for some states from 1985 through 1990. (See Appendix C.)

Limitations of multiple cause of death data include: under- or over-reporting of conditions on the death certificate by certifying physicians and incomplete/unclassified reporting of occupation and industry.

For more information refer to: Vital Statistics of the United States, 1990, Vol. I, DHHS Pub. No. (PHS) 91-1100 and Vol. II, Part A, DHHS Pub. No. (PHS) 92-1101, Public Health Service, National Center for Health Statistics. U.S. Government Printing Office, Washington, D.C. 20402.

National Health Interview Survey (1988 Occupational Supplement), NCHS

The National Health Interview Survey (NHIS) is a major data collection program administered by the National Center for Health Statistics and is regarded as a principle source of information on the health of the noninstitutionalized civilian population of the United States. The survey was mandated by The National Health Survey Act of 1956 to provide for a continuing survey to collect information on illness and disability in the United States. The NHIS was initiated in July of 1957 and has been conducted on an annual basis. The NHIS questionnaire consists of two parts: a set of basic health and demographic questions that are repeated each year of the survey, and

one or more supplemental sections that focus questions on specific current health topics. Data are collected via household interviews that are conducted each week throughout the year using a probability sample. The interviewing is performed by permanent staff interviewers employed by the U.S. Bureau of the Census. It should be noted that persons in long-term care facilities, persons on active duty in the Armed Forces and U.S. nationals living in foreign countries are excluded from the survey because of technical and logistical problems.

In 1988, the National Health Interview Survey contained a special section called the Occupational Health Supplement. The goal of this special supplement was to obtain detailed information on respondent work histories, common work-related health problems, workplace injuries and smoking status. This is the special section from which the National Health Interview Survey tables in this report are derived. Emphasis is placed on the longest held occupation reported by those who have ever worked.

For more information refer to the following publications: 1) Adams PF, Hard AM. Current estimates from the National Health Interview Survey: United States, 1988. National Center for Health Statistics. Vital Health Stat 10(173). 1989; and 2) Massey JT, Moore TF, Parsons VL, Tadros W. Design and estimation for the National Health Interview Survey, 1985-94. National Center for Health Statistics. Vital Health Stat 2(110). 1989.

National Hospital Discharge Survey, NCHS

The National Hospital Discharge Survey (NHDS) is conducted yearly by the National Center for Health Statistics (NCHS) and collects data on the use of short stay non-Federal hospitals in the United States. Data collected from the survey includes information on patient's age, race, sex, ethnicity (since 1985), marital status, length of stay, source of payment (since 1977), diagnoses and surgical procedures, hospital size, ownership, and region of the United States. Diagnoses are coded according to ICD-8 coding system (1970-1978) and ICD-9 coding system (1979-1991).

Since 1964 several sampling methods have been used. In 1991, data were abstracted from approximately 180,000 records from 400 hospitals. Only hospitals with six or more beds for patient use and those in which the average length of stay for all patients is less than 30 days are included in the survey. One of the limitations of National Hospital Discharge Survey data is that it represents number of discharges, not number of patients. In addition, information is available by region and not by state. Also, information is based on physician diagnostic practices and depends on the completeness of medical records.

For more information refer to the following publications: 1) National Center for Health Statistics, E.J. Graves: Utilization of Short-stay Hospitals, United States, 1990, Annual Summary; and 2) Vital and Health Statistics. Series 13, No. 113. DHHS Pub. No. (PHS) 92-1774. Public Health Service. U.S. Government Printing Office, Washington, D.C 20402. June 1992.

National Occupational Health Survey of Mining, NIOSH

The National Occupational Health Survey of Mining (NOHSM) was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the request of the Mine Safety and Health Administration (MSHA)(1,2). The NOHSM inventoried and characterized health-related agents to which U.S. miners are potentially exposed. The term "potential exposure" means that a health-related agent was observed to be present at a miner's work site but the level of the exposure was not measured. The health-related agents observed by NIOSH during the NOHSM included generic chemicals and trade name products, physical agents, musculoskeletal

overload conditions, welding-related processes, and bulk dust.

