A GUIDE TO THE WORK-RELATEDNESS OF DISEASE

Revised Edition

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Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
January 1979

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This guide is based upon the reports submitted in accordance with NIOSH Contract No. 210-75-0075 (J. E. Osterritter, M.D., Principal Investigator) and NIOSH Contract No. 210-77-0089 (Barbara M. O'Conner and George Christakis, M.D., authors).

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DHEW (NIOSH) Publication No. 79-116

PREFACE

The mission of the National Institute for Occupational Safety and Health (NIOSH) is to protect the health and safety of working men and women. Within the context of its program are NIOSH efforts that are directed toward the identification of those disease conditions that are closely related to or caused by the work environment as a necessary prerequisite to their prevention.

This guide, originally published in part in 1976, has been revised and expanded to reflect new knowledge as well as suggestions submitted by users of the guide. The guide is designed primarily as an aid to state agencies and others concerned with occupational disease compensation. It presents one method for assembling and evaluating evidence that may be relevant in determining the work-relatedness of a disease in an individual. Information on fourteen disease-producing agents is presented to illustrate the decision-making process. It should be noted that such information may not be complete and does not necessarily reflect the most recent data regarding health standards and epidemiologic studies.

NIOSH will welcome suggestions from users of the guide for its improvement.

ABSTRACT

This guide discusses various factors associated with establishing the relationship between disease and occupation. Prepared as an aid to state agencies, physicians, and others concerned with workers' compensation for occupational disease, the publication describes a method for collecting, organizing, and appraising medical, occupational, and other evidence with the aim of determining the probable work-relatedness of a given disease. Illustrative material on fourteen disease-producing agents is included. The guide also contains a list of occupations with potential exposure to selected agents, and other information that may be useful to those with decision-making responsibility in cases of occupational disease.

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ACKNOWLEDGMENTS

We wish to express appreciation to the following members of the advisory committee for their contributions during this program:

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INTRODUCTION

Background

Until this century, suing the employer was the only way for disabled workers or their families to obtain compensation for on-the-job injuries. Under common law, workers had to prove the employer's negligence in order to be compensated for work injuries. The injured worker, because of this narrow interpretation of law, found that compensation through the courts was seldom satisfactory.

By 1920, all but six states had passed workers' compensation statutes that sought to remedy past deficiencies and to avoid costly litigation by making employers responsible for the economic loss to workers due to injuries sustained at work.

Although the new laws established a more equitable compensation system, the system has not kept pace with the substantial changes that have taken place in the last half century in the labor force, in medical knowledge and techniques, and in industrial toxicology. In 1970, Congress established a National Commission on State Workmen's Compensation Laws to reexamine the adequacy of the compensation system in light of these changes. The Commission's published report to the Congress in 1972 lists the objectives of a modern workers' compensation program. Included is a statement that all work-related injuries or diseases should be covered by the compensation system. The report also states that coverage restricted to a list of specified occupational diseases is incompatible with complete protection.

Decision-Making

In order for the compensation system to treat both injury and disease in a uniform manner, disease must be related to the workplace as effectively as injury. For the decision-maker, however, establishing the causality of a disease is often a difficult task, especially when it becomes necessary to decide if an employee's disease resulted from, or was aggravated by, employment-related factors.

In contrast to a traumatic injury, which is readily apparent to the affected employee and to those around him, a cause-effect relationship between disease and an agent or conditions in the workplace may not be clear. Occupational disease may be slow to develop. Symptoms of disease may be confused with changes that are due to the aging process, or with the effects of smoking or alcohol abuse. Additionally, information on past work exposures is often unavailable, inadequate, or incomplete. Not all individuals react in the same way to similar exposures to disease-producing agents. Off-the-job exposures may contribute or be a primary cause of illnesses and accidents. These are but some of the factors which must be considered in the decision-making process.

The decision of the person responsible for determining the work-relatedness of a disease must be based on an evaluation of the available information. When appropriate evidence is presented in a logical and orderly sequence, when major issues are identified, and the basis for any presumption is defined, then the decision-making process is facilitated and an equitable decision is likely to result.

