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**COUNTING INJURIES AND
ILLNESSES IN THE WORKPLACE:
PROPOSALS FOR A BETTER SYSTEM**

Earl S. Pollack and Deborah Gellerman Keimig, editors

**Panel on Occupational Safety and Health Statistics
Seymour Geisser, Chair**

**Committee on National Statistics
Commission on Behavioral and Social Sciences and
Education
National Research Council**

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Seymour Geisser, Chair
Panel on Occupational Safety and Health
Statistics

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SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

In the more than 15 years that have elapsed since the passage of the Occupational Safety and Health Act of 1970, there has been widespread concern that the statistics on the numbers of injuries and illnesses in the workplace, required under the act, are grossly underreported. This report focuses on the extent to which this concern is justified and on ways of improving the national statistics on occupational injuries and illnesses.

The Occupational Safety and Health Act of 1970 was passed to ensure "so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources" (PL 91-596, 1970). As a result of this legislation, the Occupational Safety and Health Administration (OSHA) was created under the assistant secretary of labor for occupational safety and health to enforce the regulations established by the 1970 act. Very specific language in the act gave an indication that the Congress recognized that statistics on workplace injuries and diseases were essential to an effective national program of prevention. The act, among other things, directed the secretary of labor to issue regulations to require employers to develop and maintain records on workplace injuries and illnesses. The secretary of labor was also directed to compile accurate statistics on occupational injuries and illnesses and to make periodic reports on such occurrences.

The responsibility for collecting statistics on occupational injuries and illnesses was delegated to the Bureau of Labor Statistics (BLS). In order to further the purposes of this act, the language was quite specific: "the Secretary shall compile accurate statistics on work injuries and illnesses which shall include all disabling, serious, or significant injuries and illnesses, whether or not involving loss of time from work, other than minor injuries requiring only first aid

treatment and which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job." The purposes of the act are quite comprehensive and include the establishment of occupational safety and health standards, carrying out inspections and investigations, ensuring the maintenance of record keeping by employers on occupational injuries and illnesses, requiring reporting by employers of work-related deaths, and conducting research relating to occupational safety and health.

OSHA is charged with the responsibility of enforcing the provisions of the 1970 act, and BLS is the collector of statistics, essentially on contract from OSHA. Because it is the statistical agency within the Department of Labor, under the commissioner of labor statistics, BLS, rather than OSHA, issues the record-keeping guidelines for occupational injuries and illnesses (Bureau of Labor Statistics, 1986) that are used to attempt to standardize record keeping on these conditions across the broad range of employers. In addition to its role in developing record-keeping guidelines, BLS also has considerable interaction with employers in interpreting them, in answering a myriad of questions concerning them, and in responding to complaints that employers have regarding issues of recording requirements. Adequate record keeping is one of the issues addressed in the enforcement process. Furthermore, the data that result from these records are used to target industries for inspection purposes, and the records kept at the plant are ultimately used in the inspection of individual establishments. These facts, and the roles of BLS and OSHA in collecting statistics and enforcing regulations, respectively, can lead to the impression that BLS and OSHA are a single agency. And, if the gathering of statistics is viewed as part of the enforcement process, the credibility of the statistics could be jeopardized.

It has been alleged that the number of occupational injuries is seriously underreported primarily because those making the allegations feel that employers have a strong incentive not to report injuries. These allegations have been supported by the recent OSHA investigations of record keeping at Union Carbide, the Chrysler Corporation, the Ford Motor Company, the John Morrel Company, Iowa Beef Processors, and other employers whose citations and penalties for willful violations of record-keeping information have been the largest ever issued. For most of the occupational illnesses, there is little doubt that serious underreporting exists. The Committee on Government Operations of the House of Representatives expressed this quite emphatically in the report of its 1984 hearing on this topic when it stated: "since the passage of the Occupational Safety and Health Act nearly 15 years ago, a bipartisan failure of four administrations has

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thwarted the mandated development of an information and data collection system on occupational diseases. No reliable national estimates exist today, with the exception of a limited number of substance-specific studies (such as on asbestos), on the level of occupational disease, cancer, disability, or deaths. It cannot be meaningfully determined if diseases from chronic exposures to hazardous substances represent a greater problem today than when the OSH Act was passed in 1970. Such lack of reliable accurate data greatly hampers any broad-based evaluation of the OSHA program" (U.S. Congress, House of Representatives, 1984).

Hearings on this topic were held again in April 1986 by a joint session of two subcommittees of the Committee on Government Operations. After hearing witnesses from both the private sector and two government agencies--the National Institute for Occupational Safety and Health and the National Center for Health Statistics--the subcommittee concluded that the statistical information on occupational illnesses is still grossly inadequate (U. S. Congress, House of Representatives, 1986).

The concern over underreporting was heightened when OSHA changed its enforcement policy and established a targeting program that exempted employers in the manufacturing sector from routine safety inspections on the basis of their injury records. Congressional committees, labor unions, and others voiced concern that the use of employer records to determine exemptions from OSHA inspections would create an incentive for employers to underreport their actual injury experience. In 1984, in reaction to this possible underreporting and other issues related to the accuracy of the national statistics, the Congress appropriated funds in OSHA's budget earmarked for the Bureau of Labor Statistics to conduct a quality assurance study of its Annual Survey on Occupational Injuries and Illnesses.

In response to this directive, BLS requested the National Research Council to convene an expert panel to address the issue of the validity of employer records and the BLS annual survey, the problems related to the reporting and ascertainment of occupational diseases, and other key issues related to the collection and use of data on health and safety in the workplace. This report is the result of the panel's review and contains its recommendations.

CONCLUSIONS

During the course of this study the panel conducted interviews with key personnel in the agencies directly

involved with the issues of statistics on occupational injuries and illnesses (the Bureau of Labor Statistics, the Occupational Safety and Health Administration, and the National Institute for Occupational Safety and Health). It gathered information from other sources including employers, employee unions, state occupational safety and health programs, and a number of agencies. Seven meetings of the entire panel were held in which the issues were debated, alternative approaches discussed, and possible solutions proposed and agreed upon. Summarized below are the panel's major conclusions.

Conclusion 1: The BLS data systems, in their current form, are inadequate for providing OSHA with the data it needs for maintaining an effective program for prevention of workplace injuries and illnesses.

To operate an effective program on the prevention of workplace injuries and illnesses, OSHA needs data for development of standards for both safety and health, for conducting its program of enforcement of standards, and for evaluating the impact of its program. The panel reviewed the three BLS occupational safety and health data systems--the annual survey, the Supplementary Data System, and the Work Injury Reports--and noted the problems associated with each. The annual survey is a large probability sample of establishments in the United States that does not obtain information in sufficient detail needed for most purposes. The panel noted that OSHA does not have access to the individual establishment data collected in the annual survey because BLS assures the respondents to the survey that the information they provide will be held confidential. Because this is the only mandatory survey that BLS conducts, BLS believes that unless they ensure confidentiality, the response to their voluntary surveys will suffer. The Supplementary Data System is essentially a voluntary system based on workers' compensation records in which some 33 states participate. These records describe the circumstances surrounding each injury or illness, the type of injury or illness, the part of body affected, the characteristics of the injured or ill employee, disabilities, time lost from work, etc., but lack of uniformity and quality of the data raise serious questions about its usefulness as a data set that can serve all of the needs of a national program. The Work Injury Reports are based on the Supplementary Data System records but are usually confined to a small number of states and deal with specific topics. The extent to which generalizations can be made from Work Injury Report data supplied by participants so selected is a critical issue, even though these reports have been useful for some purposes.

Conclusion 2: OSHA has not demonstrated an ability to use the data it has available to it, nor does it seem to recognize the need for data to manage its program.

The panel conducted a number of interviews with key OSHA personnel and came away with a concern that the agency has little understanding of the need for data and how data might be used effectively to manage the program. Even though OSHA maintains its own Integrated Management Information System, it is based only on information obtained as a result of its inspections. Thus, it can provide counts of the number of inspections conducted, the number of citations made, the size of the penalties assessed, etc., but it does not contain systematic information on important aspects of the program such as the fatalities reported to OSHA that were not investigated, laboratory reports on exposure sampling for which OSHA did not issue citations, reports of laboratory findings from employers based on mandatory exposure sampling, and other similar kinds of information. OSHA does not seem to have a clear understanding of the kinds of questions for which it needs quantitative information.

Conclusion 3: Even if the current BLS data systems are modified, they would be unable to measure the rate of occurrence of occupational illnesses.

The basic issue here is that the information in the BLS systems is based almost entirely on data supplied by employers. The panel acknowledges that the reporting of some of the acute occupational illnesses, for example, the occupational skin diseases, may be reasonably complete. However, employers have not been able to identify and report illnesses with a longer latent period that may be related to exposures in the workplace. These conditions are difficult even for physicians to recognize; it is particularly difficult for them to identify the role of possible exposures in the workplace in the development of the disease.

Conclusion 4: No adequate evaluation of the extent of underreporting or overreporting of occupational injuries has been conducted.

BLS attempted some studies in the early years of the program, following the passage of the act in 1970, to evaluate the completeness of reporting of occupational injuries, but none has been completed. Most of the studies done by others that could provide some information on the quality of the BLS annual survey data were conducted for somewhat

different purposes, and most suffered from some methodological problems.

Conclusion 5: Only a small proportion of the information that employers are required to record on occupational injuries and illnesses is actually collected.

Employers are required to record a considerable amount of information about each occupational injury and illness; however, the BLS annual survey requires them to report only the summary information on a small part of the recorded data. Some of this more detailed information is obtained in the Supplementary Data System, but not consistently state by state.

Conclusion 6: There is no single agreed upon estimate of the number of occupational fatalities in the United States.

Any employer under OSHA jurisdiction is required by law to report an occupational fatality to OSHA within 48 hours after the occurrence of the event. Employers are also required to record the information on these fatalities on the logs from which the summaries are reported to BLS in the annual survey. The National Center for Health Statistics collects information on cause of death for every death occurring in the United States, but its reporting system currently does not permit it to identify occupationally related deaths. The National Safety Council, a voluntary association, uses the NCHS data as a basis for deriving its own estimates of the number of occupational fatalities. NIOSH has constructed a mortality reporting system by obtaining death certificates from each state for deaths that are designated as occupationally related and prepares its own estimate based on them. In 1984, the size of these estimates ranged from 3,740 based on the BLS annual survey to 11,700 as estimated by the National Safety Council. The panel found it rather startling that an agreed-upon method has not been devised to estimate a phenomenon as basic as traumatic death in the workplace.

RECOMMENDATIONS

In view of these findings, the panel considered alternative approaches for solving some of the problems, or for at least improving the situation. To this end, the panel makes 24 recommendations, the text of which appears in Chapter 8. Since the major thrust of these recommendations is to improve various aspects of existing data systems, some knowledge of the systems is required to understand them.

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The systems are described in Chapter 3; here we describe in more general terms what these recommendations are intended to accomplish.

Modification of the BLS Annual Survey

The modifications of the BLS annual survey that the panel proposes are aimed primarily at increasing the amount of detail it provides, particularly in the area of occupational injuries. The panel therefore recommends that data classifying occupational injuries by type of injury be reported in the annual survey; such detail is not collected by the survey at the present time. The panel further recommends that the categories of occupational illness currently on the annual survey form be replaced by an alternative classification that would more clearly distinguish acute from chronic occupational diseases. The panel believes that the former are more adequately reported in the annual survey. This approach would provide some useful information on occupational illnesses. For both occupational injuries and illnesses, the panel proposes that BLS collect more detailed information on the more serious cases (those that involve either a fatality, hospitalization, or out-patient surgery) by requiring reporting of the detailed information that employers are already required to maintain.

Supplementary Data System

The panel recommends discontinuing the current version of the Supplementary Data System, which is essentially voluntary and which varies considerably from one state to another in the quality of the information collected, depending to a large extent on the interest of the state itself in its own data. In its place, the panel recommends a grant program in which the states whose data systems can meet certain criteria for detail and quality could compete for resources to conduct data analyses and other research based on these data sets. BLS would specify the criteria on the basis of its perception of the needs for data and its knowledge of the information specific state programs are capable of producing. Such grants would also be made available to individual researchers in universities who would have access to these same data sets.

Ongoing Quality Assurance

The panel strongly recommends that BLS develop a series of approaches toward conducting ongoing evaluation of the quality of the data they collect. The emphasis of a quality assurance program should be on identifying underreporting of occupational injuries by comparing logs of injuries maintained by employers with lists of injuries at the same establishments obtained from independent sources. The panel commissioned a small pilot study to examine the feasibility of identifying occupational injury deaths from death certificates or medical examiner records and then determining whether these cases had been recorded by employers on OSHA logs. The panel concluded that this approach is feasible for occupational fatalities. The practicality of this approach for nonfatal injuries, however, is not clear. The panel therefore recommends that BLS assess the feasibility of this approach for nonfatal occupational cases by investigating other independent sources, including hospital records indicating inpatient care for workplace injuries and medical records from outpatient departments, clinics, and other medical care providers.

Occupational Disease Surveillance

The panel has indicated that the current BLS data systems are not an effective mechanism for collecting data on occupational illnesses, particularly those with long latent periods. None of the modifications that the panel recommends to the current data systems will markedly improve this situation, except possibly for some of the acute illnesses. The panel therefore recommends that maximum use be made of other data systems to obtain as complete a picture as possible of the incidence of occupational illness in the United States. Thus, it recommends that the National Institute for Occupational Safety and Health be charged with the responsibility of carrying out an ongoing occupational disease surveillance system and that it be charged with the responsibility of preparing a periodic report on the status of disease occurrence and hazardous exposures in the workplace. This would include coordinating data from a number of sources. These sources include mortality data from the National Center for Health Statistics, hospital discharge abstracts from states that have such information computerized, collaboration with the National Center for Health Statistics in developing occupational components in the National Health Interview Survey and the National Health and Nutrition Examination Survey, investigating the impediments to physician reporting of occupational disease and developing ways to overcome these

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impediments, making use of the experience of population-based cancer registries in identifying links between occupational exposure and cancer, and evaluating ways of incorporating data from these registries into an ongoing occupational disease surveillance system.

In the area of occupational exposure data, the panel recommends that the Occupational Safety and Health Administration enter into its Integrated Management Information System all industrial hygiene sampling data collected during its health inspections, including those in states that operate their own occupational safety and health programs. The panel further recommends that the Occupational Safety and Health Administration require reporting on industry collected exposure monitoring data for specific substances and enter them into the Integrated Management Information System. The panel recommends that the National Institute for Occupational Safety and Health compile the industrial hygiene data that it collects during its health hazard evaluations and its industrywide studies and that it analyze the data to characterize exposures in specific industries and occupations.

Occupational Fatalities

Given the vast differences in the estimates of the number of occupational fatalities in a year, the panel recommends that the National Institute for Occupational Safety and Health and the National Center for Health Statistics collaborate on improving the use of the national mortality system, based on all deaths occurring in the United States, to arrive at an ongoing approach to obtaining annual estimates of the number of occupational fatalities.

Confidentiality of Data and Consideration of an Administrative Data System

The Annual Survey on Occupational Injuries and Illnesses is the only mandatory survey that BLS conducts. However, it offers the establishments included in the sample the same assurance of the confidentiality of their responses that it does in its voluntary surveys. BLS is concerned that the absence of that assurance might jeopardize the responses to its other surveys. Its rationale for this position is based on successful BLS experience with its other surveys, in which confidentiality is carefully protected (Bureau of Labor Statistics, 1982). The majority of the panel supports this position; two of the panel members, however, believe that the Occupational Safety and Health Administration should have access to

individual establishment data from the annual survey to use as a basis for targeting inspections.

The panel did agree, however, that the Occupational Safety and Health Administration should be able to obtain individual establishment data and that this might be achieved through the development of an administrative data system, such as that maintained, for example, by the Internal Revenue Service (Wilson, 1987; Knott, 1979). A number of issues would need to be considered in developing such a system, such as whether it should be operated by OSHA and, if so, what kinds of changes in OSHA staffing, expertise, and attitudes would be required; whether it should be operated by BLS and, if so, what the effect might be on its other surveys; whether data should be collected from every establishment, or from establishments that meet certain criteria; how extensive the data set should be; and whether such a system could meet all the needs for data specified in Chapter 4.

The panel believes that such an administrative data system should not be operated in parallel with the current BLS systems. Thus, if it proved to be feasible and if it replaced the current systems, the question of whether an administrative data system could meet all of the data needs is a critical one.

The panel did not feel that it had the time or the specific expertise to consider all of these issues related to an administrative data system in the kind of detail that would be required. Therefore, we suggest that BLS and OSHA obtain the appropriate outside expertise to consider whether the development of such a system is feasible for providing OSHA with all of the data it needs, including those at the individual establishment level, to conduct an effective program for the prevention of workplace injuries and illness and, at the same time, for meeting all of the other needs for data specified in Chapter 4.

Inspection Resources

The panel recognized that more thorough evaluation of record-keeping practices on the part of individual establishments is needed in order to determine whether occupational injuries are underreported and, if so, to develop ways to improve reporting. The panel is concerned, however, that increasing efforts in this direction might result in reducing the number of inspections of workplace hazards. Therefore, the panel recommends that the Occupational Safety and Health Administration request additional resources for this purpose and that such a request be granted by Congress.

BACKGROUND

The Bureau of Labor Statistics (BLS) has a long history of collecting statistical information about the incidence of occupational injuries and illnesses. Indeed, collection of work injury data is the bureau's oldest statistical program. In this chapter we review the history and genesis of the Department of Labor's programs related to health and safety statistics and trace how that history has led to the concerns under review by our panel.

EARLY HISTORY

In the early 1900s the bureau published reports concerning accidents in industrial sectors such as rail transportation. In 1912 it initiated an annual series on accidents in the iron and steel industries. The bureau also published reports on occupational health problems, including white phosphorus poisoning and industrial lead poisoning, and played an active role in alerting the public and workers to the dangers of these substances (Goldberg and Moye, 1985).

The Bureau of Labor Statistics, however, was aware of the need to do more in the area of injuries and illnesses. In particular, the lack of any consistent reporting of workplace injuries and illnesses was recognized, and, as early as 1914, BLS Commissioner Royal Meeker urged that "the Federal Bureau of Labor Statistics should act as a central clearinghouse for State agencies, for the purpose of standardizing accident and occupational disease statistics" (Goldberg and Moye, 1985). Meeker and his staff worked with a committee of the International Association of Industrial Accident Boards and Commissions to develop standardized methods and definitions for reporting injuries. The committee recommended systems for classifying injuries by industry, cause, nature of injury, and extent of disability. BLS offered to tabulate and publish state injury statistics, and cooperative arrangements were

established with the states of Massachusetts, Ohio, and New York for reporting industrial injuries, but Meeker's efforts to establish a more uniform reporting system were not fulfilled for many years.

In 1937 the American Standard Method of Measuring and Recording Work Injury Experience, of the American National Standards Institute (ANSI), was accepted by employers and BLS as the standard for recording and reporting work injuries. Use of the ANSI Z16.1 standard, as it was termed, permitted BLS to collect national work injury data annually. The Z16.1 standard provided a basis for recording and coding the basic facts concerning injuries occurring at work, including nature of the injury, part of body affected, source of the injury, type of accident, hazardous condition, agency of the accident, and unsafe act. If all the details of an injury are available, this system constitutes an approach for coding the information systematically for statistical purposes. Using the Z16.1 standard, data were collected from employers through a cooperative program with the states. By 1968 the BLS Cooperative States Work Injury Sample recorded information submitted by 120,000 establishments in 17 states.

The Z16.1 standard was originally designed to provide uniform measures of the frequency and severity of industrial injuries. Injury frequency was calculated in terms of disabling injuries per million employee hours worked, and injury severity was measured by workdays lost due to disabling injuries per million employee hours worked. Although the use of the Z16.1 standard provided for the first national reporting of industrial injury statistics and more extensive data than had previously been collected, the system still did not produce an accurate report on the nature and extent of workplace injuries.

Employer recording and reporting to BLS under the ANSI Z16.1 standard was voluntary, producing a self-selected sample that was believed to be biased toward a disproportionate number of establishments with low injury rates. This would result in an understatement of reported injuries. The system called for reporting only disabling injuries that resulted in death or prevented an employee from doing his or her job beyond the day of the injury. Injuries that involved no lost time or less than one full day of lost time were not reported. Another major failing of the Z16.1 system was that occupational illnesses were seldom reported, due to problems with recognition and the restriction of limiting recording to disabling injuries and illnesses.

Over the years the emphasis of the ANSI standard shifted. What started out as a standard for recording and reporting injuries for the purpose of collecting a uniform national data set became a measure for employers to judge their injury

records relative to those of other employers. As employers turned to contests and awards to reduce accidents in the 1950s and 1960s, statistics were used to compare their performances with those of other establishments. Very technical and complex rules for reporting and exceptions to reporting were developed in attempts to make firms comparable. Nevertheless, the ANSI Z16.1 standard and the BLS surveys based on it failed to produce a reliable and accurate measure of the nation's industrial injury and illness experience.

In addition to the Bureau of Labor Statistics, the National Safety Council (NSC), a voluntary association consisting of both individuals and organizations interested in promoting safety, also compiled occupational injury statistics based on the ANSI Z16.1 standard. The survey conducted by the NSC was voluntary and largely limited to its members. Therefore, it may have reflected the injury experience of more safety-conscious firms and not a true picture of workplace injury incidence. Despite subsequent changes in employer reporting requirements, the National Safety Council still relies on the Z16.1 standard for injury reporting.

THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

The inadequacies in workplace health and safety statistics and the need for an accurate uniform reporting system for injuries and illnesses were well recognized as the Congress considered the Occupational Safety and Health Act of 1970. There was a general consensus that pertinent and reliable information was a prerequisite for an effective health and safety program and that the information currently available did not provide an accurate picture of the nature and extent of the workplace injuries and illnesses. The two health and safety bills under consideration, H.R. 16785 and S. 2193, contained specific provisions for recording and reporting injuries and illnesses and the establishment of a statistical system.

In constructing the legislative statistical requirements, much attention was focused on the inadequacies of the ANSI Z16.1 standard. The voluntary nature of the system, its omission of nondisabling injuries, and its failure to capture occupational diseases were highly criticized. Comparative analyses of injury incidence and fatality reported from different sources (i.e., BLS surveys and state workers compensation data) showed gross underreporting using the Z16.1 system.

The House and Senate committee reports on the legislation emphatically rejected the ANSI Z16.1 standard (U.S. Congress, Senate, 1971:156):

Full and accurate information is a fundamental precondition for meaningful administration of an occupational safety and health program. At the present time, however, the Federal government and most of the states have inadequate information on the incidence, nature, or causes of occupational injuries, illnesses, and deaths. Not only are there serious deficiencies in the present data collection procedures, but adherence to the commonly used method of work injury measurement--the Z16.1 standard of the American National Standards Institute--thwarts the collection of information regarding many significant work injuries and occupational illnesses. Thus an essential first action under this bill should be the institution of adequate statistical programs.

Review of the record-keeping, reporting, and statistical requirements that were incorporated into the Occupational Safety and Health Act of 1970 reveals the congressional intent to correct problems in the ANSI system and to provide accurate information on the occupational injuries, diseases, and fatalities in this country.

The act sets as one of its goals the establishment of "appropriate reporting procedures with respect to occupational safety and health which procedures will help achieve the objectives of this act and accurately describe the nature of the occupational safety and health problem" (Section 2[b](12)). To achieve this end a number of specific requirements are set forth in the legislation outlining employer obligations and agency responsibilities with respect to injury and illness statistics. The act requires that:

- (1) Each employer make, keep, preserve and make available records regarding activities under the act that the Secretary of Labor, in conjunction with the Secretary of Health and Human Services (formerly the Secretary of Health, Education, and Welfare), may prescribe by regulation as necessary or appropriate for the enforcement of the act or for developing information regarding the causes and prevention of occupational accidents and illnesses (Section 8[c](1)).
- (2) The Secretary of Labor, in cooperation with the Secretary of Health and Human Services, prescribe regulations requiring employers to maintain accurate records of, and to make periodic reports on, work-related deaths, injuries and illnesses other than minor injuries requiring only first aid treatment and which

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- do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job (Section 8[c][2]).
- (3) The Secretary of Labor, in consultation with the Secretary of Health and Human Services, develop and maintain an effective program of collection, compilation and analyses of occupational safety and health statistics. The Secretary is required to compile accurate statistics on work injuries and illnesses which includes all disabling, serious or significant injuries and illnesses, whether or not involving loss of time from work, other than minor injuries requiring only first aid treatment and which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job (Section 24[a]).

For collecting injury and illness statistics the act maintained the joint cooperative arrangement, which had been in existence for a number of years, between the federal government and the states. The act authorized the secretary of labor to make grants covering up to 50 percent of costs to the states to assist them in developing statistical programs and to use the services of the states in conducting such programs.

Some of the states conduct their own occupational safety and health programs under Section 18[b] of the act, which provides that "any state, which at any time, desires to assume responsibility for development and enforcement therein of occupational safety and health standards relating to any occupational safety or health issue with respect to which a Federal standard has been promulgated under section 6 shall submit a state plan for the development of such standards and their enforcement." The act further specifies that the state must be able to demonstrate that its program of enforcement of standards is at least as effective as the national program in providing safe and healthful places of employment. By 1986, 21 states and 2 territories* were designated as "18[b]" states for both the public and private sectors and two additional states (Connecticut and New York) for the public sector only. The 23 states represent about 40 percent of the United States population. The Occupational

*Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, Wyoming, Puerto Rico, and the Virgin Islands.

Safety and Health Administration does not carry out any of its enforcement activities in these states, and BLS uses the agencies responsible for the occupational safety and health programs in these states to collect the data in its annual survey.

In addition to these basic record-keeping, reporting and statistical requirements for collecting injury and disease data, the Occupational Safety and Health Act contains other important provisions for the collection of health and safety data. The act requires regulations to be issued that require employers to maintain accurate records of worker exposures to toxic substances and to provide workers access to records regarding their exposures. Standards promulgated under the act must contain, where appropriate, requirements for monitoring toxic substance exposures and medical examinations for exposed workers.

The Occupational Safety and Health Act also contains significant provisions for research on health and safety matters. Under the law, the secretary of health and human services is given a broad mandate to "conduct (directly or by grants or contracts) research, experiments, and demonstrations relating to occupational safety and health" (Section 20[a][1]). To carry out this authority, the secretary of health and human services is given rule-making authority to prescribe regulations to require employers to measure, record, and make reports on the exposure of employees to toxic substances. To determine the incidence of occupational diseases, government programs of medical examinations and tests are also mandated.

The act specifies that these research functions given to the secretary of health and human services should be delegated, to the extent feasible, to the director of the National Institute for Occupational Safety and Health, which was established under the legislation.

While the Occupational Safety and Health Act contained significant provisions for gathering information on injury incidence and for research on health and safety hazards, there was considerably less focus on collecting information for the purpose of evaluating the effectiveness of OSHA's or NIOSH's efforts. The only provision to touch on the subject of evaluation is the requirement for an annual report. Under the act, both the secretaries of labor and of health and human services are required to prepare and submit a report to Congress that, among other things, outlines the progress made in achieving the purposes of the act, the needs and requirements in the field of occupational safety and health, and recommendations for additional legislation necessary to protect the safety and health of workers and improve the administration of the law.

The requirements for record keeping and reporting, statistical programs, research, and information gathering contained in the 1970 law remain in effect today. Other than some limited amendments through the annual appropriations process, there have been no amendments to the Occupational Safety and Health Act since its passage.

IMPLEMENTATION OF THE STATISTICAL REQUIREMENTS

To implement the recording, reporting, and statistical requirements of the Occupational Safety and Health Act, the Department of Labor developed regulations outlining employer obligations for recording and reporting occupational injuries and illnesses. The regulations, 29 CFR Part 1904, require each employer to:

- (1) Maintain a log of occupational injuries and illnesses and to record within two working days each recordable injury and illness;
- (2) Maintain a supplemental record of each injury and illness containing more detailed information. Workers' compensation reports could serve as the supplemental record;
- (3) Post an annual summary of injuries and illnesses based upon the log;
- (4) Maintain records for a five-year period;
- (5) Make records available for inspection and copying to OSHA, NIOSH, and state agencies; and
- (6) Report accidents resulting in a fatality or the hospitalization of five or more workers to OSHA within 48 hours.

The regulations defined, in general terms, the cases to be recorded under the act. Additional guidance was given in the form of instructions that accompanied the reporting forms developed by the Department of Labor.

The regulations were largely the product of earlier deliberations by a study group convened by ANSI. In early 1970, when it was clear that passage of health and safety legislation containing statistical requirements was likely, Secretary of Labor Hodgson requested ANSI to review the Z16.1 standard on recording and measuring occupational injuries. ANSI formed a study group to undertake this evaluation as well as to develop a simple method of reporting injuries if a new method was deemed necessary.

The study group found that the ANSI Z16.1 standard was inadequate to serve as the basis for the national reporting system proposed by federal legislation. The group recom-

mended that the system established be simple, sensitive, and meaningful; reflect the occupational disease experience; and be usable in a very large-scale survey. The system proposed by the study group required that each establishment maintain a record of reportable injuries and illnesses in the form of a log, with a requirement for an annual summary to be posted. The study group also proposed that a sample of establishments be surveyed annually to gather information on injuries, hours worked, and location.

These basic concepts of the system recommended by the ANSI study group--the employer log of injuries and illness and the annual survey--as well as definitions and proposed forms were codified largely unchanged by the Department of Labor in its regulations implementing the record-keeping, reporting, and statistical provisions of the law.

To collect statistics on injuries and illnesses as required by Section 24 of the act, the secretary of labor delegated responsibility to the Bureau of Labor Statistics. As noted earlier, prior to the act's passage, BLS had collected occupational injury and illness data reported voluntarily by employers using the ANSI Z16.1 standard through cooperative arrangements with the states.

The new survey differed from earlier surveys not only in its definitions of reportable injuries and illness, but also in its mandatory nature. The Occupational Safety and Health Act required employers to record and report injury and illnesses as specified by the secretary of labor. The BLS annual survey was the first and only survey conducted by BLS that mandated employer response; all other surveys conducted by BLS (i.e., wages, working hours, productivity, etc.) relied on voluntary employer or individual reporting. Over the years this difference in reporting requirements has led to problems. BLS has taken responsibility for conducting a survey that accurately reflects workplace injuries and illnesses. It has been reluctant, however, to engage in any comprehensive audit of the accuracy of employer records, fearing that any such review might jeopardize the employer cooperation necessary for other BLS surveys that depend on employers' voluntary participation.

The first comprehensive annual survey under the new law covered calendar year 1972. Approximately 200,000 establishments were included in the sample, with 85.3 percent responding. The survey revealed that, on the average, 1 out of 10 employees was killed, injured, or became ill during the year as a result of workplace conditions or exposure. Manufacturing and construction had higher than average injury rates. The survey on injuries and illnesses has continued on an annual basis since that time. While the basic nature of the survey design remains intact, there have been some

changes in recording and reporting requirements. In response to complaints from the business community, particularly small businesses, that provisions of the Occupational Safety and Health Act were too burdensome, in 1974 Congress exempted businesses of 10 or fewer employees from the act's record-keeping requirements through an amendment to the OSHA appropriations bill. In 1977, this exemption was incorporated into the Part 1904 regulations. Small businesses were, however, still required to report accidents concerning fatalities and multiple hospitalizations and to maintain the log and to report to BLS if notified that they had been selected for inclusion in the annual survey of injuries and illnesses.

In 1977, through a similar appropriations rider, farming operations with 10 or fewer employees were exempted from all the act's requirements, including those pertaining to record keeping. Exemptions from record-keeping requirements were broadened in 1982, when regulations were issued excluding employers in the majority of the retail, service, financial, and educational sectors from record-keeping requirements. The 1982 regulations exempted employers in a specific set of industrial categories on the grounds that these were low hazard sectors and that record keeping was not warranted. The requirements to report fatalities and accidents resulting in multiple hospitalizations and to maintain records if selected by the BLS for inclusion in the annual survey were maintained.

Over the past 16 years, there have also been other changes in the record-keeping and statistical programs. Modifications have been made in recording forms and guidelines for determining recordable cases. The forms for the OSHA log and posted summary have been combined into one form, the OSHA 200. The time allowed for recording injuries and illnesses has been lengthened from 2 to 6 working days. Workers and their representatives have been given the right of access to the log and a summary of recordable injuries and illnesses.

CONCERNS ABOUT ACCURACY

The Occupational Safety and Health Act was intended to provide accurate information on workplace injuries and illnesses to be used in constructing preventive programs. Since the act's passage, however, there has been continued concern about the completeness and accuracy of the data recorded and reported by employers and the data presented in the BLS annual survey of injuries and illnesses. Workers and unions have raised concerns that employers do not record or report all injuries and illnesses and keep injured workers on the job

in attempts to reduce workers compensation costs and recorded rates of lost workdays from injury. Others have claimed that employers typically overreport, particularly injuries, to ensure they are in compliance with the law. Surprisingly, given these concerns, there have been few studies or investigations of the accuracy and completeness of injury and illness reports. The few assessments that have been done (see Chapter 5 and Appendix B), along with other anecdotal information, suggest a lack of consistency in injury and illness data.

Estimates from various sources of number of injuries vary considerably. The differences, however, may be due primarily to factors other than survey design. They include differences in definition of the entity to be counted (lost workday injuries versus disabling injuries), differences in coverage (private sector versus private plus public sector), and differences in definition of injury (inclusion versus exclusion of first aid cases). BLS estimates of lost workday injuries in the private sector combined with estimates for federal, state, and local employees yield a total of 2.5 million injuries involving lost workdays in a year. The National Safety Council estimates 1.9 million disabling injuries in a year. Disabling injuries are those that involve one or more days away from work, some form of permanent impairment, or death. The estimate for work-related injuries requiring emergency room treatment from the National Electronic Injury Surveillance System (for a description, see Chapter 3) is 3.2 million cases a year, but these may include a number of first aid cases that are not considered recordable injuries by BLS.

There is less quantitative information available on occupational illnesses than on occupational injuries. Although the Occupational Safety and Health Act and regulations require employers to record occupational diseases in a log, it has long been recognized that the annual survey is deficient in capturing occupational disease, particularly chronic diseases with long latency periods. Since 1977, the BLS survey has included a disclaimer regarding the completeness and accuracy of its occupational disease data: "The annual survey includes data on only current and visible illnesses of workers, it does not include data on illnesses which might surface later. To the extent that occupational illnesses are unrecognized, and therefore, unreported, the survey estimates understate their occurrence" (Bureau of Labor Statistics, 1977).

In 1981, concern over the validity of employer records and the BLS survey was heightened when the administration announced a change in OSHA enforcement policy that would put greater reliance on injury and illness records and statistics for scheduling "general schedule inspections" in the

manufacturing sector. These are inspections of a random sample of firms in high hazard industries. For many years, the results of the BLS survey had been used to target safety inspections by designating those industries with high injury rates as inspection priorities. The 1981 enforcement policy went further: under the policy, industries (defined at a four-digit Standard Industrial Classification level) that had a lost workday injury rate less than the national average for private sector manufacturing (based on the BLS survey) were exempted from general schedule inspections. For those industries still on the inspection list, the enforcement policy called for examination of the employer's log of injury and illness at the commencement of the inspection. If the log showed an average lost workday injury rate (based on two years for large firms, three years for small firms) less than the national average for the manufacturing sector, the inspection of the employer's establishment was terminated unless there were special circumstances requiring further attention by the compliance officer.

Thus, for the first time, employers' logs of illnesses and injuries and the annual survey were used to determine exemptions from routine OSHA inspections. Concern was raised by BLS, unions, and members of Congress that such a system might create an incentive for underreporting of injuries by employers and might compromise the validity of national injury statistics.

CONGRESSIONAL ACTION

In 1984 the House Government Operations Committee Subcommittee on Employment and Housing, chaired by Representative Barney Frank (D-Massachusetts), conducted a hearing on occupational safety and health statistics. The hearing examined the efforts of federal government agencies to collect health and safety data and the completeness and accuracy of the information. Testimony was presented by BLS, OSHA, NIOSH, the National Center for Health Statistics, the congressional Office of Technology Assessment, and union representatives. Federal agency witnesses acknowledged the deficiencies of current data collection efforts to collect complete and meaningful statistics on occupational disease. Unfortunately, the agencies did little to set forth specific proposals for improving the quality of data.

The committee report issued several months after the hearing called for centralizing statistical gathering functions for occupational disease in NIOSH; expansion of existing health interview surveys and examination surveys to gather more information on occupational diseases; improved occupa-

tional coding on death certificates; and a quality assurance study by OSHA and BLS to determine the accuracy and reliability of employer logs.

At approximately the same time the House Committee on Government Operations was conducting its review, congressional appropriations committees also took action to improve the quality of workplace injury and illness data. In 1983, OSHA had denied a request by BLS for \$500,000 to be earmarked in the OSHA budget proposal for a quality assurance study of employer records of injuries and illnesses. As a consequence, BLS's Labor Research Advisory Committee for Occupational Safety and Health Statistics, comprised of trade union representatives who supported a quality assurance study, appealed directly to the congressional committees for appropriation of the funds. The committees responded and the conference report accompanying the 1985 appropriations specified that: "The Department [of Labor] is directed to allocate \$500,000 from lower-priority activities in this account to the Bureau of Labor Statistics for the purpose of conducting a study of the accuracy and quality of occupational safety and health statistics. Special attention should be paid to worksite recordkeeping." BLS decided to implement this directive by spending the majority of the funds for a study by the National Research Council on occupational injury and illness record keeping and statistics.

THE PANEL'S TASK AND ITS APPROACH

To respond to the congressional directive to conduct a study of the accuracy and quality of occupational safety and health statistics, BLS contracted with the National Academy of Sciences, through its Committee on National Statistics, to convene an expert panel to conduct a study. BLS also asked the Academy to review the problems related to occupational disease reporting and statistics raised by the House Committee on Government Operations. The work statement calls for a study of "the total spectrum of the BLS occupational injury and illness statistical program with emphasis on identifying potential sources of sampling and non-sampling error; employer procedures for recordkeeping and reporting data; uses of the data and how well the data meet the broader goals of the Occupational Safety and Health Act in improving the safety and health of workers and the unique problems of statistical measurement of occupational illnesses."

The panel, which includes representatives of industry, labor, state agencies, and the academic community, was requested to provide advice and recommendations to BLS for improving its occupational injury and illness statistical pro-

gram, including quality control programs, pilot surveys, experiments, and other research and to make recommendations concerning problems that involve other agencies, such as OSHA, NIOSH, and the National Center for Health Statistics. To accomplish this, the panel was asked to evaluate:

- The accuracy and reliability of occupational injury data, including incentives for misreporting, concepts of the work relationship, interpretation of injury classifications, and the relationship between OSHA reporting requirements and state workers' compensation;
- The accuracy and reliability of occupational illness data, including problems associated with determining causality and association with work, the definition of diagnosed occupational disease, the adequacy of occupational illness data for trend or surveillance value, and the causes of underreporting and potential remedies;
- The accuracy and reliability of occupational fatality data;
- The role that hours worked play in the development of incidence rates, including employer practices for determining and reporting hours worked;
- Problems inherent in the Occupational Safety and Health Act's record-keeping and reporting requirements, including definitions and criteria for recordability and information not required to be recorded or reported;
- Whether the use of prevalence measures of injuries and illnesses would improve statistics through identification of a condition that is present regardless of when it was first diagnosed;
- Current practices of data quality management used in conducting the annual survey and in the publication of results; and
- How the annual survey meets the purpose of assessing the effectiveness of health and safety and the administration of the act by OSHA and what alternative data sources could be used to collect needed information.

In responding to its charge, the panel gave priority to investigating the details of the BLS annual survey. This included the adequacy of reporting injuries and illnesses and efforts to evaluate the quality of the data in the annual survey. These issues were considered in the context of the uses to be made of the data that the survey could provide. Because the panel could find no immediate solutions to some of the problems and because the panel found that the annual survey was not particularly useful for some of the purposes for which data were needed, attention was focused on possible alternatives to the annual survey that would provide answers to questions that the survey could not address. The

other elements of the charge were addressed during the course of dealing with these major topics.

The most fundamental issue was whether the annual survey should be conducted at all. The panel has several reasons for thinking that perhaps it should not:

- (1) The survey, as presently constituted, can provide only estimates of total numbers of occupational injuries but no information on the details of these injuries nor on the characteristics of the injured workers. Therefore, while it can provide some indication as to whether the overall injury rate is increasing or decreasing, it cannot specify the causes of such changes or yield information needed to develop programs for the prevention of injuries.
- (2) There is no immediate solution in sight to the problem of measuring the incidence of occupational illness through the annual survey.
- (3) While the annual survey is useful in providing data needed for the current system used by OSHA for targeting inspections of establishments for enforcement purposes, BLS will not identify to OSHA establishments with high injury rates because of its policy of confidentiality of survey data.

The only existing alternative for national data on occupational injuries and illnesses, however, is the Supplementary Data System (for a description, see Chapter 3). The panel recognized that the Supplementary Data System suffered from lack of uniformity among states in workers' compensation coverage and reporting requirements to be included and in data quality. The annual survey, by contrast, is a large probability sample of private sector employers, which, for large firms, is virtually a census. Thus, the annual survey permits estimates down to the detailed industry level with good reliability. The survey design issues and data processing are handled by a competent staff at BLS. The panel also recognized that all the possibilities under consideration for obtaining national data are dependent on data recorded by employers and therefore suffer from the same problems of possible underreporting and inaccuracy of recording. For these reasons, the panel decided to recommend retaining the annual survey, but to explore ways that possible reporting bias might be measured and reduced and to find ways of increasing the amount of detail obtained in the survey so that the annual survey would be able to meet most of the needs for data, at least on injuries in the workplace. Since the panel could find no data that addressed the question of underreporting of occupational injuries directly, we commis-

sioned a small pilot study in the state of New Jersey to assess the feasibility of doing this for occupational fatalities.

The panel recognized that OSHA, the agency charged with the responsibility of fostering the reduction of workplace injuries and illnesses, must have available detailed information on the injuries and illnesses that occur. Information in sufficient detail could be obtained through an administrative data system based on the data employers are required to maintain. The panel recognized, however, that if such a system were to succeed, OSHA would have to use data much more effectively than it now does.