A representative sample of mines (491) from 66 different mineral commodities was surveyed during the period of May 1984 through August 1989. Each survey included interviews with workers and work site observations to determine the health-related agents associated with their work. Bulk dust samples were gathered during the NOHSM as a means of characterizing dust exposures. Each bulk dust sample was associated with a number of miners in the vicinity of the sample location.

For more information refer to: Groce DW, Carr WG, Hearl FJ. The National Occupational Health Survey of Mining. Annals of the American Conference of Governmental Industrial Hygienists. 1986; 14:327-335.

Occupational Disease Surveillance Database, AOEC

The Association of Occupational and Environmental Clinics (AOEC) has developed a unique surveillance database for a broad range of occupational diseases and cumulative injuries. The development of this Occupational Disease Surveillance Database has been supported in part by funding from the National Institute for Occupational Safety and Health (NIOSH). In addition, AOEC member clinics, clinicians, and staff have volunteered their efforts to contribute case-report data to this project and to provide database direction and oversight.

A total of thirteen AOEC member clinics (as of December 1992) have reported cases of occupational or environmental disease or injury to this surveillance system. One of these clinics is no longer an active participant in the database project. For inclusion in the database, a case must have at least one condition diagnosed which, in the physician's judgement, is more likely than not to be related to occupational or environmental exposure(s). This criterion was established jointly by AOEC Database Committee members and NIOSH.

Just past the pilot phase, and currently operated with a minimal funding base and the volunteer efforts of many clinics, the AOEC database is a relatively small surveillance system. Case reports from a few clinics still dominate the database. At this time, the case data cannot be considered a representative sample of either cases seen in all AOEC clinics, or of occupational disease in the U.S. The AOEC database is, however, expanding to include data from many more clinics, and will continue to provide a valuable source of surveillance data.

For more information contact: Association of Occupational and Environmental Clinics, 1010 Vermont Ave., NW, #513, Washington, D.C. 20005. (202) 347-4976.

Quartz Reference Standard

For information regarding the quartz reference standard contact: Laboratory Division, Denver Technical Support Center, Mine Safety and Health Administration, PO Box 25367, Denver, CO 80225.

Respirable Coal Mine Dust Data, MSHA

These data were obtained from MSHA, and provide indications of the respirable dust levels found by MSHA inspectors at surface and underground coal mines. The data provided to NIOSH from MSHA includes the mine at which the sample was obtained, date of the sample, mining method associated with the sample, dust concentration, production level during sampling, and occupation associated with the sample. For the purposes of this report, NIOSH has used the date and concentration information from each record.

The "MRE" designation was adopted by MSHA to indicate that the sampling instruments were to have roughly the same collection efficiencies for respirable particles as the horizontal elutriators on which the British standards have been based. The MSHA dust samples are obtained by drawing air through a filter at the rate of 2 liters per minute, with a 10 millimeter nylon cyclone used to extract non-respirable particles prior to the filter. The dust weight collected on the filter is multiplied by 1.38 to complete the conversion to "MRE" units.

For more information, contact: Mine Safety and Health Administration, Safety and Health Technology Center (Pittsburgh), Dust Division, PO Box 18233, Pittsburgh, PA 15236.

Respirable Coal Mine Quartz Dust Data, MSHA

These data were obtained from MSHA, and provide indications of the respirable quartz levels found by MSHA inspectors at surface and underground coal mines. Prior to 1988, the quartz analyses were performed on respirable dust samples for known high risk occupations. In 1988, MSHA began a program to determine the quartz content of samples collected on other occupations, as well. The data provided to NIOSH from MSHA includes the mine at which the sample was obtained, date of the sample, sampling time, initial and final weights, percent quartz, production level during sampling, and occupation associated with the sample.