The following text outlines and describes a method for the collection, presentation, and evaluation of medical, occupational, and other evidence of occupational disease; presents selected information on fourteen disease-producing agents to illustrate the methodology; and discusses some problem areas associated with decision-making.

CHAPTER I—AN APPROACH TO DECISION-MAKING

Rationale

In the current workers' compensation system, the end result of the adjudicatory process is a decision that the claimant (employee) has or has not established that he has an occupational disease, that is, a disease condition resulting from, or aggravated by, his employment. In general, a disease is occupational if:

1. The medical findings of disease are compatible with the effects of a disease-producing agent or agents to which the worker has been exposed;
2. there exists in the worker's occupational environment (past or present) exposure to an agent or agents sufficient to have caused the disease; and
3. the weight of evidence supports that the disease is of occupational rather than non-occupational origin.

It would be convenient if a method could be devised which invariably led to a correct and unequivocal descision regarding the presence of an occupational disease. However, it is doubtful that such a system could be developed. A case in which the relationship of an illness to a documented agent exposure is clearly evident is not apt to be contested or to require the mechanism of a formal claims inquiry. The element of judgment is minimal and decision-making is relatively simple.

On the other hand, decision-making may be extremely difficult in many contested claims. Honest differences of opinion are common, "facts" may be subject to different interpretations,

and considerable judgment is necessary when data are lacking or incomplete.

This guide is an effort to define a step-by-step method for assembling and appraising evidence for the purpose of aiding the decision-making process. It is intended to be of particular assistance in cases where the suspected agent is not generally known to produce disease, and in those in which nonoccupational exposures must be considered.

The Method

This guide presents a suggested approach to decision-making that consists of six basic steps:

1. Consideration of evidence of disease,
2. consideration of epidemiologic data,
3. consideration of evidence of exposure,
4. consideration of validity of testimony,
5. consideration of other relevant factors, and
6. evaluation and conclusion.

Each of these steps is discussed fully in subsequent chapters. The importance of individual steps will vary according to the type of agent, the amount and quality of medical and occupational information available, and past experience with similar situations. Occasionally, one or more steps can be omitted. However, with occupational diseases, what appears to be "obvious" is often subject to controversy, and it is important to assemble complete information wherever possible in order to assure an equitable decision.

CHAPTER II—EVIDENCE OF DISEASE

The first consideration in determining the probability of a cause-effect relationship between an illness and an agent at the workplace is to establish:

1. That a disease condition does, in fact, exist, and
2. that the particular manifestations of the disease appear to be the result of exposure to a specific harmful agent.

The medical evidence which may be elicited in the course of the medical evaluation should cover the above points. Generally, a *medical evaluation* should include:

1. An analysis of the employee's medical, personal, family, and occupational histories;
2. a thorough physical examination and clinical evaluation (analysis of signs and symptoms); and
3. a laboratory evaluation (analysis of the results of specific tests).

Medical History

In order to determine the origin of illness, the worker's past medical history must be evaluated by the physician. A routine medical history includes the dates and details of:

—Onset of present illness,
—all previous illnesses (childhood, physical, mental),
—injuries,
—surgical procedures, and
—hospital admissions.

In addition, the medical history should include any details specific to a suspected occupational causative agent.

Personal History

This section of the history should give consideration to:
- —Age, sex, marital status, number of children,
- —name and location of all places of residence since birth,
- —areas visited prior to onset of symptoms,
- —alcohol and tobacco use (how much and how long),
- —medications or drug use (past and present),
- —recreation and hobbies,
- —use of chemicals in the home (cleaning agents, aerosols, etc.), and
- —details specific to a suspected causative agent.

Family History

This section of the history should consider, for each of the worker's parents, siblings, spouse, and children:
- —Age, sex, and health status (if deceased, cause of death), and
- —any chronic or occupational disease in the family or in persons in the worker's household.

Occupational History

The employee's complete occupational history, including military service, is also necessary in determining the origin of illness. The following factors regarding past and present occupations should be evaluated:
- —Job titles,
- —type of work performed (complete listing of actual duties),
- —duration of each type of activity,
- —dates of employment and worker's age for each job activity,
- —geographical and physical location of employment,
- —product or service produced,
- —condition of personal protective equipment used (if any) and frequency and duration of periods of use, and
- —nature of agents or substances to which worker is or has been exposed, if known. Include frequency and average

duration of each exposure situation. (See also Evidence of Exposure, page 11.)