For at least some of the questions that required detailed information on occupational injuries and illnesses, the panel felt that it was neither appropriate nor necessary to obtain national estimates. Data from a relatively small number of states with good systems on workers' compensation claims would serve some of these purposes, e.g., detailed data on occupational injuries and illnesses from a specific industry could be collected from only those states with a heavy concentration of that particular industry.

The debate on these issues and the choices made by the panel are discussed in the chapters that follow. Chapter 3 describes the federal agencies involved in occupational safety and health programs that operate data systems bearing on these problems. Chapter 4 discusses the major needs for data, the data that are available, and the extent to which the data have been used. Chapter 5 examines the issue of assessing the quality of data on occupational injuries, reviewing past attempts to evaluate the accuracy and completeness of employer-recorded data. Chapter 6 discusses the recording and reporting of data on occupational injuries, including fatal injuries, and suggests approaches to collecting more complete information. Chapter 7 describes the problems involved in the measurement of occupational illnesses and explores ways of improving information on workplace hazards. Chapter 8 presents the panel's proposed modifications to the BLS data systems, in the form of 24 specific recommendations.

THE AGENCIES AND THEIR DATA SYSTEMS

INTRODUCTION

A number of federal agencies are involved in occupational safety and health programs and operate data systems bearing on these problems. It is useful to examine the roles of these agencies with particular emphasis on their relation to statistics on occupational injuries and illnesses. In the process of this examination, we describe the data systems these agencies operate that either currently contribute to the body of information gathered on these problems or that could do so in the future.

The U.S. Department of Labor (DOL) and the U.S. Department of Health and Human Services (DHHS) have major responsibilities for the various aspects of occupational safety and health programs in the United States. These responsibilities come either from the provisions of the Occupational Safety and Health Act of 1970 or from the overall responsibilities of these agencies in the areas of labor and health. In the discussion that follows we describe the functions of the agencies and the data systems they operate. Other agencies, either at the state level or in the private sector, are also involved in ways that affect the overall statistical picture.

THE U.S. DEPARTMENT OF LABOR

The Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) was created by the Occupational Safety and Health Act of 1970 under the assistant secretary for occupational safety and health. It is primarily a regulatory agency with responsibility for enforcing the provisions of the act. This includes the promulgation of standards for both safety and health in

the workplace, carrying out inspections of establishments to determine whether safety and health standards are being maintained, and issuing citations for violations. The act encourages states to assume responsibility for developing their own safety and health programs. Section 18(b) of the act provides for states to carry out their own enforcement programs, provided they are deemed to be at least as effective as the federal program. Currently 23 states, known as 18(b) states, and two territories maintain their own programs.

OSHA maintains two types of data systems. The Integrated Management Information System (IMIS) is an inspection-based data system. The only information entered into it is that obtained as a result of visits by OSHA inspectors to establishments. Thus, for example, employers are required to report fatalities to OSHA within 48 hours. Only information on those fatalities for which an investigation is actually carried out is entered into the system. Similarly, information on accidents involving hospitalization of five or more individuals is entered only if an investigation is conducted. The inspections are of four types: those resulting from accidents, those resulting from complaints from employees or unions, those resulting from general schedule inspections based on a sample of establishments, and those resulting from follow-up inspections to establishments that had previously been cited for specific violations. OSHA produces an annual tabulation of its inspection activity from information in the IMIS system, including the number of various types of inspections, numbers of citations for violations, amount of penalty levied, etc.

A number of OSHA standards require employers in specific industries to collect environmental samples at work sites at which workers are exposed to particular substances. However, employers are not required to submit data on these samples to OSHA; consequently, this information is not entered into the IMIS system.

OSHA's other data system involves an analytic laboratory at Salt Lake City, Utah. All workplace samples from OSHA inspections are sent to that laboratory, which also serves as a backup for laboratories in states that operate their own OSHA programs. The Salt Lake City installation operates a computer system containing information on standards, a data base on hazardous wastes, and a data base on chemical exposures. Only information from tests done at the Salt Lake City laboratory goes into the computer system, and this information has not been merged with that contained in the IMIS system. The only subset of the exposure data obtained by the Salt Lake City laboratory that is systematically integrated with the IMIS system is the exposure data from

samples taken at various work sites where citations were issued as a result of inspections.

The Bureau of Labor Statistics

The Bureau of Labor Statistics (BLS) is a general-purpose statistical collection agency within the Department of Labor. Its data are prepared to serve the needs of business, labor, Congress, the general public, and the administrative and executive agencies for information on economic and social trends. It carries out surveys and data collection activities on labor force statistics, prices and living conditions, wages and industrial relations, productivity and technology, economic growth and employment projection, and occupational safety and health statistics.

The task of collecting statistics on occupational injuries and illnesses was delegated to BLS in 1971 by the secretary of labor to implement the provision of the Occupational Safety and Health Act, which requires the collection of comprehensive statistics on injuries and illnesses in the workplace. However, OSHA was directed to finance this activity from funds in its own budget.

With the exception of its program of occupational safety and health statistics, all the other BLS surveys are voluntary. BLS reports that it obtains excellent cooperation in its surveys because it ensures that the information provided will never be identified with the company or individual who supplied it. Even though the annual survey carried out by BLS is mandatory under the act, BLS has consistently applied the same policy to that survey on the grounds that this will ensure cooperation and will probably maintain data quality.

The BLS Annual Survey

Since 1971, the Bureau of Labor Statistics has surveyed annually a sample of establishments in the private sector to collect statistics on occupational injuries and illnesses. Approximately 5 million establishments are included in the sampling frame for the survey, which covers virtually all private employers. The Mine Safety and Health Administration and the Federal Railroad Administration provide data to the survey for employees in mining and railroads, respectively. Excluded from the survey are self-employed individuals; employers of domestics; farmers with fewer than 11 employees; employers regulated by other federal safety and health laws; and federal, state, and local government agencies (Bureau of Labor Statistics, 1982, 1984a).

Survey Design Currently, approximately 280,000 establishments are selected for the survey annually. BLS collects data directly from establishments in six states and the District of Columbia; the remaining states collect data from establishments through grants or cooperative agreements with BLS and provide these data to BLS for the calculation of national estimates. To permit the calculation of reliable state estimates of occupational injuries and illnesses, BLS selects an independent sample in each state that is representative of all private establishments in that state. In selecting state samples, BLS stratifies establishments by Standard Industrial Classification (SIC) code and employment size, and uses a weighting procedure to select establishments within each SIC code and employment size category. BLS then subsamples the state samples to select the establishments to be included in the national sample (Bureau of Labor Statistics, 1982, 1984a).

Data Collected The record-keeping requirements under the Occupational Safety and Health Act are much more comprehensive than the reporting requirements. All private sector employers with 11 or more employees, except those specifically exempted by OSHA as low hazard industries, are required to record work-related injuries and illnesses on the OSHA 200 (see Appendix A), which is the Log and Summary of Occupational Injuries and Illnesses, and to record supplementary information about each case on the OSHA 101 (see Appendix A), or on another designated form, e.g., the workers' compensation report, that requests all the required information. Recorded cases include all work-related fatalities and illnesses and those occupational injuries that involve loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment beyond first aid. On the OSHA 200, each case is recorded as a fatality, an injury or illness without lost workdays, or an injury or illness with a specified number of lost workdays or days of restricted work activity. Employers of establishments selected to participate in the annual survey report summary totals of these data to BLS on the OSHA 200S (see Appendix A), as well as their average annual employment, the total hours worked by employees, and the nature of the business of their establishment. Employers in industries exempted by OSHA from the record-keeping regulations but included in the sampling frame for the survey, (i.e., low hazard establishments such as in the services industry and high hazard establishments with fewer than 11 employees), are required to maintain the OSHA 200 and to complete the OSHA 200S for the year in which their establishment is selected by BLS to participate in an annual

survey (Bureau of Labor Statistics, 1982, 1984a). These establishments are notified prior to the beginning of the sample year that they will be in the sample.

The annual survey does not require the reporting of most of the detailed information that employers are required to record on the OSHA 200. The nonreported information includes the date of injury or onset of illness; the employee's name, occupation, and department; and a description of the injury or illness. Supplementary information that must be recorded for each case on the OSHA 101 (or equivalent) is also not reported in the annual survey. These supplemental data include the name and address of the employer; the name, address, social security number, age, sex, occupation, and department of the injured or ill employee; the location of the injury or illness; what the employee was doing at the time of injury; how the injury occurred; a description of the injury or illness and the part of the body affected; the object or substance that injured the employee; and the date of injury or illness.

Survey Measurements Data collected from the annual survey are used to produce national estimates of occupational injuries and illnesses for industries classified by the type of activity in which they are engaged using the SIC classification. In manufacturing, the data are produced on a four-digit industry code basis, which provides the highest level of industrial detail, whereas data for most nonmanufacturing industries are produced at the much broader two-digit SIC level (e.g., under the two-digit SIC code of 33 for primary metal industries are diverse four-digit codes, including 3312 for Blast Furnaces, Steel Works, and Rolling Mills; 3332 for Primary Smelting and Refining of Lead; etc.). Incidence rates per 100 full-time employees are calculated by SIC code for total cases of injuries or illnesses, cases that involve lost or restricted workdays or both, non-fatal cases that do not involve lost workdays, the number of days away from work, and the number of days of restricted activity (Bureau of Labor Statistics, 1982). Other data that are published from the annual survey include occupational injury incidence rates by industry division and employment size, number of occupational illnesses by industry division and category of illness, occupational injury and illness fatalities for employers with 11 or more employees by industry division, and the distribution of fatalities by cause and by industry division.

The Supplementary Data System

BLS developed the Supplementary Data System (SDS) to supplement the annual survey with detailed information on the characteristics of occupational injuries or illnesses and on the demographic characteristics of injured or ill workers. In 1973, BLS began testing the feasibility of obtaining this information from state workers' compensation programs. Since 1976, these data have been collected in a standardized format from participating states, the number of which has varied over the years (Bureau of Labor Statistics, 1982).

Data Collected States that have chosen to participate in the SDS provide BLS with data from a document known as the first report of injury or illness. This is also submitted to state workers' compensation agencies by employers and insurance carriers. Although workers' compensation coverage and reporting requirements vary among the states, BLS requires participating states to provide uniformly defined data items using comparable record formats and specific classification systems, i.e., the 1972 SIC Manual for classification of industry, the 1970 Bureau of the Census Alphabetical Index of Industries and Occupations for classification of occupation, and the American National Standard Method for recording facts relating to the nature and occurrence of work injuries (American National Standards Institute, 1963).

Data that participating states are required to provide include state code, reference year, case number, year and month of occurrence, occupation, industry, nature of injury or illness, part of body affected, source of injury or illness, type of accident or exposure, and sex of employee. Optional data that may be submitted include age of employee, day of occurrence, time of injury, time workday began, lapsed time, associated object or substance, length of service, weekly wages, extent of disability, kind of insurance, indemnity compensation, medical payments, and rehabilitation costs (Bureau of Labor Statistics, 1982, 1984b).

Survey Measurements Data collected from the SDS can be used to examine the detailed characteristics of injuries or illnesses and the demographic characteristics of the injured or ill employees. Although rates cannot be calculated since denominator data, (e.g., hours worked), are not collected, BLS has derived national estimates of specified characteristics of injuries and illnesses by applying the percentage distributions across the categories of each variable of interest from the SDS data to annual survey data.

The Work Injury Report Survey Program

First conducted in 1978 by BLS, Work Injury Reports are one-time surveys of injured workers conducted to obtain detailed causal information that is not available through the annual survey or the SDS. Survey topics are jointly determined by BLS, OSHA, and NIOSH and include injuries to specific anatomical sites, injuries in specific industries, and injuries resulting from specific types of accidents.

The questionnaires are specifically designed by BLS to obtain information on the circumstances surrounding the injury, work site conditions or other factors contributing to the injury, employer safety practices, and employee experience and training. These questionnaires are then mailed to workers who have been identified through the SDS as having had the specific injury of interest and who are asked to participate voluntarily in the survey. In an attempt to reduce the possibility of recall bias, BLS excludes from the surveys employees whose injury occurred more than 120 days prior to the survey. Data obtained from an injured employee may include occupation and length of service, activity and location at the time of injury, nature of the injury, part of the body affected, the length of hospitalization required, conditions or factors the employee felt contributed to the injury, personal protective equipment worn at the time of injury, and amount of training information and safety instruction provided by the employer. These data may be quite useful in the development of safety standards.

Budget Implications

Each of the BLS data systems on occupational injuries and illnesses is used for different purposes. The three systems--the annual survey, the Supplementary Data System, and the Work Injury Report--are not given equal weight by BLS. One way of assessing the relative importance of these systems currently is by examining the BLS budget for these programs.

Table 1 shows that most of the budget spent directly by the BLS for its own operation goes into the annual survey: \$4.3 million of the total \$5.3 million. In addition, about 60 percent of federal funds to states is for the annual survey. The matching funds provided by the states, by contrast, are almost equally divided between the annual survey and Supplementary Data System. The Work Injury Report program accounts for a very small part of the total budget.

Table 1: BLS Budget for Occupational Safety and Health Statistical Programs, Fiscal 1986 (in millions)

<u>Program</u>	<u>Federal Funds</u>		<u>State Funds</u>	<u>Total</u>
	<u>BLS (Internal)</u>	<u>To States</u>		
Annual Survey	\$4.3	\$2.9	\$2.1	\$9.3
Supplementary Data System	.6	1.9	1.9	4.4
Work Injury Report	.4	.1	---	.5
Total	5.3	4.9	4.0	14.2

THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

In the language of the Occupational Safety and Health Act of 1970, the secretary of health, education, and welfare (now health and human services) is expected to work closely with the secretary of labor on the development of safety and health standards, input into the designation of persons to serve on advisory committees, collaboration on record-keeping regulations, identification and publication of lists of toxic substances, and consultation on the development and maintenance of a program of occupational safety and health statistics. In addition, the National Institute for Occupational Safety and Health was established by the act, within DHHS, to conduct research, experiments, and demonstrations in occupational safety and health.

Some of the other components of DHHS, while not necessarily charged with primary responsibilities in the area of occupational safety and health, do carry out programmatic activities or collect data that bear on the problems of injuries and illnesses in the workplace.

The National Institute for Occupational Safety and Health

The National Institute for Occupational Safety (NIOSH) was established by the Occupational Safety and Health Act of 1970. Its mandate is to respond to requests to investigate health hazards in the workplace; perform research on work-related health and safety problems; recommend to OSHA and to the Mine Safety and Health Administration regulatory activity, based on its research findings; and to ensure the development of a sufficient supply of trained personnel to carry out the mandates of the act. It therefore conducts research to identify specific health and safety hazards in the workplace and to establish levels of exposure of substances that are hazardous. It carries out a program of surveillance (or monitoring) to obtain information that can be useful in the prevention of workplace injuries or illnesses and for evaluating the impact of prevention programs. To carry out these programs, NIOSH conducts several data collection activities, both independently and in collaboration with other agencies. We describe those that are primarily operated by NIOSH; the others are described under the agencies primarily responsible for them.

The National Occupational Hazard/Exposure Surveys

From 1972 to 1974 NIOSH conducted the National Occupational Hazard Survey in approximately 5,000 establishments, randomly selected to represent all nonagricultural businesses covered under the Occupational Safety and Health Act of 1970. Plant surveys included a walk-through inspection in which engineers were supposed to observe "every plant process and every employee," making estimates of the numbers of workers exposed full-time and part-time to various substances and collecting other information, including data on whether engineering controls had been implemented or personal protective equipment was required for specific exposures (National Institute for Occupational Safety and Health, 1974). A similar survey, the National Occupational Exposure Survey, was conducted by NIOSH from 1981 to 1983.

Neither of these surveys included any industrial hygiene sampling. Therefore, since these surveys provide no data on actual exposure levels, one cannot determine whether workers considered to have been exposed to a specific substance were

exposed to trace amounts or to high levels of the substance.

Health Hazard Evaluations

Health Hazard Evaluations involve the evaluation of possible health hazards through industrial hygiene, medical, and epidemiologic investigation in the workplace and the recommendation of appropriate methods (e.g., control procedures, improved work practices, medical screening) to reduce exposure levels. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, in response to written requests from employers, employees, or employee representatives. NIOSH also provides, upon request, technical assistance to federal, state, and local agencies to control or prevent occupational health hazards.

Fatal Occupational Trauma Surveillance

In 1985 NIOSH began purchasing copies of death certificates from states using the following criteria established by NIOSH: an International Classification of Diseases code of E800-E999 (external cause of death, including homicide and suicide), 16 years of age or older, and a positive response to the "injury at work" item on the death certificate. They purchased death certificates meeting these criteria retrospectively from 1980 onward from each state and are using them to obtain national estimates of work-related deaths and to analyze causes of these deaths in some detail. This system is nearing completion, with the goal of covering all 50 states. All 50 states are now included in the system, but some states have not fully met the criteria.

The National Electronic Injury Surveillance System

The National Electronic Injury Surveillance System is operated by the U.S. Consumer Product Safety Commission in collaboration with several other agencies, but it is used by NIOSH as part of its safety research program. The system involves collecting data from a sample of hospital emergency rooms to gather the following information:

- Injuries associated with consumer products (Consumer Product Safety Commission);

- Work-related injuries experienced in the course of employment (NIOSH);
- Information on cases resulting from pesticide exposure (Environmental Protection Agency);
- Information on cases resulting from cosmetics, drugs, or medical devices (Food and Drug Administration).

A sample of some 60 hospital emergency rooms provides data on workplace injuries that come to the attention of these facilities. A subsample of 14 of these hospitals also provides identification of the specific establishments in which these injuries occurred as well as codes for specific industry and occupation.

The National Center for Health Statistics

The National Center for Health Statistics is a general-purpose health statistics agency created in 1960 when the National Health Survey and the National Vital Statistics Division were combined into a single agency. NCHS has had many organizational changes over the years. It has been located until quite recently in the Office of the Assistant Secretary for Health. In June 1987, it was transferred to the Centers for Disease Control, the same agency that houses NIOSH. It does not have explicit mandates to produce data in the area of occupational safety and health, but during the past few years it has carried out some collaborative projects with both BLS and NIOSH. Formal memoranda of understanding have been signed expressing intent to collaborate on specific activities. Many of the data systems operated by NCHS have occupational components or have the potential of contributing to the overall occupational safety and health statistics picture. These data systems are described below.

Mortality Data

Through a cooperative agreement with all 50 states, the NCHS collects and compiles data on every death in the United States. All states' death certificates conform closely to the standardized certificate recommended by NCHS and contain basic demographic information, including usual occupation and industry of decedent and one or more entries relating to the sequence of pathologic and causal events leading to death. Some of the states submit their data in machine-readable coded form, while others submit copies of the original death certificate and the coding is done by NCHS. Coding of cause(s) of death is done by trained no-

sologists according to the revision of the International Classification of Diseases (U.S. Department of Health and Human Services, 1980) in effect at the time of death. NCHS and each state tabulate and publish statistics compiled from death certificates. NCHS also makes available computer tapes containing all of the coded data. Death rates for diseases are computed using Bureau of the Census data as the denominators.

Nativity Data

As with mortality records, every state collects records of all births and fetal deaths and shares these data with NCHS. Birth and fetal death certificates contain basic demographic information and information relating to pregnancy outcome including birthweight, length of gestation, Apgar scores (measuring physical status), congenital anomalies, and other complications of pregnancy and birth.

As of 1984, only 13 states or registration areas collected parental occupation and industry data on birth certificates, and 11 collected these data on fetal death certificates. Only 2 of those 13 collected data on current occupation; the remainder collected data on usual occupation. Collecting data on current (within the year prior to birth or fetal death) is necessary to suggest links between hazardous exposures and gestational events (Lalich et al., 1986). NCHS is recommending changes in vital records for 1988 that include information on parental occupation on fetal death certificates, but not on birth certificates.

The National Health Interview Survey

NCHS has conducted the National Health Interview Survey annually since 1962. This survey was designed to produce national estimates for the civilian noninstitutionalized population of the United States on the basis of a probability sample. The sample interviewed for 1985 was composed of 34,844 households containing 91,531 persons (Moss and Parsons, 1986). The basic information obtained through this survey attempts to measure aspects of morbidity, disability, and the use of medical services and facilities. Questions pertain to illnesses and injuries, days of disability, including bed days, work-loss days, school-loss days, limitation of activity caused by chronic conditions or impairments, hospitalization, doctor contacts, perceived health status, and the social, economic, and demographic characteristics of the persons interviewed. In order to make responses to the

The Agencies and Their Data Systems

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interview less dependent on long-term memory, medical information is elicited only for conditions occurring in the two weeks prior to the interview. There have been supplements to the survey annually covering specific topics that change from year to year. In 1987, for example, the supplement is devoted entirely to questions related to cancer prevention and control. Like all interview surveys, there are limitations to the accuracy of diagnostic and other information obtained in the NHIS. The respondent may not accurately pass along information received from a physician on some medical conditions or on others that may not have been medically attended. Recall biases may be significant. These data give the incidence of acute conditions but attempt to measure the prevalence rather than the incidence of chronic conditions.