For more information, contact: Mine Safety and Health Administration, Safety and Health Technology Center (Pittsburgh), Dust Division, PO Box 18233, Pittsburgh, PA 15236.

Social Security Administration Disability Awards

The Coal Mine Health and Safety Act of 1969, made comprehensive legislative efforts to deal with pneumoconiosis among coal miners. Under Title IV of the Act, a benefits program was established for coal miners. The program consisted of a cash benefit program for miners totally disabled because of pneumoconiosis arising out of employment in underground coal mining, and for the widows of coal miners whose death resulted from the disease or who were entitled to black lung benefits at the time of death. The Social Security Administration was delegated responsibility for the operation of the benefits program. The Black Lung Benefits Act of 1972 made changes in the program, designating to the Social Security Administration continued responsibility for payments to miners who were granted claims before July 1973. The Department of Labor was designated responsibility for claims filed after July 1973.

Other significant changes brought about by the 1972 Act were to extend eligibility for benefits to surface coal miners, and to extend benefits to surviving children of miners. This provision allowed children to receive benefits if both parents were deceased, or if a widow ceased to qualify for benefits through remarriage.

For more information refer to: 1) Social Security Bulletin, Annual Statistical Supplement, 1992. SSA Pub. No. 13-11700. U.S. Government Printing Office, Washington, D.C. 20402; and 2) Black Lung Benefits Act, Annual Report on Administration of the Act During Calendar Year 1991. Submitted to Congress, 1992. U.S. Department of Labor, Employment Standards Administration.

The Sentinel Event Notification System for Occupational Risks (SENSOR) Program

General Background

Since October 1987, the National Institute for Occupational Safety and Health (NIOSH) has awarded five-year cooperative agreements to state health departments to develop models for

state-based surveillance of selected occupational diseases and injuries through the SENSOR program. An important component of the SENSOR program is the provision for preventive intervention at worksites identified as potentially hazardous by this sentinel event surveillance. The SENSOR program originated out of a desire to improve capability to collect, analyze, and disseminate data on occupational conditions at the state level. SENSOR began its second five-year funding cycle in October 1992. NIOSH awarded SENSOR co-operative agreements to 14 states for 12 different target conditions and contributed funds to another surveillance program (Adult Blood Lead Surveillance and Epidemiology) which aggregates laboratory reports of elevated blood lead levels in adults from 21 states. Three SENSOR target conditions are occupational respiratory diseases: occupational asthma, silicosis, and work-related tuberculosis. Since 1987, surveillance approaches for occupational asthma and silicosis have been field-tested and refined. In 1992, state activities were initiated to develop a model for work-related tuberculosis surveillance.

SENSOR Silicosis

Silicosis case ascertainment methods vary by state. Hospital reporting, using hospital discharge data or direct hospital reports to the state health department, represent primary case identification sources for Michigan, New Jersey, Ohio, Illinois, Texas, and Wisconsin. North Carolina utilizes a long-established screening program for employees exposed to silica, the North Carolina Dusty Trades Program. In addition, each of the silicosis states except Illinois currently have legislation mandating physician reporting of occupational diseases, including silicosis. North Carolina's legislation became effective January 1, 1994. SENSOR staff from each of the seven states actively solicit occupational disease reports from physicians likely to see silicosis cases, such as pulmonary and occupational medicine physicians and B-readers (physicians trained and certified by NIOSH in the use of the International Labour Office system for classification of radiographs for pneumoconioses). Death certificate data and workers' compensation records are also used to identify silicosis cases in most of the seven silicosis states. State SENSOR staff collect demographic, work history, and medical information about each silicosis case from case-patient interviews, disease reports, death certificates, hospital records, state Department of Labor records, or some combination of these.