Clinical Evaluation

This portion of the medical examination may vary somewhat with the type of illness but should include at least the following:

1. Routine examination of all physiological systems—
   head and neck
   eyes, ears, nose, and throat
   endocrine
   genitourinary
   musculoskeletal
   neurological
   respiratory
   cardiovascular
   gastrointestinal,
2. observation and evaluation of behavior related to emotional status,
3. specific examination for health effects of suspected or possible disease agents (seek competent medical consultation),
4. comparison of date of onset of symptoms with occupational history,
5. evaluation of results of any past biological or medical monitoring (blood, urine, other sample analysis) and previous physical examinations, and
6. evaluation of laboratory tests: routine (complete blood count, blood chemistry profile, urinalysis) and specific tests for suspected disease agents (e.g., blood or urine test for specific agent, chest or other X-rays, liver function tests, pulmonary function tests).

CHAPTER III — EPIDEMIOLOGY

Epidemiology is the branch of medical science that deals with the incidence, prevalence, distribution, and control of the diseases that occur amongst human populations. It is the study of the distribution and determinants of disease frequency in man.

Epidemiology is concerned, among other things, with measuring the frequency of illnesses and deaths in certain population groups and with the study of the relationship between exposure and incidence of disease. Thus, studies of illness in groups of workers have made it possible to relate some diseases to various substances with which the workers had been in contact. Epidemiologic studies point up possible associations but do not prove cause-effect relationships.

Epidemiologic studies of coal miners demonstrated that prolonged exposure to coal mine dust could produce the crippling lung disease, coal workers' pneumoconiosis (black lung). Other studies have shown the relationship between workers' illness and exposure to sugar cane dust (bagassosis), cotton dust (byssinosis), silica dust (silicosis), and various fibrous silicates (asbestosis).

Epidemiologic studies have often revealed the carcinogenic action of certain substances and chemicals. Some studies were simply descriptive accounts of observed effects. Scrotal cancer was noted in English chimney sweeps two hundred years ago, and skin cancers in chromium workers at the turn of the last century. More recent studies have shown the carcinogenic properties of arsenic, vinyl chloride, ionizing radiation, and other agents.

Epidemiologic data documenting that groups of workers and other human populations exposed to a suspected agent have sustained certain types of illnesses may be extremely helpful in establishing the fact that the substance in question may cause an illness of a certain type. Whatever epidemiologic data is available should be included in the evidence presented.

CHAPTER IV — EVIDENCE OF EXPOSURE

Having heard evidence that establishes the medical condition of the claimant and its compatibility with known health effects of the suspected agent, and epidemiologic information about human populations with similar exposure histories, the examiner must consider evidence of exposure of the claimant to the suspected agent. Generally, occupational data will be presented for each relevant job or duty. The following information would be helpful:

1. Identification of the substances handled or used directly in operations in the area or in nearby areas;
2. any information from industrial hygiene studies, especially air sampling data, that indicate magnitude of worker exposure for the job or similar jobs (see specific guides);
3. data to be accumulated for work exposure evaluation:
   a. inhalation exposure information—expert testimony should be obtained concerning general environmental conditions, especially when there are no industrial hygiene studies available as evidence. Such testimony should include reference to at least:
      (1) Establishing the precise chemical or physical form of the agent (name the chemical; specify type of dust);
      (2) a complete description of the operation *as performed by the worker* including materials handling practices, accessory equipment, operating procedures, and protective equipment;
      (3) information on the particle size of the agent (for dusts) generated by the operation;