The National Health And Nutrition Examination Survey

The National Health and Nutrition Examination Survey is also a probability sample of the civilian noninstitutionalized population of the United States. It is carried out at infrequent intervals--the first having been carried out in the early 1970s, the second in the late 1970s, and the third is expected to go into the field in 1988. In the early 1980s, the survey was carried out on a sample of the U.S. Hispanic population. The survey involves a detailed physical examination with extensive associated laboratory work as well as an interview. The kinds of information obtained are dietary intake, hematological and biochemical tests, body measurements, clinical assessments, history of various medical conditions, and data on health status and medical care needs. The only information obtained on occupation is current occupation and industry for those that are currently employed.

The National Hospital Discharge Survey

Since 1965, NCHS has conducted annually the National Hospital Discharge Survey (NHDS). This is a probability sample of discharges from all short-stay hospitals in the United States exclusive of veterans and military hospitals (short-stay hospitals are those with 6 or more beds, with an average length of stay of less than 30 days). In 1984, 553 hospitals were included in the sample and, of these, 407 participated in the survey.

A modest amount of information is obtained on each hospital discharge, including up to seven discharge diagnoses coded according to the International Classification of Diseases (9th Revision, Clinical Modification). Data are used

to characterize utilization patterns by diagnostic categories, by characteristics of the patient, and by characteristics of the hospital. As with all hospital discharge abstract data, information on occupation and industry is not included in the data set. Since hospitals are paid for their participation in the NHDS, NCHS would need additional funding to require collection of occupational information. This might be the first step in having occupation and industry included in all discharge records as part of the Uniform Hospital Discharge Data Set--an abstracting format followed by many hospitals in the country.

National Death Index

The National Death Index (NDI) is not really a data system but rather a mechanism for determining the vital status of groups of individuals for purposes of follow-up studies. The NDI itself consists of identifiers on every death occurring in the United States from 1979 to the present time. An investigator can submit a list of identifiers on each member of a study group and request a search through the NDI from 1979 on to determine whether any of these individuals have died. An investigator's study proposal must be approved by a committee appointed by the NCHS before the matching procedure can be carried out. When matching information is found in the NDI, the investigator is provided with the name of the state in which the death occurred and the death certificate number. If the investigator wants to know the causes of death, he or she must then obtain them from the health departments in the states where the deaths occurred. An example of the application of this mechanism in the occupational health area would be a cohort study of the workers in a particular area of a plant to determine the proportion that died over a specified period of time and to analyze the possible relationship between causes of death and specific exposures in the workplace.

The National Center for Health Services Research

The National Center for Health Services Research conducts its own research and provides grant support to outside investigators in the area of health services research. Over the years it has carried out large population surveys on medical care expenditures, either alone or in collaboration with the National Center for Health Statistics. It is currently in the initial stages of a large survey on medical care expenditures that could provide some information that

might be useful for analyses of the relationship between occupation and certain medical conditions. The National Medical Expenditure Survey (NMES) is a panel survey that includes 14,000 households with four rounds of interviewing in 1987. It also includes an institutionalized population component that will include 13,000 persons in nursing homes, facilities for the mentally retarded, and psychiatric hospitals and will collect essentially the same kind of information as that collected in the household sample. The NMES sample includes an oversampling of groups of special interest. These include blacks, Hispanics, the poor, the elderly, and persons with functional limitations. A preliminary sample will be interviewed first with a 20-minute interview to obtain demographic information. This will serve as the sampling frame for the final sample, with the sampling fraction varying among subgroups depending on their characteristics. The household information will be obtained by three face-to-face interviews, two telephone interviews, and one self-administered questionnaire. The household component will obtain answers to questions on characteristics of family, employment, income, taxes, assets, access to use, health insurance, disability days, physician visits, other provider visits, hospital stays, prescription drugs, equipment, and supplies. Because the survey obtains information of this type on individuals at various points in time and can relate medical information to type of employment, it holds some promise for identifying conditions of a more chronic nature that might be associated with particular work situations.

The National Cancer Institute

The National Cancer Institute (NCI) is one of the National Institutes of Health, whose major mission is medical research. The research activities of NCI include basic biomedical research, clinical trials and investigations, research into cancer prevention, and epidemiologic and biostatistical research. Part of NCI's epidemiologic research effort is devoted to studying factors in the work environment that may lead to high risk of cancer. NCI also operates a large cancer registry program that serves as a basis for monitoring cancer incidence and cancer patient survival in the United States.

NCI operates the Surveillance, Epidemiology and End Results Program (SEER), which is a group of 11 population-based cancer registries covering 5 states (Connecticut, New Jersey, Iowa, Utah, New Mexico, and Hawaii), 4 metropolitan areas (Atlanta, Detroit, San Francisco, and Seattle), 4 counties in New Jersey, and the Commonwealth of Puerto Rico. Every case of cancer diagnosed among residents of these

areas is identified. Information on them is abstracted from medical records and coded in a uniform way. Patients are then followed from diagnosis until death so that vital status can be determined at least once a year. This allows the computation of survival rates for groups of patients. Although most of the SEER registries collect some information on the occupation of cancer patients, the information is incomplete and lacks uniformity. Some of these registries have been used as a mechanism for determining the extent to which specific occupational cohorts have developed specific cancers. This is a way of linking occupational exposure to a disease outcome.

In addition to the SEER registries, there are approximately 17 other population-based cancer registries, covering another 36 percent of the U.S. population. Some of these are in early stages of development and data from them are not yet available. In contrast with the SEER registries, these are not operated in a uniform way and the standards for completeness and accuracy vary considerably.

DATA USES AND NEEDS

In order to analyze the existing data systems on occupational injuries and illnesses, identify inherent problems, and propose solutions, it is necessary to consider the context of the uses to be made of the data produced by these systems. In the course of its investigation, the panel attempted to identify potential uses of data in relation to current uses and to elicit expressions of needs for data from the various users or potential users.

The primary users of data on occupational injuries and illnesses are OSHA and NIOSH, and their needs are related to the implementation of their mandates under the Occupational Safety and Health Act of 1970. There are a number of other users, such as state occupational safety and health programs, state health departments, individual employers, labor unions and employees, and Congress. The discussion that follows is organized in terms of the major needs for data expressed by users as well as our assessment of additional, but unexpressed, needs. We specify the data that are available to meet each of the major needs and indicate the extent to which the data have been used.

DATA FOR SETTING STANDARDS

The Occupational Safety and Health Act requires OSHA to set standards that are based on the best available evidence. Data are needed to determine the priorities for standards to be issued and to make determinations of risk and the feasibility of control measures for individual standards. Executive Order 12291 on Regulatory Reform also requires OSHA to develop a Regulatory Impact Analysis of all of its major regulations and to submit the regulations to the Office of Management and Budget for review. To prepare the regulatory analysis, estimates of the numbers of workers exposed

and the impact of the standard on disease and injury must be developed.

For setting safety standards, data are needed in considerable detail on specific pieces of equipment, numbers of workers using them, their exposure to hazards, rates of injury resulting from their use, types of injury, source of injury, and part of the body affected. For setting health standards, data are needed on the incidence of specific occupational diseases and on the relation between specific exposures in the workplace and the occurrence of particular diseases. Against this background, data are needed on the extent to which these hazards exist, the numbers of workers exposed, the numbers of cases of disease that can be expected, etc. Information about current exposure levels is a prerequisite for estimating the impact of setting new exposure limits. Exposure information is also useful in determining the feasibility of control to lower levels. These data are necessary at the priority-setting stage, when the issue is which hazards to address first. They are also necessary for calculating the impact of different exposure limits for a particular hazard.

OSHA has expressed the need for the following kinds of information as a basis for developing health standards:

- Data on employee exposure levels to specific workplace health hazards by industry and job category, methods used to collect such exposure data, and data on work practices and conditions related to exposures for specific industries.
- Data on the cost of control equipment and on the efficiency of this equipment in reducing or eliminating exposures to health hazards.
- Data on the morbidity and mortality of certain chronic diseases in specific worker populations.
- Data from medical surveillance programs that could provide the following: the results of tests conducted to determine the effects of exposures, the relationship between the test results and exposure levels, and specifications of medical and clinical tests.
- Data on risk assessment for cancer and other diseases.

The BLS annual survey does not provide the detailed information on injuries or on the characteristics of the injured worker necessary for the development of standards or for research into injury etiology. Much of this detailed information is recorded on the OSHA 200 or the OSHA 101, but these items are not currently reported in the annual survey.

The BLS Supplemental Data System provides detailed information on the characteristics of occupational injuries and illnesses and on the demographic characteristics of the injured or ill workers. These data are useful in the development of standards, but analyses must take into account the limitations of the SDS. One of these limitations is the amount of detail contained in the SDS for use in identifying the causes of injuries. Further information is needed on specific makes and models of equipment, whether the equipment was properly used, whether the worker had been trained, etc. This is a problem regardless of whether the data are being used at the state or the national level. For use at the national level, however, there are several additional limitations.

One must exercise caution in attempting to use the SDS as a basis for national estimates, since it is not a probability sample of state workers' compensation agencies. States can enter and leave the SDS at their own discretion. For 1986, 32 states and one territory* provided BLS with data from their first report of injury or illness forms. In addition, the data collected from the SDS do not include average annual employment or total hours worked by employees in the establishment in which the injury occurred. Thus, no denominators are available from the SDS to calculate incidence rates. However, BLS has derived national estimates of specified characteristics of injuries and illnesses by applying the percentage distributions of SDS data to annual survey data. OSHA uses these data, to some extent, in its development of standards. NIOSH also uses these data for the development of its *Alerts* about specific hazards; these are recommendations about safety procedures that can have an effect similar to that of a standard.

Variability in workers' compensation laws among states leads to noncomparability in the data. State regulations are not uniform as to which employees are eligible for workers' compensation, and reporting requirements can involve recording all occupational injuries and illnesses or just those resulting in a specified period of disability or number of lost workdays. The minimum number of lost workdays required for eligibility for indemnity compensation varies among states from none to eight. The underlying lack of comparability of

*Alaska, Arizona, Arkansas, California, Colorado, Delaware, Hawaii, Indiana Iowa, Kentucky, Louisiana, Maine, Maryland, Michigan, Mississippi, Missouri, Montana, Nebraska, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming, and the Virgin Islands.

data among states is further complicated by the fact that some states send BLS data from every workers' compensation claim that is received, even those that have not accumulated the number of lost workdays required for reporting in that state. The data systems cannot always distinguish these "voluntary" claims from those that meet the requirements for reporting. To complicate the situation further, many states pay workers' compensation even for first aid. Furthermore, some workers may receive compensation for medical care costs even though they may not have met the minimum lost workday requirement.

Work Injury Reports provide detailed causal information on specific research topics that are quite useful in the development of safety standards and supplement the data provided by the SDS. A particular Work Injury Report uses data from one or more states participating in the SDS. The limitations of Work Injury Reports, however, include the lack of trend data, since these are one-time surveys. In addition, Work Injury Reports instruct the user to exercise caution in using the survey data as a basis for population estimates, since states participating in the Supplementary Data System that participate in a particular Work Injury Report do so on a voluntary basis and are therefore not selected to be representative of the entire United States. Workers' compensation cases included in a Work Injury Report are subject to the same inconsistencies in state reporting requirements that are discussed above.

The only illness data from the BLS annual survey that might be useful for any purpose may be those on occupational skin diseases. All the other illnesses included on the annual survey form are underreported and can be used only with great caution.

Some information on workplace exposures is available in the OSHA Integrated Management Information System, but only systematically for those situations in which workplace samples were taken during the course of inspections that resulted in citations. OSHA uses this information, but the panel was told by several OSHA representatives that little use is made of the IMIS system. Thus, there has been little incentive to improve inadequate data. NIOSH has produced data on exposure to hazards, including estimated numbers of employees exposed to specific substances; however, this information is based on two surveys, National Occupational Hazard Survey and National Occupational Exposure Data, neither of which involved actually measures of levels of exposure or length of exposure and neither of which adequately estimated the number of workers exposed.

The only information available on the cost of control equipment and efficiency in reducing or eliminating hazards

is that obtained by contractors of OSHA in studies on particular substances as part of OSHA's preparation for a standard.

Cancer registries can provide data on the incidence of specific cancers, but they have been a poor resource for direct data on the relation between specific occupations and certain cancers. Concerning morbidity and mortality from specific diseases in worker populations, such data are not routinely available, but a number of states are now participating with NCHS and NIOSH in coding occupation and industry on death certificates.

DATA FOR SAFETY ENFORCEMENT

To implement the Occupational Safety and Health Act of 1970, OSHA carries out a program of inspections of establishments for compliance with safety standards. This is done in response to reports of fatal injuries, complaints received from, or on behalf of, employees, or as a result of random selection of plants (general schedule inspection). With regard to the latter, there has never been a cadre of inspectors large enough to carry out inspections across the entire range of industry. The method employed has been to identify industries with the highest risk of injury and to give priority to sampling firms within them. States that conduct their own occupational safety and health programs do their own selection of priority industries.

In 1981 a new policy was adopted for the manufacturing sector: once a plant was selected for inspection, the inspector, upon arrival, would first compute from the plant's log of injuries the lost workday injury incidence rate. If that rate was below the national average for manufacturing, the visit would be terminated at that point without any further inspection. For targeting purposes then, national aggregated data are needed that would permit the ranking of industries according to some measure of rate of injuries. Individual establishment data are also needed to determine whether a complete inspection should be carried out. Because of the BLS policy on confidentiality, OSHA does not have access to the individual establishment data from the annual survey. Therefore, it obtains the data for computing lost workday injury rates only after it enters a plant for inspection. We note that this last step is not used in some of the states that operate their own occupational safety and health programs. Data are needed on the number of violations contributing to serious accidents by accident type, industry, and size of plant in order to improve the targeting of inspections and accident investigations and to aid in the

assessment of which violations should be penalized most heavily (Mendeloff, 1984).

For targeting industries for inspections, OSHA uses the BLS annual survey data classified by detailed industry and computes lost workday injury rates. To determine whether to carry out a complete inspection in a particular establishment, the OSHA inspector obtains the information from the firm's OSHA 200 log at the time of the inspection. No data on injuries at the plant level are available to OSHA for inspection targeting purposes in advance of an on-site inspection.

DATA FOR HEALTH ENFORCEMENT

There are no clear-cut criteria now in use for establishing priorities for inspections for health violations. Among the possibilities are the selection of those industries or individual plants having histories of prior problems in complying with health standards or those in which employees are thought to have high exposure to hazardous substances. Consistent data are needed on the results of inspections, numbers of employees exposed to specific hazards, and measures of exposure levels for specific substances.

In addition, data are needed on numbers of abnormal biological indicators that are consistent with exposures to substances for which there are specific standards. For example, such indicators may include high blood lead levels, X-ray evidence of changes in the lung, and temporary or permanent hearing loss. OSHA is also interested in data on the occurrence of symptoms that are consistent with exposure to specific substances.

Since the occupational disease data from the BLS survey are deficient, OSHA cannot use the BLS annual survey data for targeting health inspections. Instead, OSHA uses data from the IMIS system that indicate the experience of an industry with prior violations. This results in targeting only those industries in which violations had already been found.

DATA FOR EVALUATION

OSHA needs quantitative information to facilitate the optimal allocation of resources to conduct its program effectively and efficiently. Employers are required to report to OSHA all occupational fatalities and all occupational injuries resulting in the hospitalization of five or more individuals. OSHA needs data on the number of such reports, the number of inspections that result from these reports, the distribution

of factors that influence whether an inspection is made, and data reflecting the outcome of inspection. Some OSHA standards require the employers in certain industries to take environmental samples at work sites with specific kinds of exposures and to take samples from, and to offer physical examinations to, exposed workers. Systematic data are needed on the results of these tests and examinations, such as the number of samples taken, the number of positive findings, the relationship of findings to exposure information on individuals, and data to indicate the impact of findings on subsequent exposures in the same establishments.

To evaluate OSHA's effects on the injury rate requires longitudinal establishment-level data on types of inspections, numbers of citations for violations, specific standards violated, and size of penalties. It also requires data that link the type of inspection to the type of injury before and after citations were issued.

For ongoing evaluation of the effectiveness of the overall OSHA program for preventing workplace injuries and illnesses, data are needed on changes in the distribution and the rates of injuries and illnesses. For injuries, it is critical to assess changes in injury rates over time according to some measure of severity. Temporal changes in overall injury rates could be due to fluctuations in the numbers of less severe injuries in the face of increases in the rate of serious injury.

For known or suspected hazards, a measure of how many workers have been exposed and the levels of exposure can provide a measure of progress. If firm-specific data are available, studies can be conducted to see if programs in particular industries or plants, or for particular types of hazards, have been successful.

At the present time, both BLS and OSHA use the injury rates from the BLS annual survey to assess whether health and safety in the workplace is improving or worsening. None of the current data systems has any built-in measures of severity that would permit the tracking of more severe injuries for a more meaningful evaluation of program effectiveness. Some information on inspections and the results of inspections are contained in the IMIS system but not on the number and types of reports of accidents or fatalities for which inspections were not carried out. The BLS data, which do permit longitudinal analysis, frequently contain information on whether the plant was inspected by OSHA during the year.

DATA FOR RESEARCH

The passage of the Occupational Safety and Health Act of 1970 led to the emergence of much research on the effectiveness of OSHA in reducing injuries and illnesses in the workplace, on the impact of enforcement, on the impact of standards, on the causes of particular categories of injuries, on the relationship between exposure and illness, etc. Data are needed for research on some of the economic aspects of injuries and illnesses, such as the relation between wages and the risk of injury or illness, between injury and absenteeism, and between injury and resignation from jobs. For many purposes the BLS data have been adequate, but to answer other questions requires special studies rather than routinely produced national data.

The 1970 act created NIOSH as a research organization in occupational safety and health. In carrying out its research mandate, NIOSH needs data that will provide an ongoing picture of the incidence of occupational injuries and illnesses and that can be used to generate hypotheses for further research. Other researchers in states and academic institutions carry out research in this area as well.

NIOSH has created its own data bases or has worked out collaborative data projects with other agencies when it cannot obtain satisfactory data from the BLS data systems. For this reason, they have conducted two national hazard surveys to develop estimates of numbers of workers exposed to specific hazards; they have developed a national occupational fatality data system through an arrangement with all 50 states; they have developed collaborative agreements with the National Center for Health Statistics to develop occupational components in the two major NCHS population surveys, the National Health Interview Survey and the National Health and Nutrition Examination Survey.

University researchers have used the annual survey data as well as the Supplementary Data System to carry out studies to assess various aspects of the OSHA program. They have also used the exposure data in the OSHA IMIS system for research on the impact of workplace exposures.

DATA FOR INFORMATION AND COMMUNICATION

The major data users whose needs are for information and communication are Congress, employers, employees, and unions.

Congress is interested in whether the Occupational Safety and Health Act of 1970 is being properly implemented, whether it is having an impact, and whether there are prob-

lems of health and safety in the workplace that are not being addressed. These needs require data that show whether rates of specific types of occupational injury and illness are decreasing as a result of specific efforts to reduce them. They include needs for data on OSHA's enforcement activity and information concerning efforts to reduce the incidence of occupational diseases as well as ways of measuring the occurrence of occupational diseases.

Employers are particularly interested in how their establishment's safety record compares with that of other similar establishments or with their particular industry. They also need to know what injuries and illnesses result in large numbers of lost workdays and therefore in decreased productivity. For this latter purpose it would be extremely helpful if an establishment were able to compare its lost workday experience for a specific type of injury with that for the industry as a whole.

Unions have expressed the most concern about the existence of hazards in the workplace and about the inadequacy of the data that reflect the situation. Assurance of a safe and healthful work environment is of particular concern to this group. For this purpose they need data that are similar to those needed by employers. And, since the majority of employees are not members of unions, employees themselves have need for this kind of information.

Congress has held two hearings in the past three years on the need for much better data on occupational illness than now exists. Some information can be pieced together to obtain better quantitative information on occupational illnesses; we discuss this in more detail in Chapter 7.

Much of the data needed by employers and by employees is available through the BLS systems, but it is not disseminated to these groups in understandable form and in a way that will permit individual employers to understand what is needed to reduce the numbers of injuries and illnesses in the workplace and employees to understand their particular risks of hazardous exposures in the workplace and the consequences of such exposures.

CONCLUSION

Our examination of data needs, available data to meet these needs, and current uses of the data reveals that, for the most part, the needs for data are not being met. The problem is particularly acute for occupational illnesses, for which there are substantial gaps in statistical information. OSHA does use some data for standard setting and for enforcement, but the data are far from adequate for these

purposes. OSHA operates its own data system on inspections, the IMIS system, but it excludes from the system important information to which it has access that would make it much more useful.

We also note that the BLS annual survey does not serve many of the purposes for which data are needed. Much of the information that employers are required to record is never collected, and OSHA does not have access even to the individual establishment data that are collected. The completeness of reporting of occupational injuries is questionable and occupational illnesses are apparently grossly underreported. Furthermore, the annual survey treats all injuries alike, without distinguishing the serious injuries from the more superficial ones.

To address these problems, we first review past attempts to assess the quality of the BLS annual survey (Chapter 5). In Chapter 6 we discuss approaches to obtaining more useful data on occupational injuries. In Chapter 7, we explore ways of putting together more useful information from several sources on occupational illnesses and hazardous exposures in the workplace.

QUALITY ASSESSMENT AND ASSURANCE

One of the major issues leading to the establishment of this panel was a concern that there may be serious underreporting of both occupational injuries and illnesses. In this chapter we examine the issue of assessing the quality of injury and traumatic fatality data by reviewing past attempts to evaluate the completeness and/or accuracy of employer-recorded data. The limitations of previously conducted studies preclude a definitive assessment of the quality of occupational injury data. Because problems of measuring occupational illnesses are very different from those of occupational injuries and fatalities, we postpone discussion on the quality of occupational illness data for Chapter 7.