The silicosis surveillance guidelines [*MMWR 1990;39;25:433-437*] encourage physicians, including radiologists and pathologists, and other health care providers to report all diagnosed or suspected cases of silicosis. This includes persons with: 1) a physician's provisional diagnosis of silicosis, OR 2) a chest radiograph consistent with silicosis, OR 3) pathological findings consistent with silicosis. Silicosis is considered confirmed for surveillance purposes if: 1) there is a history of occupational exposure to silica, and a chest radiograph or other imaging technique is interpreted as consistent with silicosis, OR 2) pathological findings are characteristic of silicosis. States apply specific exclusion criteria for individuals with occupational work histories involving coal mining.

Prevention efforts vary among the participating State Health Departments, and include some or all of the following activities: 1) interviews with individuals with reported and/or confirmed silicosis; 2) the distribution of literature to cases and physicians regarding the health hazards of silica exposure; 3) State Health Department industrial hygiene investigations with environmental monitoring to measure exposures to airborne respirable silica; and 4) referral to appropriate regulatory agencies (e.g. OSHA or MSHA). In addition to occupational disease newsletters, reports, and educational material, NIOSH and the SENSOR states have published numerous articles on SENSOR-related occupational respiratory disease surveillance. For a listing of these articles, contact the Surveillance Section, Epidemiological

Investigations Branch, Division of Respiratory Disease Studies, NIOSH, 944 Chestnut Ridge Road, Morgantown, WV 26505-2888. (304) 291-4476.

SENSOR Occupational Asthma

California, Massachusetts, Michigan, New Jersey, New York, and Wisconsin currently have legislation mandating physician reporting of occupational diseases, including occupational asthma. SENSOR staff actively solicit reports from physicians in their states who have a high likelihood of encountering patients with occupational asthma, such as allergy, pulmonary and occupational medicine specialists. These physician-generated occupational disease reports represent a primary case ascertainment source for occupational asthma surveillance.

Although the original SENSOR concept was based primarily on physician reporting, other sources of case ascertainment, including hospital discharge data, emergency room data, and workers' compensation data, have been utilized. In addition, California identifies cases through a unique mandatory reporting system, the Doctor's First Report (DFR) of Occupational Injury or Illness, which is tied directly to physician reimbursement procedures.

SENSOR occupational asthma surveillance guidelines [*MMWR 1990;39;7:119-123*] have two distinct components: the "reporting guidelines" and the "surveillance case definition". The reporting guidelines encourage health care providers to report all suspected or diagnosed cases of occupational asthma. This includes individuals with a diagnosis of asthma and an association between symptoms of asthma and work. The surveillance case definition requires meeting the reporting guidelines and one or more of the following work-relatedness criteria: 1) workplace exposure to an agent or process previously associated with occupational asthma, OR 2) significant work-related changes in forced expiratory volume in one second or peak expiratory flow rate, OR 3) significant work-related changes in airways responsiveness as measured by nonspecific inhalation challenge, OR 4) positive response to inhalation provocation testing with an agent to which the patient is exposed at work.

While not specifically addressed by the published occupational asthma surveillance guidelines, the following supplemental case classification scheme was devised to augment the published occupational asthma guidelines:

1) A reported case is considered **possible occupational asthma** if it meets the reporting guidelines and insufficient information or available information indicates it did not meet any of the work-relatedness criteria in the case definition.

2) A reported case is considered reactive airways dysfunction syndrome (RADS) if asthma developed for the first time immediately following an acute exposure to an irritating substance at work.

3) A reported case is considered to have **work-aggravated asthma** if there is a work-related worsening of asthma symptoms in a previously diagnosed asthmatic.

NIOSH and the four current asthma states (California, Massachusetts, Michigan, New Jersey) are revising the published occupational asthma guidelines to explicitly include the supplemental categories listed above (possible occupational asthma, RADS, work-aggravated asthma).

In addition to occupational disease newsletters, reports, and educational material, NIOSH and the SENSOR states have published numerous articles on SENSOR-related occupational respiratory disease surveillance. For a listing of these articles, contact the Surveillance Section, Epidemiological Investigations Branch, Division of Respiratory Disease Studies, NIOSH, 944 Chestnut Ridge Road, Morgantown, WV 26505-2888. (304) 291-4476.