(4) information about the solubility of the agent affecting absorption by the body;
(5) possible additional modes of entry of the agent into the body (inhalation, ingestion, skin absorption);
(6) available ventilation:
—was general exhaust ventilation provided?
—was local exhaust ventilation provided?
—was it properly designed?
—was it installed to design specifications?
—was it properly maintained?
—was it properly used by the operator?
—was contaminated exhaust air recirculated into the plant?
(7) general housekeeping:
—was dry sweeping done?
—were spills cleaned up properly?
—was equipment properly maintained and serviced?
—were all plant areas regularly cleaned?
—were materials stored properly to prevent spills or leaks?
(8) respiratory protection (While respirators are not the preferred method of protecting workers from inhalation of airborne toxic agents, they are sometimes used until other controls can be installed. They must be used properly to fulfill this function, and testimony directed toward this point should be elicited.):
—was the proper type of respirator used? It should have been selected by an industrial hygienist for the specific agent involved, and approved by NIOSH or the Mine Safety and Health Administration.
—were the respirators fitted properly? Leaks in the facepiece negate effectiveness.
—did employee use the repirators?
—were cartriges, filters, etc. changed at appropriate intervals?
—were employees trained in the proper use, purpose, and care of respirators?
—were the respirators periodically inspected and maintained?

b. skin contact, skin absorption, and ingestion. Evidence should include information regarding:

(1) potential for skin contact
—was the operation a "closed system"?
—was personal protective clothing used?
—was the proper type of clothing supplied?
—was it used properly? laundered properly?
—were change rooms available? protective skin creams? emergency washing facilities?

(2) potential for ingestion
—was smoking permitted in the work area?
—were smoking materials permitted in the work area?
—was eating permitted in the work area?
—was food stored or prepared in the work area?
—were there separate facilities for storing food and eating?
—were proper washing facilities available?

Exposure Evaluation

The best evidence to confirm the exposure of a worker to an agent is measurements (such as air samples, noise levels, or radiation measurements) obtained at the worker's actual job stations, past and present. Factors which should be considered when evaluating the measurements are:

1. *Number of samples* (or duration of time covered by samples). In most cases, a few (two or three) samples covering only a small portion of a working day are not sufficient to establish degree of exposure. Generally, samples or measurements should be obtained covering most of a complete working day; covering several non-consecutive work days is even better. For very short duration samples or readings (less than 15 min.), a minimum of seven samples, spaced randomly over the workday, is advised.
2. *Location of samples.*
The best location for sample taking is in the breathing zone (within a few inches of nose and mouth) of the employee or a worker doing an identical job, under conditions identical to those under which the employee worked. Samples obtained at a stationary point in the work environment (area samples) can give an indication of possible exposure but can also be very misleading. For example, measuring noise levels a few inches from a

noisy machine when the worker is located several feet away may indicate erroneously high exposures. Obtaining air samples for a solvent at the center of the room, when the worker must lean into a solvent tank, would indicate erroneously low exposures.

3. *Air sampling method.*
   The methods mentioned in the illustrative agent section of this guide are those commonly used or accepted in the industrial hygiene profession. Other methods may exist and give satisfactory results. However, expert opinion should be obtained concerning their validity. All equipment used should be accurately calibrated.
4. *Laboratory analysis.*
   Analysis of air samples is a difficult science and should be performed by experienced, competent persons. Laboratories can be accredited by the American Industrial Hygiene Association for these analyses. In any case, the laboratory's previous experience with the specific type of analysis should be ascertained. Certification of laboratory staff is another indication of competence.

CHAPTER V — AGGRAVATION OF PREEXISTING CONDITIONS

With regard to occupational disease, there is no generally accepted medical definition of aggravation. In the current system of workers' compensation, aggravation of a preexisting disease or physical impairment may be defined as any occupational occurrence, act, or exposure that will make worse, intensify, or increase the severity of any physical or mental problem known to exist before the occupational exposure. An example of aggravation would be the effects on an employee with known allergies exposed to allergens in the workplace resulting in frequent asthmatic attacks. In another example, a recovered alcoholic with mild liver damage is exposed to carbon tetrachloride at work, resulting in greater liver damage. This definition implies that if there is any occupational contribution to an existing disease, the disease can become compensable. However, this guide is concerned solely with the causation of disease and whether or not the causes are occupational.

The existence of a condition before exposure does not necessarily mean before employment. Many companies change processes and products from time to time. When such changes occur during an employee's period of employment, there may be an aggravation of a condition that was not adversely affected by prior work in the same job or plant.