Ideally, to assess the completeness and accuracy of the data collected in the BLS Annual Survey of Occupational Injuries and Illnesses, one would have access to all the information needed to make independent decisions as to whether injuries should have been recorded on the OSHA log. One would then determine the extent to which the employers have made these same decisions. This could require examining medical records, death certificates, or medical examiner records. In many instances, these records are difficult to obtain.

We discuss quality assurance in terms of the programs that have been developed to ensure the quality of occupational injury and fatality data on an ongoing basis.

PAST ATTEMPTS AT QUALITY ASSESSMENT

During the early years of the annual survey, BLS attempted to check the accuracy of the data reported by employers. A number of studies have also been conducted by individual researchers to assess the completeness or accuracy of the information obtained in the annual survey. The following discussion briefly reviews these attempts.

Quality Assessment by BLS

Quality assessment programs were conducted by BLS for its annual survey from 1971 to 1976: the Response Analysis Survey in 1971, the Quality Measurement Survey from 1972 to 1974, and the Quality Assurance Program from 1975 to 1976. The major objectives of these surveys were to identify and resolve any problems that employers were experiencing in interpreting the record-keeping requirements and to check the accuracy of the data reported.

On-site visits, conducted by BLS and state occupational safety and health staff members in a sample of approximately 2,000 establishments each year, included the administration of a questionnaire to evaluate employers' understanding and implementation of the OSHA record-keeping system and comparison of the OSHA 200 log with OSHA 101s and other employer-maintained records to identify inaccuracies in the BLS annual survey. Although results of the quality assessment programs were used internally by BLS, primarily to design seminars and training aids to educate employers on the record-keeping requirements under the 1970 act, no internal reports of the results were prepared, nor have the data been published (personal communication, William Eisenberg, BLS, October 6, 1986).

BLS recognized that a serious limitation of its previous quality assessment program was the inability to assess the underreporting of injuries or illnesses on the annual survey, since employer-maintained records were the only source of data being examined. Injuries or illnesses could be detected only if an employer had completed another form, the OSHA 101, on an injury or illness that had not been recorded on the OSHA 200 or the OSHA 200S. However, overreporting of injuries and illnesses could be detected, e.g., from employers recording cases on the OSHA 200 that involved only first aid and not medical treatment (Internal BLS memo by Norman Root, April 20, 1973).

No quality assessment survey has been conducted on the annual survey since 1976. However, a study comparing 1983 annual survey results and workers' compensation records was conducted in Nebraska and Wyoming. These two states volunteered to participate in a pilot study to compare the number of injury and illness cases reported by a sample of establishments in the annual survey with the number of workers' compensation reports filed by these establishments. An internal BLS document discusses problems in making such a comparison: (1) identifying the workers' compensation reports filed by the specific establishments that had been selected from the annual survey, especially when multi-establishment employers were involved and (2) identifying those

workers' compensation cases that required only first aid treatment and that must be removed to make the annual survey and the workers' compensation records comparable. The document suggests that a comparison of workers' compensation and annual survey records might therefore require further examination of cases on an individual basis to ensure that the records are comparable.

Other Attempts at Quality Assessment

Few studies have been conducted since the 1970 act was passed that attempt to examine the completeness or accuracy of employer-recorded occupational injuries. As summarized below, all of the studies are limited in their ability to assess whether occupational injuries were underreported on employer records. A more detailed review of each study, including methodology, results, and critique, is presented in Appendix B.

Studies by the Insurance Company of North America (INA) (Mazor, 1976) and Safety Sciences (1978) examined the accuracy of employer-recorded data on nonfatal occupational injuries. The INA compared data from a sample of employer's first reports of injury or illness with data obtained from INA's standard investigation of these cases. Safety Sciences compared injury data recorded on the OSHA 101 with the employee's description of the injury. These studies were not designed to examine the completeness of the data. Since INA examined only cases that had already been reported through the employer's first reports of injury or illness, and Safety Sciences interviewed employees only about cases that had been identified on an employer-maintained injury record, these studies could not have detected whether employers were underreporting occupational injuries.

Studies by Discher et al. (1975), Arthur D. Little (1981), Fine et al. (1984), and Ruser (1986) examined the completeness of employer-recorded data on nonfatal occupational injuries by comparing various data sources. Arthur D. Little and Fine et al. examined only employer-maintained data sources: Arthur D. Little compared the number of cases for which first reports had been completed with the number of lost workday cases that had been recorded on the OSHA 200; Fine et al. compared data on cumulative trauma disorders of the upper extremities obtained from OSHA 200 logs, workers' compensation claims, and medical leave registries with plant medical records. Discher et al. conducted employee interviews and Ruser used the National Health Interview Survey as independent data sources: Discher et al. compared data on occupational injuries obtained through questionnaires

administered to employees, workers' compensation claims, and OSHA 200 logs; Ruser compared the estimates of numbers of occupational injuries from the NHIS with those from the BLS annual survey. None of these studies compared data sources on a case-by-case basis to determine whether an injury identified by one source was recordable by another source, such as the OSHA 200.

Studies by Karlson and Baker (1978), Baker et al. (1982), System Sciences, Inc. (1980), and Parkinson et al. (1986) examined fatal occupational injuries. Karlson and Baker identified occupational injury deaths to Wisconsin residents from death certificates and workers' compensation records. Baker et al. used medical examiner records, workers' compensation claims, cases reported to OSHA, and death certificates to identify fatal occupational injuries in Maryland. System Sciences used medical examiner records to identify the number of fatalities that were, or would have been, investigated by OSHA in North Carolina. Parkinson et al. identified traumatic deaths in Allegheny County, Pennsylvania, from a review of death certificates. None of these studies was designed to evaluate the completeness of employer-recorded data on occupational fatalities by identifying recordable fatalities by independent sources and then examining whether these cases had been recorded by the employers on the OSHA 200.

QUALITY ASSESSMENT INITIATED BY THE PANEL

Previously conducted studies have been limited in their ability to evaluate the underreporting of occupational injuries by employers. The panel therefore contracted with the New Jersey Department of Health to perform a pilot study to examine the methodology involved in identifying cases of recordable occupational injuries by sources independent of employers, and then comparing these cases with those recorded on OSHA logs to determine whether in fact they had been recorded by employers. The study did not examine whether the identified cases had been reported in the BLS annual survey or reported to OSHA as required by the regulations of the Occupational Safety and Health Act of 1970. We emphasize that the panel considers this effort to be a pilot study solely to determine the feasibility of the approach. Given the constraint of both time and money, the panel could not conduct a study that would provide definitive results.

In the pilot study, deaths from occupational injury in New Jersey during 1983 were identified using three sources: death certificates, medical examiner records, and the IMIS system.

Fatal occupational injuries involving homicide, public roadway or boating accidents, and airplane crashes were excluded from the analyses for reasons unrelated to the study, even though these are categories of fatalities that should be included on the OSHA logs.

Employers of the cases who were identified as being covered by OSHA were divided into three categories: (1) those in low hazard industries regardless of size and those in high hazard industries with fewer than 11 employees, who are not required to maintain an OSHA 200 log unless their establishment is selected by BLS to participate in an annual survey; (2) those in high hazard industries with 11 or more employees who are always required to maintain an OSHA 200 log; and (3) those for whom insufficient information was available to make this determination. Employers in the latter two categories who had current telephone numbers were contacted and asked whether they were required to maintain an OSHA 200 log. Employers who claimed to be exempt from the OSHA record-keeping requirements were queried as to the reason for the exemption. Appointments were made with employers who were required to maintain a log. The interviewer then visited each employer with whom a meeting could be scheduled and requested access to the employer's OSHA log for 1983. If the identified case appeared on the log, all information recorded on the log regarding that case was copied. If the case did not appear on the log, the interviewer queried the employer to ascertain why the case had not been recorded.

Results from the pilot study indicate that the 3 sources of occupational fatality data identified 66 deaths from fatal occupational injury in New Jersey in 1983, excluding those involving the specific circumstances previously listed. Based on SIC codes or industrial groupings, 45 of the 66 fatalities were determined to be under the jurisdiction of OSHA; the 14 cases not covered by OSHA and the 7 cases that lacked sufficient information on the employer to make any determination on OSHA coverage were dropped from the study. Since 2 of the 45 cases under the jurisdiction of OSHA involved the same employer, there were 44 employers covered by OSHA remaining in the study. Of these 44 employers, 10 could not be interviewed--6 did not have a current phone number, 3 were incorrectly identified and thus could not be located, and 1 refused to be interviewed. Of the 34 employers with whom telephone interviews were conducted, 7 claimed they were exempt from OSHA record-keeping requirements because they had fewer than 11 employees.

Of the 27 employers with whom visits were scheduled, 17 had properly recorded the fatalities on the OSHA 200 logs. Five employers did not maintain OSHA 200 logs. Four of

these employers were construction companies with a variety of reasons for not complying with the OSHA record-keeping requirements: one employer thought he was exempt from maintaining an OSHA 200 log since his usual number of employees was less than 11, but he did have more than 10 employees at certain times of the year and thus was not exempt; the employer with two fatalities had had an OSHA fatality inspection but claimed unfamiliarity with OSHA record-keeping requirements; similarly, another employer claimed he had never heard of an OSHA 200 log, although he had been in business for over 20 years; and the remaining construction employer stated that the OSHA 200 log had not been maintained since 1982, when the employee who had been the record keeper had left the company. The final employer, a transportation company, had been instructed to maintain a log during a 1986 routine OSHA inspection but had neglected to comply.

The other five employers with whom visits were conducted did maintain OSHA 200 logs but had not recorded the fatality. Two of the employers were manufacturers: one of these employers had been instructed by OSHA in 1984 that the company was required to maintain a log and that the 1983 log was to be reconstructed from other records, but the fatality did not appear on the reconstructed log; the other manufacturer denied that the decedent had been an employee, although the interviewer spoke with other sources who reaffirmed that the manufacturer had been the decedent's employer. One case involved a construction worker whose employer claimed that the company who contracted the work should be responsible for recording the fatality. Another case occurred one day after the opening of a warehouse, and the company stated that they did not begin maintaining an OSHA 200 log until one month after the warehouse opened. The remaining case occurred in a large national trade corporation whose spokesman could not account for the omission of the fatality on the OSHA log. The study is described in more detail in Appendix C.

Since the study was not designed to produce results that could be interpreted nationally, we cannot generalize the numerical results. However, the study did reveal that some employers claimed they had never heard of an OSHA 200 log, that others did not maintain a log even when they had been instructed to do so by OSHA, and that several employers who maintained the log had failed to record the fatality for various reasons. Thus, studies of this type, carried out periodically in a state, could identify reasons why employers had failed to record serious injuries, and steps could be taken to resolve these problems.

ESTIMATES OF THE EXTENT OF UNDERREPORTING

It is clear from the foregoing discussion that there are no straightforward estimates of the extent of underreporting of occupational injuries in the BLS annual survey. A straightforward estimate would be one obtained by matching lists of recordable occupational injuries obtained from independent sources against OSHA 200 logs maintained by employers to determine the extent to which they could be found on the latter. Although the panel commissioned a study to do just that in New Jersey, the purpose was to assess the feasibility of such an approach, at least for occupational fatalities. The panel is reluctant to use the results, based on such small numbers and on an admittedly incomplete list of fatalities for a year, as though they were definitive findings. If we were to do so, we would say that 37 percent of the workplace fatalities identified by death certificates, reports to OSHA, or medical examiner records were not recorded on the OSHA logs.

None of the other studies of occupational fatalities, either published or unpublished, were done in a comparable way. Some of them did not involve review of the recording on the OSHA logs, some combined both injuries and illnesses, and some included only a specific industry in particular states. In an unpublished study, NIOSH compared deaths in the construction industry in three states with reports to OSHA of occupational fatalities. Death certificates that were checked as being job-related were used as a basis for this comparison. The proportion of these deaths that had not been reported to OSHA were: Tennessee: 38 percent, North Carolina: 35 percent, and Kentucky: 30 percent. No attempt was made to determine the extent to which these deaths had been recorded on the OSHA logs. In the Wisconsin study by Karlson and Baker, described in Appendix B, the number of combined occupational injuries and illnesses combined estimated by the annual survey for Wisconsin was approximately 57 percent of the number of fatal occupational injuries determined from death certificates and workers' compensation records combined. This implies that about 43 percent of the deaths were not recorded on the OSHA logs. Baker et al. (1982) estimated that at least one-third of the fatal injuries identified from four sources were reported to the Maryland OSHA office. Again, the study did not involve checking the OSHA logs against these deaths.

Given these studies, with all of their shortcomings for estimating the extent of underreporting of occupational deaths in the annual survey, what can we say about the extent of underreporting of occupational injuries? First, these studies seem to suggest that there is at least some

underreporting of fatal injuries. If it were possible to conduct a proper study of adequate sample size, this proportion might run as high as 30 to 45 percent. Since the identification of work-related deaths is considered by some to be more clear-cut than for nonfatal injuries, some panel members argue that nonfatal injuries may be even more seriously underreported. No data exist to even allow speculation of a range for such a proportion.

Regardless of the level of underreporting, it seems clear that underreporting does exist. If the data in the annual survey are to be useful, therefore, it is important for the extent of underreporting to be estimated on an ongoing basis. The resulting estimates can then be used in at least two ways: (1) to devise ways of intervening to reduce the level of underreporting and (2) to adjust observed injury rates so that comparisons between injury rates will not be contaminated by differences in reporting bias.

CURRENT QUALITY ASSESSMENT EFFORTS

The BLS Recordkeeping Audit Program

A BLS Recordkeeping Audit Program has been established to verify compliance in manufacturing establishments required to keep records in accordance with the OSHA record-keeping requirements (U.S. Department of Labor, 1986). This pilot program will be conducted in 100 establishments in Massachusetts and in 100 establishments in Missouri, randomly selected by BLS within employment size and industry injury rate categories. Three lists of 100 establishments each have been selected for each state and numbered from 1 to 100, so that if an investigator encounters an establishment that, for example, has either been recently inspected by OSHA or is currently involved in litigation with OSHA, he can select the same numbered establishment from the second, and then the third list, if necessary. If that numbered establishment on the third list must be deleted, then the sample size is reduced by one.

At each establishment, OSHA compliance officers will conduct record checks in the following manner:

- (1) Administering a questionnaire that includes questions for the establishment's record keeper on record-keeping procedures;
- (2) Identifying the location of all required employer records (i.e., the OSHA 200, the OSHA 101 or equivalent, state workers' compensation forms, and medical records) and optional records;

- (3) Determining the number of cases to be reviewed, i.e., all cases are reviewed if there are 185 or fewer total cases listed on the employer's records; if there are more than 185 cases, the Audit Record Selection Sheet is to be used to determine which records to review;
- (4) Reconstructing the OSHA 200 log using medical records, OSHA 101s, workers' compensation first report of injury forms, and optional records as needed;
- (5) Comparing cases recorded on the employer's OSHA 200 with the cases recorded on the log reconstruction worksheet by the compliance officer;
- (6) Reconciling cases with coding differences through discussions with the employer;
- (7) Administering a questionnaire to determine the record keeper's understanding of basic record-keeping practices;
- (8) Administering an employee questionnaire--designed to obtain information about occupational injuries or illnesses experienced by the employee and coworkers during 1986 and about whether employees had reported injuries or illnesses to the employer--to randomly selected employees, with the number of interviews conducted at each establishment predetermined by BLS on the basis of establishment size.

Information obtained during the record checks will be analyzed by BLS. In evaluating the data, BLS is limited by the design of the pilot program. BLS is using only employer-maintained records to verify accuracy and completeness on the OSHA 200, except for those cases in which records are not available at the establishment and in which the compliance officer is able to review employer-independent sources--e.g., if an establishment does not have on-site medical records, the compliance officer has been instructed to review, if possible, the medical records maintained by the employees' private physicians.

Follow-back of the National Health Interview Survey

BLS has arranged for NCHS to conduct a follow-back survey in 1987 in which each individual who reported having had a work injury in the two weeks prior to being interviewed in the National Health Interview Survey will be telephoned. If the worker was injured in an industry that would be represented in the BLS annual survey, the worker will be asked to provide the following information about the injury: the number of days lost from work; the number of

days of restricted work; the type of treatment administered; whether the injury involved a hospital admission; whether the injury had been reported to the employer; whether a workers' compensation claim had been filed; whether the employer had entered the injury information on any other form and if not, why not; and whether the worker had quit, retired, been fired, or been laid off as a result of the injury.

BLS has no plans to check employers' OSHA 200 logs to determine whether these employee-reported injuries were recorded on their employer's log. The information collected in the survey will be used to calculate an estimate of the number of occupational injuries that occurred in 1987 in the universe covered by the BLS annual survey. This estimate can then be compared directly with that obtained in the BLS annual survey.

DEVELOPMENT OF QUALITY ASSURANCE PROGRAMS

Definitive studies have not been found to either demonstrate or refute the allegations that occupational injuries are seriously underreported. This situation serves to underline the urgency for developing ongoing programs designed to measure the quality of reporting.

Quality assurance involves both (1) efforts to investigate whether the mechanics of the system are working properly and (2) efforts to determine whether the employer-recorded data are both complete and accurate. We have been able to find evidence of only an early attempt by BLS to carry out evaluations related to the mechanics of the survey, even though these are perhaps the easiest to conduct. With regard to studies to validate employer-recorded data, BLS made early attempts to check the accuracy of the data reported in the annual survey, but the results were never published and the studies were not continued. Currently, BLS is conducting a pilot study aimed at a more rigorous validation of the information obtained in the annual survey. Thus, in both of these areas, additional work is needed to provide systematic ongoing evaluation of the data obtained in the annual survey.

In Chapter 8, we make recommendations for ensuring the quality of the mechanics of the BLS annual survey as well as the quality of the BLS survey responses.

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OCCUPATIONAL INJURIES

In this chapter we discuss issues that have arisen in recording and reporting occupational injury data and suggest approaches to collecting more complete occupational injury data. The discussion includes estimates of the number of fatal occupational traumatic injuries and sources of information on occupational fatalities.

RECORDING AND REPORTING OCCUPATIONAL INJURY DATA

Determining the Recordability of Injuries

To ensure uniformity in the occupational injury and illness data recorded by employers covered by the Occupational Safety and Health Act of 1970, BLS issued record-keeping guidelines in 1972 (and revised in 1973, 1975, 1978, and 1986), which are supplemental instructions to the OSHA record-keeping forms (OSHA 101, 200, and 200S). The extent to which employers understand and implement these guidelines in their record-keeping practices affects the validity of the occupational injury and illness data collected by BLS.

The 1986 revision of the record-keeping guidelines was undertaken during a period of increased interest in all aspects of record keeping following the 1981 change in OSHA targeting policy: an establishment's total number of injury cases involving lost workdays and/or restricted workdays recorded on the OSHA 200 log was now used to determine exemptions from complete OSHA inspections. Prior to the revision, task force groups were convened and public comments on the guidelines were solicited through a July 17, 1985, notice in the *Federal Register*. Controversial issues in determining the recordability of injuries included the distinction between medical treatment and first aid treatment, criteria for distinguishing between injuries and illnesses, and

the determination of work relatedness. We discuss each of these issues below, including the BLS viewpoint as stated in the 1986 revision of the record-keeping guidelines and the concerns expressed by employers in comments we received during our deliberations.

Medical Treatment Versus First Aid Treatment

The 1970 act limits the recording of occupational injuries to cases "other than minor injuries requiring only first aid treatment, and which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job." An understanding of the distinction between medical treatment and first aid treatment is important to the employer in determining of the recordability of occupational injuries. In 29 CFR Part 1904, medical treatment and first aid are defined as follows:

Medical treatment includes treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered professional personnel.

First aid is any one-time treatment, and any followup visit for the purpose of observation, of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care. Such one-time treatment, and followup visit for the purpose of observation, is considered first aid even though provided by a physician or registered professional personnel.

Prior to the current revision, the guidelines included a medical treatment list of conditions and treatments that, if experienced by an employee, had to be recorded on the OSHA 200 log. The 1986 revision includes a list restructured to focus on treatments that are "generally considered medical treatment" and therefore "almost always recordable." Although BLS states that the revision "allows for more discretion in recording borderline cases," the distinction between medical treatment and first aid treatment is still not considered by employers, in certain instances, to be either clear-cut or appropriate. We do not know how uniformly employers implement the guidelines, but overreporting of injuries will occur when employers record all injuries regard-

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less of the treatment received and underreporting of injuries will occur when employers do not record an injury because they have incorrectly determined that only first aid was given when medical treatment was actually rendered.

Injuries Versus Illnesses

On the OSHA No. 200, occupational injury and occupational illness are defined as follows:

Occupational injury is any injury such as a cut, fracture, sprain, amputation, etc., which results from a work accident or from an exposure involving a single incident in the work environment.

Occupational illness of an employee is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases which may be caused by inhalation, absorption, ingestion, or direct contact.