APPENDIX B
Methods

MORTALITY

Number of Deaths

The number of deaths for each of the specific occupational respiratory diseases represents the number of deaths in which the condition was mentioned as underlying or contributing cause of death on the death certificate. The numbers were tabulated from the record axis of the multiple cause of death data tapes (see Appendix A for further information on multiple cause of death tapes). For the period from 1968-1978 all conditions were coded according to the International Classification of Disease, Eighth Revision (ICD-8), while the International Classification of Disease, Ninth Revision (ICD-9) was used for coding from 1979-1990. All deaths were reported for United States residents, 15 years or older, based on state of residence at death. Where race was specifically noted in this report, race classifications were black, white, and all others.

Crude Mortality Rates

The cause-specific crude mortality rates for occupational lung conditions were computed annually for the years 1968-1990 for the United States. To compute rates, the annual total number of deaths, mentioned as either underlying or contributing cause, due to the specified condition in United States residents, 15 years and older, was divided by the United States population, 15 years and older, in the same year. Further restrictions may be placed on the data to compute rates for specific age, race, and sex groups. In this report, the cause-specific crude rate is presented as the number of deaths per million population for a given time period. The state-specific rates for 1989-1990 were computed by dividing the yearly reported deaths in each state by the state population, 15 years and older, in the corresponding year, and then computing a two-year (1989-1990) average.

Age-adjusted Mortality Rates

Age-adjusted mortality rates published in this report were computed by the direct method. Rates were calculated annually for each specified condition from 1968 through 1990. The age-adjusted rates represent the rates that would have been observed if the age-specific rates for a given year, for specified age intervals, had occurred in a population with the same age distribution as that of the standard population. This allows a more valid comparison for trends over time. For this report, the 1940 United States population was used as the standard. The specific age intervals used were 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85 years and older. Rates for the entire U.S. population, and for each sex-race group were adjusted separately, each using the same standard population.

The method of calculation first computed the annual age-specific rate per million population for each age-sex-race group of interest. The product of the age-specific rates and the number in the comparable age-sex-race specific group in the standard population equals the expected number of deaths per million population for each age group. The expected numbers of deaths were then summed over all age groups. The sum of the expected number of deaths was divided by the sum of the standard population and the resulting quotient was multiplied by 1,000,000 to produce the age-adjusted rate.

Years of Potential Life Lost

Years of potential life lost (YPLL) were calculated using the method used at the Centers for Disease Control (CDC) (MMWR, Vol 34/2S: December 19,1986). YPLL were calculated both to age 65 and to life expectancy. YPLL to age 65 may be seen as a loss of years to working life, while YPLL until life expectancy may be seen as a loss of years in the overall life span. For YPLL to age 65, the number of deaths with a mention of the condition of interest were classified into the ten-year age groups mentioned in the section on age-

adjusted mortality rates. The number of deaths in each age group was then multiplied by the difference between 65 years and the mid-point of the age group. Thus for the 15-24 year age group, the number of deaths would be multiplied by 45, (65 minus 20 years). The age- specific YPLL were summed over all age groups for the total value. For YPLL to life expectancy, the single difference was that the calculation was based on the number of deaths in the age-specific group multiplied by the difference between the mid-point of the age group and the life expectancy at that age in that year of death. Life tables published annually by NCHS were used to determine life expectancy.

Proportionate Mortality Ratio (PMR)

The data for PMR analysis were death certificates from 25 states which reported usual occupation and industry codes from 1985 to 1990. (See Appendix C for a list of these 25 states and years reporting.)

PMR was defined as the observed number of deaths from the disease of interest with the specified occupation divided by the expected number of deaths for that disease. The PMRs in the report have been internally age-adjusted. A PMR over 1.00 indicates that there may be an elevated risk of the disease of interest in the specified occupation. For bronchitis and emphysema, PMRs with 95% confidence interval exceeding 1 have been listed. For all other diseases, PMRs have been listed for occupations with at least 3 deaths from the disease of interest, regardless of the confidence interval.