Any stress may be an aggravating factor and has been so considered by the courts for such jobs as firefighting and police work.

Since most states hold that the employer accepts the worker "as is," such factors as age, sex, heredity, and obesity can be logically excluded from the list of causative factors. This leaves

those environmental (occupational) exposures—mechanical, chemical, physical, or biologic—which may occur at work or in the nonworking environment, as candidates for discussion of the "cause" of an aggravated disease or condition.

This consideration appears to lead to a very straightforward decision-making scheme to weigh the "percent contribution" of various factors in a specific case with the aim of awarding compensation on a contributory basis. Unfortunately, no such single approach is feasible.

Aggravation cases frequently have multiple causes, not all of which are known, and most of which are poorly understood. The table on page 17 lists some agents which may contribute to disease and aggravation of disease.

A problem with aggravation of chronic diseases is that there are many parameters involved. The causes, courses, and eventual outcome of these diseases are usually unknown and poorly understood. As chronic diseases progress, they may exhibit irregular periods of worsening and of improvement. This factor confounds the role of an aggravating agent, and it is therefore necessary to medically monitor these employees over several of the cycles of improvement-worsening. Furthermore, the time of life when symptoms of chronic disease develop often contributes to the complexity of the problem, since both the degenerative processes of aging and the appearance of chronic diseases are associated with the middle years.

Arthritis

Arthritis is a disease that is almost universally present in the older age group. Arthritis can cause effects that range from nuisance aches to severe incapacity. Certain abbatoir workers are required to work in damp, cold conditions. Over the years, some of these workers develop a disabling form of arthritis, but some escape it entirely. Are the work conditions responsible for the disabling arthritis? The courts have most often held that they are, but since the cause of arthritis is unknown, these decisions are based on adjudicatory and administrative rulings supported by medical testimony.

CONTRIBUTORY AGENTS

Disease	Nonoccupational	Occupational
1. HEART DISEASE (cardio-vascular including coronary occlusion)	age heredity sex smoking diet obesity stress medication or drugs climate	various chemicals, solvents, gases pulmonary irritants unusual exertion stress temperature
2. HEARING LOSS	age heredity noise impacted cerumen (wax) foreign body in ear canal ear infection nasopharyngitis medication or drugs trauma	noise foreign body in ear canal trauma nasopharyngeal irritants
3. ARTHRITIS OR "RHEUMATISM"	age heredity diet trauma infection obesity stress	repeated articular movement trauma cold, damp work environment improper lifting work-required poor posture
4. PULMONARY (LUNG) DISEASES	age heredity sex smoking allergy air pollution infection climate	various dusts, gases, mists, etc. allergens wearing of respirators decreased oxygen supply temperature, humidity

Coronary Artery Disease

Coronary artery disease, which may lead to a heart attack, is one of the most frequent "preexisting conditions" cited as being aggravated by work. There are those who feel that heart attacks should never be compensable and, since they have such complicated etiology (causation), that they should be removed from the compensation system. (National Commission on Workmen's Compensation Laws, 1973. *Compendium on Workmen's Compensation.* Washington: GPO.)

In addition to the commonly accepted factors such as age, smoking, diet, heredity, etc., there are some chemicals that have profound effects on the heart and cardiovascular system. Aniline and nitrobenzene are myocardial (heart muscle) depressants. Ethylene, chloroform, and trichloroethylene are myocardial irritants. The azides produce severe vasodilation. Carbon disulfide induces atherosclerosis.

Carbon monoxide, cyanide, and certain insecticides can have damaging effects on individuals with impaired cardiac function or reduced cardiac reserve. Pulmonary irritants such as ammonia, chlorine, phosgene, and sulfur dioxide can be quite hazardous to the person with heart impairment. Silicosis, asbestos, and other pneumoconioses may result in right heart failure (cor pulmonale). Heat, cold, and electrical shock can seriously affect the impaired heart.

Heart attacks seem to occur at a lower rate in workers than in the population at large. This may result, in part, from the fact that the American worker is "selected," that is, he often receives a preplacement medical examination to place him in a job that is compatible with his health and physical abilities. He may also receive periodic follow-up examinations at work to monitor his health.