Thus, as stated by BLS in its 1986 record-keeping guidelines, "whether a case involves an injury or illness is determined by the nature of the original event or exposure which caused the case, not by the resulting condition of the affected employee. Injuries are caused by instantaneous events in the work environment. Cases resulting from anything other than instantaneous events are considered illnesses. This concept of illness includes acute illnesses which result from exposures of relatively short duration." For example, a loss of hearing resulting from an explosion (an instantaneous event) would be classified as an injury, but a hearing loss resulting from exposure to industrial noise over a period of time would be classified as an occupational illness.

The distinction between injuries and illnesses has important record-keeping implications since the lost workday injury rates for establishments are used to determine exemptions from complete OSHA inspections. Under the 1981 OSHA enforcement policy, an inspection of an establishment can be terminated if examination of the OSHA 200 log shows an average lost workday injury rate less than the national average for private-sector manufacturing. This policy could create an incentive for employers to underreport injuries,

possibly by inaccurately recording them as illnesses, since the illness rate is not considered in the current targeting policy.

Work Relatedness

The employer must ascertain the relationship of an injury or illness to the workplace in order to determine its recordability. The 1970 act requires "employers to maintain accurate records of, and to make periodic reports on, work-related deaths, injuries and illnesses." Previous editions of the guidelines considered an injury or illness to be work-related if it occurred on the employer's premises. The 1986 revision states that the "work relationship is established under the OSHA record-keeping system when the injury or illness results from an event or exposure in the work environment. The work environment is primarily composed of: (1) the employer's premises, and (2) other locations where employees are engaged in work-related activities or are present as a condition of their employment. When an employee is off the employer's premises, work relationship must be established; when on the premises, this relationship is presumed."

Since work relatedness is a requirement for recordability, it is important for employers to adhere to the BLS definition if occupational injuries and illnesses are to be uniformly recorded. In the 1986 revision, BLS modified its position on company parking lots and company ball fields, which are no longer considered part of the employer's premises for OSHA record-keeping purposes. Injuries to employees occurring in these areas are no longer recordable as work-related unless the injured employees were engaged in work-related activities on the parking lots or ball fields. However, in other situations in which employers have objected, the BLS interpretation of work relatedness remains unchanged. For example, employers maintain that injuries that occur in nonoccupational locations such as company restrooms or cafeterias should be considered not work-related and thus not recordable. The 1986 revision states that "injuries occurring in the work environment are considered work related. The specific activity the employee was engaged in at the time of the injury is not the controlling factor." Companies also expressed objections to the recording of injuries that they consider nonpreventable and over which they feel their safety personnel have no control, e.g., choking on food in the company cafeteria or acts of violence occurring on the employer's premises. In commenting on such cases, BLS states in the 1986 revision that "there are cases which occur on the employer's premises that do not seem to have anything to do with work, but must still be recorded to maintain the simplicity of the re-

ording criteria. . . . These are included to keep relatively simple the recording boundaries necessary for maintaining a workable system which can be used by the 5 million employers and 75 million employees subject to the record-keeping regulations."

Incentives to Underreport or Overreport Occupational Injuries

Concerns over the completeness and accuracy of employer-recorded injury data increased in 1981 when OSHA changed its enforcement policy. Reliance on employer-maintained injury data to determine whether an establishment would receive a complete OSHA inspection could create a strong incentive for employers to underreport injuries. The recent change in OSHA policy to issue citations, accompanied by some very large fines, for willfully violating record-keeping requirements for injuries could create incentives to report all possible workplace injuries, thereby leading to overreporting. Either underreporting or overreporting injuries could compromise the accuracy of national injury statistics collected through the annual survey. However, a bias in reporting does not necessarily prevent the analysis of changes over time or the comparison of injury rates among industries at a point in time. In making these comparisons, however, we must satisfy ourselves that the biases for the rates being compared are not sufficiently different to affect the conclusions we would draw. If employers do begin to record all possible workplace injuries, there will be an increase in the injury rate that is an artifact due solely to a change in what is being counted.

Incentives to Underreport

Incentives for employers to underreport occupational injuries include concerns over maintaining lost workday injury rates below the national average for manufacturing to secure exemptions from OSHA inspections, and competition among companies and among plants within a company to maintain injury rates as low as possible, since safety performance is often an important criterion in judging a supervisor's performance. In addition, peer pressure from coworkers not to be the one to deprive other employees of a "safety prize" may be an incentive for underreporting of occupational injuries by employees.

Incentives to Overreport

Small establishments with no personnel trained to determine the recordability of injuries by examining the guidelines may record all injuries regardless of the treatment received to ensure they are in compliance with the law. (At the other extreme, some of these establishments may not report at all.) Recently, some larger organizations (e.g., Monsanto) have considered recording all injuries, including those not considered definitely work-related and possibly even those involving only first aid treatment, to avoid citations for intentionally violating record-keeping requirements in cases that employers believe involved judgment calls, i.e., the record-keeping guidelines were not clear as to whether a minor injury was recordable on the OSHA 200 log.

NEW APPROACHES TO COLLECTING OCCUPATIONAL INJURY DATA

The annual survey is currently designed to provide national estimates of the number and rate of injuries by industrial classification. The Supplemental Data System provides more detailed data, but only a limited number of states participate in the SDS and the data are not comparable among states. In the discussion that follows we describe approaches to collecting more complete and consistent detailed data.

Collect All OSHA 101s

Employers are required to record a good deal of information on each occupational injury in a reasonably systematic way on OSHA 101s (or equivalents), but none of this detailed information is collected in the BLS annual survey. One approach to obtaining these detailed data systematically on an annual basis would be to collect, from each of the 280,000 establishments in the BLS annual survey, copies of the OSHA 101s (or equivalents) on each injury occurring during the year. This would involve the collection of approximately 2.5 million forms. As a first step, this kind of detailed information could be collected on only the most severe injuries. If this approach proved to be feasible, injuries with successively lesser levels of severity could be incorporated into the reporting system.

Collect Data According to the Severity of Occupational Injuries

The agents of injury are the various forms of energy--mechanical, thermal, chemical, ionizing radiation. Too much energy (or occasionally too little) relative to the resilience of the human organism results in injury. However, the current reporting system does not include specification of the energy involved or the source of that energy, such as specific machines, machine parts, and the like.

It is important that injury surveillance include a measurement of severity of injury. Without knowledge of severity and the conditions that result in more severe injuries, efforts at control may be directed to the prevention of frequent but trivial cuts and bruises, while the energy and its conveyances that account for long-term disability and death are ignored. The current system of reporting lost-workday injuries or numbers of lost days as an indication of severity is inadequate. A worker may recover quickly from a life-threatening injury in one case, but in another case may lose months from an injury that limits activity but is no threat to life.

Severity scales have been developed for various types of injuries including blunt trauma, burns, and poisoning. A single scale that incorporates various specific injury scales would be too cumbersome for use on the log and in the annual survey. A simplified and direct method of indicating severity would be to indicate on the OSHA 200 log and on the annual survey injuries considered of highest severity, i.e., those resulting in death, hospitalization, or outpatient surgery. The panel realizes that implementation of such an approach will take further study since the categories of hospitalization and outpatient surgery are not clear-cut and that admission and referral patterns will affect the recordability of cases.

Add Injury Categories to the Annual Survey

To obtain more detail on injuries in the annual survey, we propose a move toward the collection of all OSHA 101s. In the interim, the panel suggests that injury categories be added to the OSHA 200 log and the OSHA 200S to provide more detail. These categories could include amputation, burn, contusion/bruise, cut/laceration/puncture, and fracture. We also propose that a separate sprain/strain/unspecified pain category be included, since recent research on the contribution of workers' compensation to the willingness of workers to take time off for certain types of injury suggests that year-to-year comparisons of injury rates for the purpose of

evaluating control efforts are misleading without separating the types of injuries most affected by compensation rates (Robertson and Keeve, 1983).

In analyses of workers' compensation data (from the SDS) and in special studies of occupational injuries, data have been gathered in sufficient detail to categorize injuries by type. These studies suggest that one grouping of injuries--unspecified pain, sprains, and strains (usually in the back)--are more akin to some chronic diseases than acute conditions. The diagnosis is highly dependent on the subjective description of the condition rather than objective evidence. The severity of the condition at examination may have been precipitated by job-related activity, but the origin of the problem may have occurred on a previous job, in some other activity, or may even be hereditary, congenital, or of psychologic origin (Leavitt et al., 1982).

Research indicates that injury claims are strongly related to the workers' compensation payment structure in a given state (Butler and Worrall, 1983). When funds available from workers' compensation in a given state are increased faster than inflation, the number of days lost for pain or strain increase (Robertson and Keeve, 1983).

Thus, trends in reported lost-workday injuries are affected by the workers' compensation system. Furthermore, if a given establishment's operations are concentrated in states with higher than average worker's compensation payment schedules, the establishment will appear to have a worse injury record than others in the same industry in states with lower compensation. To the extent that OSHA inspections and insurance rates are based on previous injury rates, such a company would be punished for an injury rate that is being affected by more liberal workers' compensation practices.

Develop Special Studies to Collect Detailed Data

An additional approach that could be used to obtain more detailed data through the annual survey is one that could be varied from year to year to meet specific demands for information as they arise. Special studies could be conducted in which either BLS selects a specific industry and requests all establishments in that industry to send copies of their OSHA 101s (or equivalents) for all injuries for a designated year, or BLS selects a specific type of injury and requests all establishments that had recorded this injury in a previous time period to send copies of their OSHA 101s for those injuries.

For example, to determine the distribution and causal factors of injuries in a high hazard industry like meatpack-

ing, BLS could require the industry to submit all OSHA 101s for all injuries for a specified time period. The OSHA 101s would be coded and analyzed to learn more about the nature of injuries and how to prevent them.

FATAL OCCUPATIONAL INJURIES

In order to evaluate the accuracy and reliability of data on fatal occupational injuries, we have attempted to identify the existing national estimates and to understand how they were derived and to what segment of the U.S. population they refer. The national estimates come essentially from two sources: BLS and the National Safety Council. In 1984, BLS estimated 3,740 occupational fatalities and the NSC 11,700. Although these are vastly different estimates, part of the difference is due to differences in coverage. We examine the basis for these estimates, assess other attempts to develop estimates, and describe other data sources that could provide such estimates.

Existing Estimates of Fatal Occupational Injuries

The two existing sources of estimates of occupational fatalities derive their estimates in different ways, and there are problems associated with each. We discuss each of these approaches below.

The BLS Estimate

The BLS estimate of 3,740 occupational fatalities in 1984 was derived from its annual survey. This estimate includes fatalities due to both injuries and illnesses, but only 440 of the fatalities were the result of illnesses. In computing the fatality estimate, BLS does not include workers in establishments with fewer than 11 employees, self-employed persons, or workers in the public sector. Therefore, the BLS does not attempt to estimate the number of occupational fatalities for the entire United States population and users of the data must bear this distinction in mind.

The National Safety Council Estimate

The National Safety Council (NSC) is a voluntary association consisting of both individuals and organizations interested in promoting safety. They derive their estimates

from two sources--mortality data from the National Center for Health Statistics. NCHS divides its accidental deaths into 10 categories of places where the deaths occurred. The NSC combines these into four categories: home, work, motor vehicle, and public. It counts as work-related, accidental deaths all those classified as occurring at work plus a portion of the motor vehicle deaths that it determines to be work-related. There are two problems with this estimation procedure: (1) The number of accidental deaths classified by NCHS as "place of occurrence unknown" is more than 25 percent of all accidental deaths; the NSC makes the assumption that a portion of these deaths are work-related. (2) The NSC estimates the number of motor vehicle deaths that are work-related by applying a percentage, which is based on past experience, to the total number of motor vehicle accidents, therefore, is the sum of the number classified by the NSC as occurring at work plus the number of motor vehicle deaths estimated by the NSC to be work-related.

Other Sources of Mortality Data

The basic sources of mortality data in the United States are the state health departments. Each is charged with the responsibility of collecting death certificates for all deaths occurring within their jurisdictions. These are then incorporated into a national mortality data system by the National Center for Health Statistics. Because the information available in the mortality data set used by NCHS is insufficient to identify occupational injuries, NIOSH has developed an injury mortality system by purchasing data from each of the states. We describe each of these systems below.

The NCHS Mortality Data System

NCHS collects data on every death occurring among residents of the United States. Based on the information they receive, however, they cannot identify deaths that occur from occupationally related injuries. To be able to do so would require that they identify all deaths for which the underlying cause was coded as an externally caused injury. In addition, some mechanism would be needed to indicate which of those was work-related. Although there is an item on the standard death certificate on whether the death was due to injury at work, it is not one of the coded items reported to NCHS. All the causes of death are coded according to the 9th revision of the International Classification of Diseases. This classification does not provide a code for injuries that are

work-related. Thus, at present, estimates of the number of work-related fatal injuries through the NCHS vital statistics system cannot be obtained other than to use the crude procedures employed by the National Safety Council.

The NIOSH Fatal Occupational Trauma Surveillance

The NIOSH surveillance system for occupational fatalities based on death certificates from the 50 states is described in Chapter 3. Theoretically, it should provide a complete count of occupationally related fatal injuries. There are at least two aspects of the system, however, that raise questions as to the completeness of these counts: (1) how consistently the states are using the "E-codes" to designate injuries as the underlying cause of death and (2) how valid the responses are to the item "injury at work." On many death certificates, this question is left unanswered. In such instances, the death certificates would not be sent to NIOSH. The system needs to be tested in some detail in order to assess its validity. A very crude first estimate from this system of the number of fatal occupational injuries for 1985 in the United States was 7,000 (National Institute for Occupational Safety and Health, 1987).

Medical Examiner Records

An important source of information about occupational fatalities is the office of the medical examiner or coroner in states or local jurisdictions. In general, when a death occurs unattended by a physician, it must be investigated by the medico-legal system in the jurisdiction in which the body is found. In most instances, this is the state or county medical examiner or coroner. The investigation usually includes verification of the reported death, collection of personal and medical information about the decedent, review of the circumstances surrounding the death, including causal agents. If additional investigation is not recommended, a certification of the cause of death is made. Thus, the report of the medical examiner provides significantly more information than the death certificate, particularly on the possible work relatedness of the death.

A comprehensive review of laws and policies affecting death investigation in each state was carried out in 1977 (U.S. Department of Health and Human Services, 1978). It revealed that only 17 states had statewide medical examiners. The others had county-based medical examiners or coroners. The report pointed out, however, that the list of states with

statewide or county-based systems changes from year to year, with movement toward more statewide systems. No similar review has been published since the 1977 study. Assuming that the situation has not changed drastically since that time, it would be necessary to deal with a large number of agencies to enumerate all of the occupational deaths through this source. Furthermore, the information resulting from death investigations in most jurisdictions is not processed systematically. As of 1986, the medical examiner offices in only two states (North Carolina and Oklahoma) had computerized their records. Thus, this rich source of occupational fatality data is not readily accessible. Nevertheless, it is a useful source of data when it is important to identify a list of occupational deaths that is as complete as possible. Baker et al. (1982), in a study of 148 occupational deaths in Maryland that had been identified through four sources--medical examiner records, workers' compensation claims, the Maryland OSHA office, and death certificates--found that 96 percent of the deaths were found in the medical examiner records, whereas less than 66 percent were found by any one of the other three sources. However, the workers' compensation system and the reports of fatal injuries to OSHA are not intended to measure all occupational fatalities, since not all occupational deaths are reportable to these agencies.

Estimate by the Office of Technology Assessment

In preparing a report on preventing illness and injury in the workplace, the Office of Technology Assessment (OTA) produced an estimate of the number of occupational fatalities by attempting to reconcile the various estimates through the use of a number of assumptions (Kronebusch, 1984). Beginning primarily with the BLS and NSC estimates, OTA modified them by estimating the magnitude of each element of difference in coverage of the two estimates. The resulting estimate was approximately 6,300 deaths. As a means of arriving at a one-time crude estimate, this might be a reasonable thing to do. To use a complex set of assumptions to produce estimates year after year, however, could produce trends that are not realistic.

THE CODING OF WORK-RELATED INJURIES

The panel proposes that occupational injuries that require inpatient hospitalization or outpatient surgery as well as fatal occupational injuries be identified on the OSHA 200 log and reported in the BLS annual survey and that detailed informa-

tion be collected on them as well. As another check on the completeness of reporting of these cases, it would be desirable to compare independent estimates for both of these categories against those obtained in the annual survey as modified according to the panel's recommendation.

We have pointed out the vast discrepancies in the estimates of fatal occupational injuries. We also searched for estimates of the number of hospitalizations for occupational injuries but failed to find any in the literature. One unpublished investigation estimated that 6 percent of lost-workday injuries result in hospitalization (Mendeloff, 1978). One reason for this lack of information on hospitalization for occupational injuries is that diagnoses on hospital records in the United States are, for the most part, coded according to the International Classification of Diseases. The ninth revision of the classification, in use since 1979, does not readily lend itself to identifying injuries that are occupationally related. Since the World Health Organization is in the final stages of obtaining consensus on the tenth revision of the International Classification of Diseases, to go into effect in 1993, the panel recommended a change in the codes for external causes of morbidity and mortality to ensure the identification of work-related injuries. The text of the recommendation appears in Appendix D.

OCCUPATIONAL ILLNESSES

INTRODUCTION

We observed in Chapter 4 that the BLS annual survey does not provide useful measures of the numbers of occupational illnesses. The Committee on Government Operations of the House of Representatives expressed the problem more strongly in the report of its 1984 hearing on the topic of statistics on occupational illnesses (U.S. Congress, House of Representatives, 1984):

Since the passage of the Occupational Safety and Health Act nearly fifteen years ago, a bipartisan failure of four administrations has thwarted the mandated development of an information and data collection system on occupational diseases. No reliable national estimates exist today, with the exception of a limited number of substance-specific studies (such as on asbestos), on the level of occupational disease, cancer, disability, or deaths. It cannot be meaningfully determined if diseases from chronic exposures to hazardous substances represent a greater problem today than when the Occupational Safety and Health Act was passed in 1970. Such lack of reliable, accurate data greatly hampers any broad-based evaluation of the OSHA program.

If the purposes of the 1970 act are to be achieved, if effective measures of prevention of occupational disease through elimination of hazards in the workplace are to be developed and the effectiveness of these programs is to be evaluated, we must find some solutions to the problems of obtaining adequate data on occupational diseases. In this chapter we describe the problems that hamper the measure-

ment of occupational illnesses, indicate how our knowledge of the number of occupational illnesses can be improved, discuss how the use of the existing data systems can contribute to this improvement, and explore ways of improving the quantitative information on occupational hazards.

Accurate estimates of both the magnitude and the distribution of occupational illnesses are needed to focus limited resources on efforts to control the problems and to measure the success of those control efforts. As discussed in Chapter 4, the purposes of these estimates include targeting inspections, targeting research priorities, establishing priorities for standard setting, and providing data documenting the need for new or revised standards. In addition, both employers and employees need feedback to maintain both financial and procedural commitments to what may appear to be unnecessary precautions. This is particularly true for occupational illnesses, for which the immediate relation between work and disease is not often evident to either employers or employees.

The public health community's approach to the prevention of lung cancer through efforts to reduce the prevalence of cigarette smoking illustrates the importance of the use of data for surveillance or monitoring. Monitoring lung cancer mortality initially led to the suspicion and later the realization that cigarette smoking was its major cause (Wynder and Graham, 1950; Schrek et al., 1950; Mills and Porter, 1950; Levin et al., 1950). Detailed surveillance that involved analyses of trends in lung cancer incidence by age, sex, race, and other factors and periodic population surveys to measure the prevalence of cigarette smoking according to these same factors has led to the development of prevention programs. Continuing surveillance provides evaluation of the effectiveness of these preventive measures. Similarly, a surveillance program for occupational disease must involve monitoring the incidence of and/or mortality from specific occupational diseases as well as monitoring the prevalence of exposure to substances thought to be associated with the diseases.

To continue the lung cancer-smoking analogy, however, such a surveillance program would have to go further to allow for the possibility of identifying diseases that were not heretofore considered to be occupationally related. This is extremely difficult to accomplish on a routine basis. One approach would involve obtaining a complete occupational history of each person diagnosed as having a particular disease. Most attempts to do this have resulted in compromises such that the occupational information obtained was either current occupation or the job the individual had for the longest period of time. Another approach is to follow cohorts of workers in particular occupations over a period of

time to observe the diseases they develop. To refine this approach, however, would also require obtaining occupational histories to determine which job in the worker's history might have been associated with the disease. An alternative to this is a cross-sectional analysis of rates of occurrence of all diseases among workers in specific occupations. However, this also requires information on prior occupational history. The panel considered these possibilities but was not able to recommend a routinely workable approach other than to use current or usual occupation when obtaining information on cases of specific diseases.

In addition to immediate needs for setting priorities for preventive programs, there is a long-range need for occupational illness surveillance data. We have much still to learn about the etiology of chronic disease and its relation to occupational exposures. An active surveillance system is important to researchers; the data in such a system is useful both to generate hypotheses on etiology as well as to provide potential access to the individuals with occupational disease for more definitive studies of etiology and treatment. Individuals with one type of occupational disease may be at increased risk for additional occupational disease (e.g., an individual with asbestosis is at increased risk for lung cancer). Individuals identified by a surveillance system as having an occupational disease become the index cases, information about whom may lead to substantial improvements in diagnosis of occupational disease, toxic substances registries, worker notification programs, and other modalities of disease prevention. These individuals will be in need of continued follow-up to prevent additional occupational diseases and to be advised of new treatments; the workplace will need to be investigated to make certain that the hazardous substance has been removed.