MORBIDITY

Prevalence Rate Ratios

The prevalence rate ratios were computed by dividing the industry-specific prevalence of the disease of interest by the overall prevalence of that disease. The industry-specific prevalence of the disease of interest was computed by dividing the observed number of the disease of interest within the specified industry by the total respondents of that industry. The overall prevalence was computed by dividing the total observed number of the disease of interest by the total respondents excluding data for the specified industry. For disease which typically have long durations (e.g. emphysema), a ratio greater than 1 indicates that there may be an increased risk in the specified industry compared to the combined risk in all other industries. However, the same may not be true for diseases with shorter durations (e.g. lung cancer). The ratios in Table 10-10 are not adjusted for age, race, sex, or smoking status.

Computation of Estimated Number of Workers Potentially Exposed to Silica

Estimates of the number of miners potentially exposed to silica were computed from information in three databases: the National Occupational Health Survey of Mining (NOHSM), the Mine Safety and Health Administration (MSHA) address and employment data, and the MSHA respirable coal mine dust data analyzed for quartz.

The number of miners potentially exposed to respirable quartz was calculated by mining class and by occupation. "Mining class" refers to a grouping of the mineral commodities into one of two groups: coal (anthracite and bituminous) or non-coal (stone, nonmetallic, metallic, and sand and gravel). The estimated percent of the mining work force attributable to each occupation, within the mining class, was estimated from the NOHSM data. During NOHSM, the surveyors recorded the number of workers associated with each occupation at each mine. The estimated number of workers in the current mine labor force for each mining class was determined from the 1991 MSHA address and employment data tapes. The NOHSM percent of work force for each occupation/mining class combination was multiplied by the current mine labor force for each mine class to estimate the current number of miners in each occupation/mining class combination.

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Methods

For the coal mining class only, the estimated number of current miners in each occupation was multiplied by the percentage of the MSHA respirable coal mine dust samples analyzed for quartz which had been found to contain any amount of quartz. The result was the estimated number of workers potentially exposed to respirable quartz in coal mining.

For the non-coal mining class, the estimated number of current miners in each occupation was multiplied by the proportional NOHSM projection factors associated with each mine when the occupation was potentially exposed to quartz through (a) a NOHSM bulk dust sample, (b) a trade named product, or (c) a generic chemical substance known to contain quartz. The data for each class was totalled, by occupation. The result was the number of workers potentially exposed to respirable quartz for each occupation in non-coal mining classes.

It should be noted that these are estimates of potential exposure only (i.e., the presence, but not the exposure level, of quartz has been determined), and do not necessarily reflect actual measurements of exposure. The estimates for non-coal mining are likely to be underestimates, since only a minority of all NOHSM bulk dust samples were analyzed for quartz.

APPENDIX C
Selected states

States reporting industry and occupation codes from death certificates to NCHS, 1985-1990

State	1985	1986	1987	1988	1989	1990
Alaska			X	X		
Colorado	X	X	X	X	X	X
Georgia	X	X	X	X	X	X
Idaho				X	X	X
Indiana		X	X	X	X	X
Kansas	X	X	X	X	X	X
Kentucky	X	X	X	X	X	X
Maine	X	X	X	X	X	X
Missouri	X	X				
Nebraska	X					
Nevada	X	X	X	X	X	X
New Hampshire	X	X	X	X	X	X
New Jersey				X	X	X
New Mexico		X	X	X	X	X
North Carolina			X	X	X	X
Ohio	X	X	X	X	X	X
Oklahoma	X	X	X	X	X	X
Rhode Island	X	X	X	X	X	X
South Carolina	X	X	X	X	X	X
Tennessee	X	X	X	X		
Utah	X	X	X	X	X	X
Vermont		X	X	X	X	X
Washington					X	X
West Virginia				X	X	X
Wisconsin	X	X	X	X	X	X

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