One researcher (Paffenberger, the American Journal of Epidemiology) studied longshoremen. Those performing heavy work had a lower rate of sudden death than workers doing light work, suggesting that perhaps heavy work may help to prevent sudden deaths from coronary artery disease rather than to cause them. These conclusions have been confirmed by many other studies.

In almost all heart attacks that go to litigation, the problem is that of causation. To make a determination that an employee was subjected to a stressor "sufficient to bring about the heart attack or reaction," is extremely difficult because of the limitations of medical knowledge as to etiology. Rarely can a physician state that a heart attack is related to a particular stress, nor can he point with certainty to the initiating process of any heart attack. Although the presence of some atherosclerosis may be granted, it is not possible to predict when particular coronary vessels will occlude and precipitate the myocardial infarction or a fatal arrhythmia.

The physician does have a role in informing the court that the worker did indeed have a heart attack and in presenting substantiating data. A final judgment must be rendered in accordance with the administrative and adjudicatory framework of the state.

Several of the more troublesome areas concerned with determination of aggravation of preexisting conditions have been discussed above. Causation and the lack of positive medical knowledge about causation are the most important deficits in this determination. That a specific disease state can be caused or aggravated by more than one stressor is another important factor in determination, inasmuch as not all stressors can be identified. The other factors in the determination can be identified and quantified by experts; for example, factors related to genetics, physical characteristics, personal habits, work exposure, work habits, work processes, contaminants, age, and sex. To assist in arriving at a just decision, it is suggested that qualified medical and other professional advice should be obtained during the decision-making process. Consideration should be given to:

a. Using this guide, and other material, as sources of information which should be obtained to help support opinions and decisions; and
b. using the services of an impartial advisory board made up of occupational medical specialists and other physicians and industrial hygienists. Participants should be selected by state or local medical societies and professional organizations.

Other measures that may ultimately enhance the equitable handling of cases involving possible aggravation of disease are:

a. Encourage research on the causes of chronic disease and the relative degree of contribution of various factors;
b. encourage research into the possibility of removing cases of aggravation from the "all or nothing" decision realm. While this approach has certain drawbacks, it may also make possible partial compensation for diseases not previously held compensable. (This is being done through second injury funds established in some states.)
c. encourage preventive medicine through preplacement medical examinations and job selection procedures to place workers in jobs which will not aggravate any of their preexisting health conditions.

CHAPTER VI — VALIDITY OF TESTIMONY

Non-professional persons cannot be expected to collect and evaluate all of the information needed. In most cases, physicians will provide testimony on medical conditions and laboratory and other medical tests; industrial hygienists will testify concerning evidence of exposure; epidemiologists give testimony on epidemiologic data. These professionals must consider all pertinent points in their area of expertise in order to present an accurate and meaningful evaluation of the available data. The hearing examiner, board, commissioner, or officer should verify:

1. The professional qualifications of those testifying, and
2. the basis of the testimony, that is, the importance attributed to various areas of the information reviewed, and the conclusions that were drawn.

Medical

The phrase "competent medical person" is frequently used in both the lay and professional literature, including this guide. But what does it mean? Who is a competent medical person? Board certification (other than in occupational medicine) and academic status do not in themselves confer expertise in occupational disease. An expert in a specific medical field is not necessarily medically competent to render clinical judgment on an entire case, but only on that portion which is within his or her area of expertise. No rigid rules for judging competency can be defined. Because of the many variables, some guidelines are offered to aid the decision-maker in judging who is or might be considered a "competent medical person."

A competent medical person is:

1. A physician, judged competent in one of the several disciplines of medicine, and
2. specially trained in the particular expertise required for the testimony to be presented. In determining occupational causation of disease, such expertise would include intimate knowledge of the work environment.

For compensation purposes, a medical specialist—such as an internist, pathologist, surgeon, specialist in chest diseases, or an occupational health physician—is usually a competent medical person, but not in all instances.