ESTIMATES OF THE NUMBER OF OCCUPATIONAL ILLNESSES

Various attempts have been made to estimate the number of cases of occupational disease in the United States. The most widely cited estimates are 100,000 deaths due to occupational illnesses and 390,000 cases of occupational illness annually (Office of Technology Assessment, 1985a). But the accuracy of these estimates has never been substantiated. Based on its annual survey, BLS estimated 124,800 cases of occupational illness in 1984. One study by Discher et al. (1975) suggested substantial underreporting from BLS data sources, the Supplementary Data System, and the OSHA logs.

Survey data from the Social Security Administration provide estimates of the prevalence of occupational illnesses. In 1972, of approximately 15 million individuals considered disabled by the Social Security Administration, 1,738,000 (or 12 percent) felt their illness was caused by their job (Shor, 1979). This data set did not allow one to estimate the annual occurrence of occupational disease because it was cross-sectional in nature and based on a selected population. In addition, it was based on individual self-reporting of diseases, subjective assessment of the causes of these conditions, and cases that had to be certified as disabled according to the criteria of the Social Security Administration. The estimates of the proportion of cancers that can be attributed to occupational exposure vary markedly (Higginson and Muir, 1979; Wynder and Gori, 1977; Doll and Peto, 1981; Cole, 1977; Stallones and Downs, 1979; Bridbord et al., 1978). However, even if we use Doll and Peto's (1981) scientifically conservative estimate that 4 percent of cancers are attributable to occupation, we would expect 17,000 deaths per year in the United States from cancer attributable to occupational exposures. Current estimates from the BLS surveillance system include only about 200 individuals a year with work-related cancers (Wegman and Froines, 1985). The Office of Technology Assessment (1985a) made the following statement on the number of occupational diseases: "There is so little agreement about the number of workplace-related illnesses that OTA does not take a position on the controversy about the 'correct number.'"

PROBLEMS IN ESTIMATING THE OCCURRENCE OF OCCUPATIONAL ILLNESS

Length of Latent Period

One reason for the difficulty in estimating cases of occupational illness is that, for any disease that occurs as a result of exposure in the workplace, there is an interval of time between the exposure and the occurrence of the disease. It may be very short, as in the case of some skin diseases, or it may be very long, as in the case of mesotheliomas that have occurred as a result of exposure to asbestos, for which the latent period may be as long as 30 years. As the latent period between exposure and appearance of the disease lengthens, the difficulty in identifying the link between exposure and the disease increases. Furthermore, with long latent periods, employers are less likely to report a disease for a variety of reasons: because they are unaware of the disease due to the fact that the employee has left their

employment, because they do not recognize it as occupationally related, or because they believe that the exposure that caused the disease occurred during an earlier job the employee held in another establishment.

Data on the occurrence of silicosis, a chronic disease of the lung due to exposure to silica dust that usually appears 15-20 years after first exposure and is considered to be almost entirely occupationally related, is a good example of the problems involved in diseases with long latencies. The number of individuals estimated by the BLS Supplementary Data System as developing silicosis is approximately 250 (U.S. Department of Labor, 1983). The individuals currently exposed will probably have lower exposure than the workers exposed to silica 20 years ago who now have silicosis. Yet, despite assumed differences in exposures, the number of individuals reported each year in the BLS surveillance system is far below the number expected to accumulate over the estimated working lifetime of current employees (U.S. Department of Labor, 1980). The fact that BLS data vastly underestimate the number of individuals with silicosis is supported by the fact that hospital discharge data for the period for 1980-1985 from two states alone, New York and New Jersey, indicate that 320 new individuals a year are hospitalized in these states with silicosis (personal communication, New Jersey Department of Health, David Valiente, 1987). Since this number represents hospitalized individuals, it is itself an underestimate of the number of new cases per year in New York and New Jersey.

The diseases that are reported in current systems of occupational illness surveillance are mainly acute conditions involving the skin or the eyes. This is true not only for the BLS annual survey and the Supplementary Data System, but also for the system in California that is based on a requirement that physicians report occupational illnesses (U.S. Department of Labor, 1980).

Multiple Causes of Disease

A second reason why a disease may not be recognized as being occupationally related is because of the multifactorial etiology of chronic disease. This problem of multiple etiologic agents is well illustrated in the controversy over the percentage of cancers that can be attributed to occupational exposures. A similar problem exists with regard to whether certain cases of heart disease are attributable to occupation.

The issue of whether a disease is work-related is a difficult one for an employer to decide for purposes of recording it in the log. The issue must frequently be decided

on a case-by-case basis by the courts; for the public health community, it remains a controversy in the epidemiologic and occupational health literature.

Lack of Recognition of Occupational Disease by Physicians

The lack of recognition and diagnosis of occupational disease by physicians is another major reason for the under-reporting of occupational diseases. It is well documented that physicians receive extremely limited, if any, training in occupational diseases. Only about half of U.S. medical schools require that students take courses in occupational medicine. Even in the schools that require course work in occupational medicine, the median time spent on occupational disease in a four-year curriculum is four semester hours (Levy, 1985). In addition to a lack of training in occupational disease among health care providers, there are other reasons for physicians' not recognizing or reporting occupational disease: (1) the multifactorial etiology of occupational illness, (2) the lack of standardized diagnostic guidelines for occupational disease, (3) a dearth of characteristic symptoms, (4) a lack of appropriate exposure histories, (5) the reticence of physicians to report a condition that may involve them in a potential legal dispute, (6) concern that reimbursement may be lower if a condition is diagnosed as work-related, and (7) a lack of integration between clinical practice and public health programs.

Problem in Linking Diseases to Occupational Exposure

NIOSH (1983) has published a list of the 10 leading work-related diseases and injuries in the United States: certain lung diseases, musculoskeletal injuries, certain cancers, severe traumatic injuries, cardiovascular diseases, disorders of reproduction, neurotoxic disorders, noise-induced hearing loss, dermatologic conditions, and psychological disorders. Physicians rarely consider occupational exposures for some of the illnesses included on the NIOSH list, for example cardiovascular diseases, disorders of reproduction, neurotoxic disorders, and psychological disorders. For the most part, occupational illnesses within these categories are nonspecific. They have no pathognomonic signs, symptoms, or pathologic findings that distinguish them from those of nonoccupational origin. Diagnosis is based on history of substantial exposure and epidemiologic consideration of increased disease among exposed individuals. Lack of inclusion of time-consuming work histories and awareness of disease among coworkers of

the patient contribute to the physician's difficulty in recognizing the work-relatedness of the illness. None of these problems is unique to nonspecific occupational illnesses. Even for well-recognized occupational diseases, physicians often do not record the proper diagnosis. For example, in one study of deaths among asbestos workers, only 76 (48 percent) of 160 deaths from asbestosis were correctly diagnosed on the death certificate (Hammond et al., 1979).

Employees and employers themselves often do not recognize the occupational causes of diseases. This is partly because of the multifactorial, nonspecific, or long latent nature of particular diseases. It is also because of the significant lack of knowledge about the potential health hazards of the specific exposures experienced by employees. This need for information was the basis for the recently developed OSHA hazard communication standard, which requires employers in the manufacturing sector to inform workers about the hazards associated with current or potential exposures to hazardous chemicals.

Disincentives to Report

Even when illnesses are diagnosed as occupationally related, both employers and employees have disincentives to record and report these conditions. Employers are naturally reluctant to assume the legal and financial responsibilities for illnesses that may not be a result of the employee's current working environment, as is often the case for diseases with long latencies. Employees are frequently hesitant to acknowledge the occupational cause of a disease because health insurance will not cover the costs of treatment and workers' compensation, if granted, may not be paid until many years after the medical costs are incurred. In addition, workers may fear the loss of their jobs and limitations on future employment or the burdens of other social stigmas attached to the diagnosis of an occupational disease.

One additional caveat relevant to the use of occupational disease surveillance data is its use in follow-up intervention activities designed to reduce exposure to workplace hazards. Some occupational illnesses that are only now being diagnosed are secondary to hazardous exposures that have previously been identified and controlled; an example is asbestosis. The actual percentage of workplaces in which the causative hazard that existed has been eliminated is unknown. For those diseases with much shorter intervals between exposure and disease, current identification of this link is more likely and may lead to effective control of hazards that would otherwise have persisted.

Thus, in attempting to identify and count occupational illnesses, we are faced with a situation in which an illness in a worker identified now may have been caused by an exposure in a different establishment, may have been caused by factors other than occupational exposure, or may have been caused by exposure in the current work environment for which the link between exposure and disease had not yet been clearly established. For all these reasons, data on occupational illnesses in the BLS annual survey, other than those for skin diseases, are understated to the point that they are more misleading than useful. While research continues in an attempt to sort out all of these issues, efforts should be made to determine whether a disease contracted by an employee is due to specific conditions in the workplace and approaches should be developed to eliminate those hazards. We point out that the problem of trying to identify and measure the incidence of occupational disease is not unique to the United States but is a common problem among all industrialized countries.

A COMPREHENSIVE OCCUPATIONAL ILLNESS SURVEILLANCE SYSTEM

Because of the problems outlined above, a reporting form such as that used by BLS to be completed by employers is inadequate as the sole mechanism for occupational disease surveillance. Instead, what is needed is the development of a comprehensive system including the design, coordination, compilation, and analysis of multiple data bases. Because of the complementary nature of many of the existing data bases and surveys, such a comprehensive system should substantially address the problems we have discussed.

Historically, the responsibility for such a complex surveillance system has been the responsibility of a public health agency with experience and responsibility in occupational health. Accordingly, surveillance for occupational illness should become the responsibility of the occupational division of the Centers for Disease Control: the National Institute for Occupational Safety and Health. The following discussion describes briefly the elements of a system for providing improved data on occupational illnesses. The ways in which existing data systems can be used and the role of data on hazardous exposures will then be discussed in more detail.

Improve the Classification of Occupational Illness in the BLS Annual Survey

Despite the consensus that the current BLS system of occupational illness surveillance is inadequate due to under-reporting, its annual survey still serves some useful purposes and should be an integral part of the comprehensive system. Certain disease conditions such as those involving the skin, the eyes, and the musculoskeletal system are readily recognized and recorded by the current system. Since other data systems, such as that of death certificates, will be useful only for summing up the more severe conditions, the BLS annual survey, like the National Health and Nutrition Examination Survey and National Health Interview Survey, is necessary for the collection of data on those conditions that, although widespread, are not of such severity or specificity as to be noted in data systems that do not depend on recording by the employer.

In addition, the mandate to employers to record this information is an important reminder of their responsibilities for the occupational health of their employees. As current deficiencies in diagnosis and reporting systems are resolved over time, the annual survey may begin to more accurately reflect the occupational disease experience of workers. For the near future, the categories under which occupational illnesses are reported should be changed to maximize the reliability and detailed nature of the information collected, placing the primary emphasis on acute illnesses. Division of the diseases to be reported by employers into acute and chronic, with collapsing of the reporting of most chronic conditions, will simplify the task for employers. This will separate out illnesses for which reporting is most complete and relegate to a single category those that are difficult to identify and report.

Make Use of Existing Data Systems

NIOSH should take the lead in developing and compiling data from the various existing data sets that would be useful in occupational disease surveillance. Some modifications in currently available data sets, some of which are national and some of which are based on only a few states at this time, can form a nucleus of a comprehensive disease surveillance system. These data sets include mortality records, interview data from national health surveys, cancer registry data, state-based heavy metals and disease reporting, and hospital discharge abstracts. NIOSH will need to work closely with

the National Center for Health Statistics, state health departments, and BLS to develop this system.

Improve Physician Education

For the most part, the system described above depends on the recognition of occupational illnesses by physicians. Additional efforts are needed to increase physician education in occupational diseases and physician involvement in public health activity to prevent occupational disease. NIOSH has been involved since its inception in the early 1970s in funding programs to increase physician education in occupational medicine. These efforts and financial commitments should be continued. Efforts now under way at NIOSH to address potential impediments to physician involvement in occupational disease recognition and prevention should continue and should be expanded.

Improve Worker Notification

OSHA and NIOSH should be involved in the issue of worker notification of hazards and the risks of disease. The OSHA hazard communication standard now requires employers in the manufacturing sector to inform workers about the hazards associated with current potential exposures to hazardous chemicals. In general, the panel believes that it is important to tell workers what hazardous agents they have been exposed to as well as what their potential effects on health are. We recognize, however, that the issue of when, how, and who should be notified about exposure to known health hazards is still controversial.

Integrate and Expand the Role of State Health Departments

State health departments play a pivotal role in the prevention of communicable diseases. Since the late 1800s, they have required physicians to report infectious diseases. Follow-up and compilation of the data reported by physicians, and now by laboratories and hospitals, has become the basic tenet of public health infectious disease control.

Although similar reporting for industrial diseases was implemented in the early 1900s by state health departments, by the 1920s these statutes were either repealed or were no longer actively used in most states. NIOSH, with limited funding, has begun in the last six years to encourage state health departments to reenter the field of occupational

disease prevention and to collect reports of occupational disease. This effort should be expanded.

Criteria for both a minimum and an ideal level in occupational illness surveillance at state health departments should be developed by NIOSH and the states. State health departments currently operate several basic data systems. Some state health departments now submit data from some of these to federal agencies, and others do not. At this time, without modifications, certain state data systems could contribute to a national occupational illness surveillance system. Specifically, these include:

- Hospital discharge data for definitive occupational injuries and illnesses;
- Death certificate data using both the underlying cause of death and all causes listed for definitive occupational injuries and illnesses as well as what are called sentinel health events. (See the section below on national mortality data for a definition).
- Birth and fetal death data for monitoring reported clusters of adverse reproductive outcomes; and
- Cancer registry data for sentinel health events.

New systems that are currently under development or being tested on a pilot basis by state health departments may also prove useful in the near future. They include:

- Physician reporting systems based not only on the traditional infectious disease model but also on reporting by specialists of specified occupationally related diseases.
- Laboratory reporting of elevated blood levels of lead, mercury, arsenic, and cadmium.
- Regional poison control center data, which covers 42 percent of the U.S. population (Blanc and Olson, 1986).

Improve Hazard Surveillance

Any surveillance system, whose goals include the prevention of occupational disease through control of the causative agents, should include components of both hazard and disease surveillance. One purpose for conducting hazard surveillance is to locate and monitor groups of workers who are exposed to agents with well-known adverse health effects. A second purpose is to discover previously unrecognized relationships between exposure and disease by constructing comprehensive inventories of the potential exposure agents found to be

associated with occupational groups and linking the data to toxicologic or epidemiologic sources of information.

USING EXISTING DATA SYSTEMS FOR OCCUPATIONAL ILLNESS SURVEILLANCE

We have proposed above that the classification of occupational illnesses in the BLS annual survey be revised so that data on at least acute conditions would be more immediately useful. The various relevant data systems operated by other agencies (described in Chapter 3) also require some modifications in order to make useful contributions to the picture on occupational illnesses. Some of these modifications are already under way; others should be seriously considered. We discuss below the roles of these systems in occupational surveillance.

National Mortality Data

As described earlier, the collection of mortality statistics originates with the death certificates required in each state. Data are then submitted to NCHS. Not all states code occupation and industry information from death certificates, and NCHS does not collect these data. However, routine surveillance of occupational illnesses, that is to say counting cases and tracking trends, can be done for known occupational diseases such as silicosis and asbestosis, even in the absence of information on occupation and industry.

Surveillance could be expanded to include multifactorial diseases that are associated with specific occupations and industries if occupation and industry are part of each computerized death record. Rutstein (1983) has developed a concept he calls the sentinel health events-occupational, which could be the basis for such a surveillance effort. A sentinel health event-occupational is defined as a work-related condition that signals a breakdown in prevention in the workplace. Such breakdowns demand investigation and intervention. The published list of particular sentinel health events-occupational now includes 51 entries. These events include instances of nonspecific conditions that are known to be associated with, although not necessarily caused solely by, exposures in specific occupational settings (e.g., lung cancer among asbestos insulators). Counting such nonspecific conditions within the context of the sentinel health event-occupational makes it possible to recognize potential problems without making attributions of direct cause and effect. NIOSH has written a computer program that sorts sentinel

health events-occupational, from death records that have occupation and industry coded according to the method described below. The program will be available to state health departments and other interested persons, and NIOSH itself is experimenting with ways of analyzing the data and with uses that can be made of the output.

Analyses of sentinel health events-occupational could be applied to multiple cause-of-death data that are available from NCHS. NCHS has data tapes for every state that includes cause-of-death codes for every cause of death listed on each death certificate, not just underlying cause (Chamblee and Evans, 1982; Israel et al., 1986). Many occupationally related diseases often contribute to death but do not cause it. For example, asbestosis was the underlying cause of death in 101 cases nationwide and was a contributing cause in 238 additional cases in 1980 (United States Department of Health and Human Services, 1986).

Occupation and industry data on death certificates could also be useful for hypothesis-generating studies. Such studies have been made of the entire United States (Guralnick, 1963) and for several states (Milham, 1976; Gute, 1981; Dubrow and Wegman, 1984; Brockert et al., 1985; Pennsylvania Department of Health, 1985; MacCubbin et al., 1986). Multiple cause-of-death data were used by North Carolina to examine statistical associations between occupational and industry information and causes of death (Rothwell, 1979).

Currently 27 states routinely code occupation and industry according to a method developed by NIOSH and NCHS. In 1978, NCHS, in cooperation with NIOSH and the Census Bureau, initiated a study to determine the feasibility of coding occupation and industry reported on death certificates. In the study a random national sample of 5,000 death records was coded by the Census Bureau using its standard occupation and industry coding procedures and its three-digit classification system. The study found that a majority of the entries reported on the death certificates could be coded using this system.

In 1980, a cooperative project of NCHS, NIOSH, and the Census Bureau was begun to refine the coding procedures developed by the Census Bureau and to test the feasibility of having states implement these procedures. In 1981, a draft manual and training package was developed by the Census Bureau, and training was provided to eight states which agreed to participate in a test of the coding system. The system proved feasible; training courses were given; and NCHS, working with NIOSH and the Census Bureau, provided quality control and advice to the states.

NCHS has published coding manuals and a handbook for distribution to funeral directors and field representatives indicating examples of right and wrong ways to collect information on occupation and industry (National Center for Health Statistics, 1978). Stable federal funding is perceived to be the key issue in full development of this program; current funding to states from NIOSH and the National Cancer Institute is committed through 1988.

In January 1987, NCHS in cooperation with NIOSH and BLS, held a workshop on needs and resources for occupational mortality data. Most of the participants supported the expansion of the current effort of coding occupation and industry (Byars, 1983) on death certificates to include all of the states.

Natality Records

Exposure by parents to a variety of chemical and physical agents has been associated with several adverse reproductive outcomes (Office of Technology Assessment, 1985b). Occupation and industry information on birth certificates has been used in a study of nervous system tumors (Johnson et al., 1985). Such information on birth and fetal death certificates makes it possible to monitor temporal trends by parental occupation and industry group and to identify existing hazards in a timely way. Data on parental occupation and industry would be useful for assessing reported clusters of adverse reproductive effects and for designing case control studies (Lalich et al., 1986; Shillings and Lalich, 1984).

NIOSH is funding three studies (in Maine, Massachusetts, and New York City) to assess the usefulness of occupational and industry data on birth certificates to identify occupational risk factors for adverse pregnancy outcomes. Coding of occupation and industry are done using the same procedures that have been developed for mortality records.

The National Health Interview Survey

Data from the National Health Interview Survey has been and should continue to be a very important source of data on occupational illness and injuries. It is the only data source currently containing both occupation and disease data that has sufficient sample size to make accurate statistical associations between diseases and occupations.

NIOSH has used NHIS for various research projects, including, for example, a 1980 study titled "Industrial Characteristics of Persons Reporting Morbidity During the

Health Interview Surveys Conducted in 1969-1974" (Kaminski and Spirtas, 1980). Currently NIOSH is using NHIS data to examine the relationship between smoking characteristics and occupation and industry data; it is also using NHIS data to compare "usual" to "current" occupation and industry.

Plans for the 1988 survey supplement include questions specifically related to occupational illnesses and injuries. Respondents will be asked about the occurrence of many diseases and injuries within the past year (unlike the regular survey, which asks for occurrence within the last two weeks). Questions will be asked on the work relatedness of any conditions that occurred. Conditions of particular interest include low back pain, carpal tunnel syndrome, eye-nose-throat irritation, and skin conditions. The supplement will collect information on current and longest-held job and information about activities related to each that is necessary to determine accurate coding of job categories. The questionnaire was pretested in June 1987.

The National Health and Nutrition Examination Survey

In collaboration with NCHS, NIOSH has proposed additions to NHANES III, the 1988 National Health and Nutrition Examination Survey, which would determine the extent of five categories of occupational disorders: lung diseases, musculoskeletal disorders, neurotoxic disorders, noise-induced hearing loss, and certain dermatologic conditions. Limited job histories will be included that could be linked with exposure estimates from the National Occupational Exposure Survey (see Chapter 3).

Two specific outcomes of this project are: (1) to develop standardized diagnostic methodologies for the conditions specified above and (2) to develop a data base of parameters relevant to these conditions from the examination of unexposed populations that provides normative values for a general population. These data can also be used for follow-back surveys on specific groups or conditions. The sample size is too small, however, to assess reliably the association between specific health conditions and occupational and industry categories.