For example, in a compensation case involving a question of occupational lung disease, the chest specialist can certainly use his or her expertise to diagnose a chest condition. But unless such a specialist is familiar with the work history and exposure of the employee, and has the background to coordinate and evaluate toxicological, epidemiologic, and industrial hygiene information in terms of the medical condition, that specialist should not be considered competent to render an expert opinion regarding the occupational origin of the disease condition.

Generally, a physician certified in occupational medicine is a competent medical person. Occasionally, however, the physician's particular work experience does not include an understanding of the exposure issues involved, such as carcinogenic factors. In the examples given, two physicians may be required to provide the expert opinion.

It is important for the medically competent person to maintain impartiality and to have an understanding of labor and industry. Almost all persons, medical and otherwise, who testify in compensation cases have some degree of bias. This does not invalidate their testimony. However, the examiner should consider the extent, nature, and effect, if any, of expert bias in arriving at his decision.

It is the duty and responsibility of a compensation hearing officer, lawyer, or any interested person to be aware of the requirements for medical competency in order to assure sound decisions. The following should be considered in judging medical competence:

1. Is the physician certified in occupational medicine by the American Board of Preventive Medicine?

2. Is the medical expert's specialty directly related to the type of disease in question (cardiologist for heart disease, pulmonary specialist for lung disease, etc.)?
3. Does the physician have industrial experience? In what industries? Does this include experience in diagnosing the disease in question?
4. What is the expert's formal training in occupational medicine?

Exceptions: Although the competent medical person is a physician, there are some instances when the physician's testimony will be supplemented by testimony from a dentist, anatomist, toxicologist, occupational health nurse, or industrial hygienist concerning special health issues in their area of expertise. In such circumstances, these professionals are considered "competent experts" for the purposes of the particular adjudicatory proceedings. The testimony of such non-physicians should not be permitted to be substituted for the medical testimony of a physician. In addition, the qualifications of such individuals should be ascertained as is done in qualifying any expert in any court case.

Industrial Hygienist

According to the American Industrial Hygiene Association, a professional industrial hygienist is "a person possessing either a Baccalaureate Degree in Engineering, Chemistry, or Physics, or a Baccalaureate Degree in a closely related biological or physical science from an accredited college or university, who has, in addition, a minimum of three years of industrial hygiene experience. A completed Ph.D or Sc.D. in a related physical or biological science or an M.D. can be substituted for two years of the three year requirement." Further, it is suggested that all industrial hygienists consulted be professionally certified by examination of the American Board of Industrial Hygiene.

The following should be considered when judging an industrial hygienist's competence:

1. Is the industrial hygienist certified by the American Board of Industrial Hygiene or under the direction of a certified industrial hygienist?

2. Is the area of specialty of the industrial hygienist related to the evidence being given (comprehensive, engineering, toxicology, acoustics, air pollution, chemistry)?
3. Does the industrial hygienist have experience with the particular occupation involved?

Whenever possible, reports of past industrial hygiene studies pertinent to the case should be relied upon to provide basic environmental evidence. To be credible, personnel conducting industrial hygiene studies for use as evidence should be professionals trained in industrial hygiene or be under the direction of such professionals.

CHAPTER VII — CONCLUSIONS

Evidence presented by qualified professionals according to the method described in the preceding chapters will generally be sufficient for the hearing examiner to answer the following questions to his satisfaction:

1. Has a disease condition been clearly established?
2. Has it been shown that the disease can result from the suspected agent(s)?
3. Has exposure to the agent been demonstrated? (by work history, sampling data, expert opinion?)
4. Has exposure to the agent been shown to be of sufficient degree and/or duration to result in the disease condition? (by scientific literature, epidemiologic studies, special sampling, replication of work conditions?)
5. Has nonoccupational exposure to the agent been ruled out as a causative factor?
6. Have all special circumstances been weighed?

Occasionally, special circumstances must be considered. Were there any unusual events at work that reduced the effectiveness of protective equipment? Of ventilation? Of safe work practices? If the employee is a woman, are there special risks to women from exposure to the agent? If so, this factor must be evaluated.

7. Has the burden of proof been met—did the evidence prove that the disease resulted from, or was aggravated by, conditions at work?

If the answer to all of the above is "Yes," the decision can be made that the disease is occupational in origin.