Cancer Registries

Information on occupation and industry has not been part of the data set for the Surveillance, Epidemiology, and End Results program of the National Cancer Institute. Most of the SEER registries have attempted to collect such informa-

tion and to code it according to the Census Bureau classification. Several of the other population-based cancer registries also collect data on occupation and industry. Unfortunately, these data are incomplete and not uniform, primarily because the data collected by these registries are abstracted from hospital records. For information on occupation, the registries are dependent on that which the routine hospital admissions procedure happens to obtain, which varies considerably from hospital to hospital.

In Connecticut, the legislature passed a law requiring that occupation be reported on all cancer cases. To implement the law, the Connecticut state health department and the state hospital association agreed that information on occupation would be obtained on every person admitted to a Connecticut hospital, whether for cancer or for any other condition. For those who are employed at the time of admission, information on current occupation is obtained. For those who were not working or retired, information on usual occupation is obtained. This information has been collected since 1983 but has not yet been analyzed.

Swanson et al. (1984) found that for the cancer registry covering metropolitan Detroit, reporting was only 39 percent complete for occupations and 63.5 percent complete for industry. This is typical of occupational reporting in a cancer registry when no special attempt is made to obtain the information. NIOSH is funding a study being conducted by the Detroit registry that involves obtaining complete occupational histories from cancer patients by telephone interview. One of the questions to be answered concerns the extent of agreement between current and usual occupation. A pilot study on this project revealed that it is both possible and feasible to obtain detailed occupational histories from the cancer patients or their proxies (Swanson et al., 1985). The success of this study holds promise for finding a way to evaluate the usefulness of the kind of occupational information usually obtained by a cancer registry.

Through the use of the sentinel health event approach described above, or through analyses of proportionate incidence ratios, cancer registries could be used as a monitoring device or to generate clues for further studies of the possible relationship between certain occupations and specific diseases. In doing so, however, the rather poor quality of the occupational information must be taken into account. Meanwhile, the experience in Detroit of obtaining occupational histories by telephone should be followed closely; it may be sufficiently inexpensive to permit application on a broader scale.

Hospital Discharge Data

All hospital discharge abstract records, which include discharge diagnoses coded using the International Classification of Diseases-Clinical Modification are recorded and computerized in 20 states. These data are available to state health departments, especially in the nine states that have state regulations on the collection of patient discharge data. Although the occupation and industry of patients are not collected or coded in any of these systems, hospital discharge records have been used for occupational studies using case control designs (Burkart, 1980).

Hospital discharge data are of limited usefulness because of certain biases, including selectivity of patient populations, exclusion of outpatient data, and data variability in terms of quality or reliability for different hospitals. Nevertheless, hospital discharge data can be useful for surveillance of those diseases that are inherently occupational in nature, such as silicosis and asbestosis. Numbers of individual cases can be determined by subjecting the data to computerized programs that eliminate repeat admissions by matching on birth date, geographical location, and sex. BLS is currently conducting a pilot project collecting these data from four of the six states that are members of the Bureau of Labor Statistics-State Health Department Select Committee on Occupational Illnesses and Injuries.

Inclusion of occupation and industry information on hospital discharge abstracts would make this data set suitable for the same state-based routine surveillance activities that have been proposed with mortality and cancer incidence data. Although occupational information is often not collected in medical histories of patients, Wisconsin collects such information and, as indicated above, Connecticut requires minimal information on occupation on every hospital admission. The success of these projects should be monitored.

State Health Departments

Physician Reporting of Occupational Diseases

Many states have laws and regulations regarding physicians' reporting of occupational diseases. Of 27 states with some sort of regulations, 3 have reporting policies that are voluntary; 15 with mandatory policies require that all occupational diseases be reported; the remaining 9 specify only that

selected conditions be reported. Four other states are in the process of developing reporting policies.

Generally the statutes or regulations requiring that physicians report such cases are of a very broad nature. Most states' experience with these reporting systems has been that they do not work well. Physicians are reluctant to report, states are reluctant to enforce the reporting laws, and no follow-up investigations are conducted by the state health departments. The few reports that are made are usually submitted by the same few physicians. For example, in Maryland, where 398 reports were made in 1983, 85 percent of the reports came from only two physicians (Clayson, 1986).

California has for a number of years required the reporting of occupational diseases by physicians to the Division of Labor Statistics and Research of the Department of Industrial Relations. All indications are that reporting is very incomplete. Ways of improving the situation are being explored by the California Department of Health Services; one approach that may improve reporting is to change the language of the law to require reporting of only a limited number of specific occupational diseases. Such an approach has been implemented in Texas, in a law that went into effect in July 1985, requiring the reporting of newly confirmed or suspected cases of asbestosis, silicosis, acute occupational pesticide poisoning, and elevated blood lead levels in persons 15 years of age or older. Upon receiving reports of these occupational diseases, the commissioner of health would proceed as follows (Texas Department of Health, 1986):

- Investigation shall be made for the purpose of verifying the diagnosis, ascertaining the source of the causative agent, obtaining an occupational and employment history and discovering unreported cases;
- Collection of specimens of the body tissues, fluids, or discharges, and of materials directly or indirectly associated with the case as may be necessary in confirmation of the diagnosis, and their submission to a laboratory for examination;
- Obtaining samples of air or materials from the current or former business or place of employment of a case, as may be necessary to ascertain if a public health hazard exists. If a hazard is found, the commissioner or his/her designee shall make appropriate recommendations concerning the hazard.

This appears to be an ambitious program, even though it pertains only to a small number of occupationally related

conditions. It is too early to assess the implementation of this legislation, but its progress should be followed closely to determine the feasibility of adopting this approach in other states and to compare the data on occupational illness generated in this way with those obtained through the usual channels.

Efforts are under way at NIOSH to improve the usefulness of physicians' reporting of occupational diseases, including:

- Surveys of physicians are planned in those states requiring physician reporting. The questionnaire to be completed by physicians is designed to explore factors that may affect physician reporting of occupational disease.
- Strategies for maximizing follow-up investigations of physician reporting are being planned in two states.
- Guidelines for a sentinel physician surveillance network are being developed. Rather than depending on passive surveillance by all physicians, a group of physicians who will agree to a more intensive involvement in surveillance are identified by the surveillance agency. This type of system has been used in infectious disease surveillance both in the United States and abroad (Graytcer and Thacker, 1986).
- Case definitions are being developed for different occupational diseases. These criteria should be useful to physicians in deciding whether a disease should be reported as work related.

Laboratory Reporting of Heavy Metals Exposure

Four states (Texas, California, New York, and New Jersey) now have heavy metals exposure registries that collect information from laboratories on elevated blood and/or urine levels of lead and, in some instances, arsenic, mercury, and nickel. Specific metals included in the registries and biological levels above which reporting is required vary among the four states. In general, the levels are set low enough so that the reports can identify individuals who have elevated body burdens but are not yet necessarily symptomatic. These are thus sentinel cases, indicating workplaces and larger populations exposed to potentially hazardous levels of heavy metals. Because the OSHA lead standard requires routine biologic monitoring of certain exposed workers, the laboratory reporting of lead includes a much larger universe of exposed workers than that for other metals that are not subject to OSHA medical monitoring requirements.

Currently there is no systematic nationwide monitoring of abnormal laboratory results; 23 states have laws regarding the regulation and licensing of laboratories. The federal government routinely inspects all laboratories nationwide as part of the Medicare program. If it can be assumed that there is some degree of uniformity throughout the country in the quality of laboratories, then it should be possible to expand the heavy metals reporting projects to other states.

Other Projects

A number of other pilot projects for occupational disease surveillance have been or are being carried out:

- NIOSH has funded several pilot projects in state health departments to increase their capacity to conduct occupational disease surveillance, including, for example, surveillance of silicosis and farm workers exposed to pesticides.
- A recent evaluation of the utility of poison control centers for surveillance of occupational illnesses due to chemical exposures concluded that the nationwide system of Regional Poison Control Centers could be used for that purpose (Blanc and Olson, 1986).
- Additional efforts to obtain access to and use the vast amount of medical data collected by insurance companies for employers who provide group health insurance should be conducted (Van Peenen, 1986; Wilson, 1983). Both types and rates of diseases covered by insurance programs could be determined for both individual employers as well as industry groups.

OCCUPATIONAL EXPOSURES TO HEALTH HAZARDS

Data on occupational exposures to health hazards are essential for the design of occupational health policy and are often useful in the recognition of occupational diseases. Exposure data are especially critical because many occupational diseases often occur after long periods of latency and are difficult to detect. Information about exposures gives an indication of the potential for future disease; the extent of exposure to a hazard among a population of workers is often the best measure of the success of current prevention efforts.

The Occupational Safety and Health Act of 1970 requires that, where appropriate, any standard promulgated under sub-

section 6(b) "shall provide for monitoring or measuring employee exposure at such locations and intervals, and in such manner as may be necessary for the protection of employees." Since 1970, 11 OSHA standards have been promulgated for specific hazards that require employers to periodically measure their employees' exposures to these hazards; these 11 hazards are among approximately 400 health hazards for which OSHA has established permissible exposure levels. It is not feasible to conduct the necessary industrial hygiene sampling to measure exposure levels on each health hazard to which an individual is exposed. An alternative is the development of a hazard surveillance program making much better use of existing data sources than is now being done. We describe below available sources of data on occupational exposures to health hazards.

The National Occupational Hazard Survey and the National Occupational Exposure Survey

The National Occupational Hazard Survey and the National Occupational Exposure Survey, conducted by NIOSH in 1972-1974 and 1981-1983, respectively, are described in Chapter 3. A major limitation of these surveys involves the failure to conduct any industrial hygiene sampling. Neither survey provides data on actual exposure levels, so one cannot determine whether workers estimated to be exposed to a specific substance were exposed to trace amounts or to high levels of the substance. Only if we know the actual distribution of exposures can we apply dose-response curves to calculate the number of cases of disease that are currently being induced or the number that would be prevented if exposure levels were reduced by a given amount.

Health Hazard Evaluations

During fiscal 1985, NIOSH received 569 requests for general industry health hazard evaluation and technical assistance, conducted 465 site visits, and completed 536 such evaluations.

Exposure data are frequently collected by NIOSH during health hazard evaluations. The feasibility of developing a system to make these data available should be explored.

OSHA's Integrated Management Information System

Selected information collected during OSHA inspections is recorded in the Integrated Management Information System

(described in Chapter 3), which contains data from over 40,000 inspections since 1972 (Mendeloff, 1983). During health inspections, OSHA inspectors may collect industrial hygiene samples that are usually analyzed by the OSHA laboratory in Salt Lake City, which then computerizes the results. However, these exposure data have not been systematically entered into the IMIS system unless a citation was issued (personal communication, OSHA, Joseph DuBois, February 10, 1987). Thus, it is not possible to determine from OSHA's own inspection data the distribution of exposure levels for the specific substances that were sampled.

Even if all sampling data collected during health inspections were systematically entered, other limitations of the IMIS system would still have to be considered if it were to be used as a basis for exposure estimates. First, since industrial hygiene inspections are not conducted randomly, data on them may not provide an accurate representation of the entire distribution of exposures in an industry (Froines et al., 1986). Second, although the federal IMIS system does include exposure data from all states that conduct their own occupational safety and health programs except California, Michigan, and Washington (personal communication, Frank Frodyma, OSHA, November 10, 1986), the small number of inspections that are usually conducted for a particular substance may not provide data representative of exposures to that substance throughout the entire industry (Froines et al., 1986).

Exposure Data Collected by Industry

For a very few specified health hazards--asbestos, cotton dust, ionizing radiation, coke oven emissions, lead, inorganic arsenic, vinyl chloride, acrylonitrile, 1,2-dibromo-3-chloropropane, ethylene oxide, noise--OSHA standards require employers to periodically measure and record the level to which their workers are being exposed. Although these records may be examined during OSHA health inspections, the data are not reported to OSHA and OSHA does not conduct systematic monitoring to determine the extent to which the sampling has been done in compliance with the regulations. As verified by the agency, "OSHA does not have a national data base for exposure levels reported by employers" (personal communication, Frank Frodyma, OSHA, January 27, 1987).

In addition to the data mandated by OSHA, employers may collect other exposure data. Under the 1980 OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.20), employer-generated exposure records must be main-

tained for 30 years and made available upon request to employees, employee representatives, and OSHA. These data are available to OSHA for use in evaluation, intervention, and standard setting programs. However, OSHA has never used its authority under this standard to seek such data since, according to the agency, any request for information to 10 or more employers must be cleared with Office of Management and Budget under the Paperwork Reduction Act. They considered the clearance process as too time-consuming in relation to possible benefits that they might derive from the data.

Contractor Surveys

In order to estimate what compliance with a given permissible exposure level would cost, OSHA hires contractors to find out how many workers are exposed above those levels, how many work stations would have to be modified, and to what extent. Usually, these studies cost OSHA between \$80,000 and \$300,000. Despite that cost, the contractors undertake little or no actual sampling activity, relying almost entirely on exposure profiles submitted by firms in the industry. In response to a query from the panel, OSHA stated (personal communication, Frank Frodyma, OSHA, November 10, 1986):

OSHA contractors rarely are asked to collect independent samples as part of their impact analyses. The contractor for the benzene standard sampled [a total of] about 30 workers in 6 work places in 2 industries. . . . The contractor for the ETO [ethylene oxide] standard is scheduled to sample [a total of] about 45 workers in 9 workplaces in 5 industries. I believe that these are the only two standards for which contractors have collected exposure samples except possibly for the lead standard years ago and the details are not readily available.

Another major limitation of the information collected by contractors is that it is collected only for substances that are the subject of a standard. That means, of course, that the information is not available at the stage when decisions are being made about which hazards should be addressed.

Improving the Data on Occupational Exposures to Health Hazards

Although the importance of information on exposures to health hazards as an indicator of potential occupational illnesses is clear, the amount of information on these hazards that is recorded or required but not collected is of concern to the panel. The panel felt very strongly that much of this information must be collected systematically and used by OSHA for standard setting and for evaluation. This effort should include improving any national occupational hazard survey by requiring actual industrial hygiene sampling, recording all the exposure data obtained by OSHA and the state OSHA programs during the inspection process, and developing a system for collecting exposure monitoring data that industry is required to maintain. The panel presents its recommendations for improving data on hazardous exposures in Chapter 8 as Recommendations 18 through 21.

DATA SYSTEM ALTERNATIVES AND RECOMMENDATIONS

The panel's charge is to make recommendations to the Bureau of Labor Statistics for improvements in its statistical program on occupational injuries and illnesses. The panel approached this charge with the understanding that the primary purpose of this statistical program is to provide OSHA with data that will serve as a basis for maintaining an effective program for the prevention of workplace injuries and illnesses. The panel concludes that the BLS data systems, in their current form, are inadequate for this purpose. The centerpiece of the program, the Annual Survey on Occupational Injuries and Illnesses, contains insufficient detail to be useful for most purposes. Furthermore, the panel concludes that this survey is not an effective mechanism for obtaining data on most work-related diseases.

The Supplementary Data System was seriously considered by the panel as an alternative to the annual survey because it does contain considerable detail, particularly on injuries. The panel commissioned a small study in Wisconsin (see Appendix E) to compare injury rates based on the Supplementary Data System (workers' compensation) with those based on the annual survey. The results of this study suggest that, at least in Wisconsin, the SDS might be used as a surrogate for the annual survey, but in only a very limited way. Several problems make the Supplementary Data System virtually unworkable as a sole national system: about one-third of the states are not included in this system; the definitions, criteria for inclusion of cases, and data quality vary considerably among the states; and coordinating the data activities of some 33 states with disparate systems to achieve a reasonable level of uniformity is a complex and time-consuming problem.

The annual survey, by contrast, is a sound probability sample of private sector industry in the United States. Furthermore, additions to the sample have been drawn for each state in such a way that it is possible to derive reliable

estimates for each state that is able to fund the additional data collection. Although in most states the data are collected for BLS by a state agency, the design and procedures are controlled by BLS. Thus, the annual survey still emerged as the panel's first choice for the source of national data on occupational injuries and for some of the occupational illnesses. We realize, however, that substantial improvements must be made in the annual survey to make it responsive to the broad range of data needs. Therefore, we concentrated our efforts on exploring ways of improving the usefulness of the annual survey.

At the present time, the only data need that can be met by the annual survey is that of identifying industries with high injury rates in order to establish priorities for inspections. The kinds of changes in the annual survey that we recommend will make data available to meet other needs. By obtaining detailed information on each occupational fatality and on injuries requiring hospitalization or outpatient surgery, data on the more serious injuries will be available for establishing standards, for identifying unsuspected hazards, and for evaluating the effectiveness of the efforts to reduce the rates of serious injuries.

The panel also investigated whether the sample needs to be as large as it is and whether reducing its size would result in substantial savings in cost. We conclude that as long as estimates are needed down to the detailed industrial classification level, the current size is necessary in order to maintain reasonable reliability in the estimates. We further conclude that even substantial reduction in sample size would not appreciably affect cost, since the major elements of cost are in the mechanism for carrying out the survey.

In the preceding chapters, we have considered the problems associated with the BLS data systems and discussed some possible solutions. In this chapter, we present our proposed modifications to the BLS data systems, suggest ways in which other existing data systems can be used to increase knowledge of workplace injuries and illnesses, and discuss some of the more crucial related issues. In the course of this discussion, the panel makes 24 specific recommendations.

REVISION OF EXISTING BLS DATA SYSTEMS

The panel believes that major revisions in the current BLS data systems are needed as soon as possible so that data can be made available to meet the needs for the various purposes listed above.

Annual Survey

The basic problems that need to be addressed in the BLS annual survey are the lack of detailed data on occupational injuries, the difficulty in obtaining data on occupational illnesses, dissatisfaction with the classification of illnesses that are reported, and the lack of a built-in mechanism for ensuring the quality of the data.

One of the primary reasons that more detailed data are needed on occupational injuries is for estimating the number of severe injuries. This is particularly critical for analyzing trends in injury rates over time. Even though overall injury rates may be increasing or decreasing, such changes may be due entirely to changes in the much larger number of less severe injuries, while the trend in serious injuries might even be going in the opposite direction. Estimates of the number of serious injuries are also needed to refine the setting of priorities for purposes of enforcement. Much of this information might be obtained from the OSHA Form 101s, but provision has never been made for employers to submit these forms either to BLS or to OSHA. The panel feels that collecting these forms from every establishment included in the annual survey sample for every injury may not be practical at the present time. We therefore propose that such detailed information be obtained for the more serious injuries only. To experiment with this approach, the panel proposes that detailed information be obtained on all fatal injuries and for all injuries for which in-patient hospital care is required or for which outpatient surgery is performed. If one assumes that about 6 percent of occupational injuries result in hospitalization and that there are about 7,000 occupational deaths annually, this approach would require the submission of approximately 160,000 forms annually by establishments in the BLS sample.

Recommendation 1: The BLS annual survey should be modified to permit the collection of detailed data on severe occupational injuries categorized as injuries resulting in death, hospitalization, or outpatient surgery. This will require:

- Modification of the OSHA 200 and 200S to provide categories for admission to a hospital or for outpatient surgery, regardless of whether at a hospital, clinic, physician's office, or the establishment itself. BLS should convene a working group to develop an appropriate classification and corresponding definitions.

- **Collection and coding of data from the OSHA 101 (or equivalent) for all fatalities, hospitalizations, and outpatient surgery.**

The only information describing the nature of an injury in the workplace on the OSHA 200 is contained in the portion of the form reserved for a narrative description of the injury. No such information is collected in the annual survey. Some of this information would be useful for developing standards. Some is considered essential for separating out injuries of a more subjective nature, which depend more heavily on the employee's statement of symptoms. The number of these injuries could be affected by changes in workers' compensation laws, changes in sick leave practices, and changes in insurance coverage. Thus, the panel believes it important to count separately those injuries due to strain, sprain, or unspecified pain.

Recommendation 2: The OSHA 200 and 200S should be modified to include specific categories of injuries, such as amputations, burns, cuts, fractures, contusions or bruises, sprains/strains/unspecified pain, and other.

Although the panel felt that the annual survey is not an effective mechanism for collecting data on most occupational illnesses, we believe that the information that is obtained should be as meaningful as possible. This would require a revision of the categories of illness specified on the OSHA 200 and also the reporting of more detailed information on certain categories of illnesses.

Recommendation 3: The annual survey should continue to collect occupational illness data from the OSHA 200 log with the following revision in the distinction between "acute" and "chronic" and in the categories of illness:

- **Acute occupational illnesses should be divided into such categories as skin, respiratory, gastrointestinal, nervous system, musculoskeletal, and other. Illnesses would be recorded in this section if the onset of an illness is less than 14 days after the last exposure identified as the probable cause.**
- **Chronic occupational diseases should be divided into such categories as hearing loss, repetitive trauma disorders, illnesses diagnosed as a result of a medical examination required under an OSHA health standard, and other chronic illness.**

Recommendation 4: The annual survey should be modified to permit the collection of detailed data on occupational illnesses resulting in hospitalization or death, as recommended above for occupational injuries. This will require:

- Modification of the OSHA 200 and 200S to provide a category for hospitalization.
- Collection by BLS of the OSHA 101 (or equivalent) for all hospitalizations and fatalities.

One of the major shortcomings of the annual survey, as pointed out in Chapter 5, is that there is no provision for ongoing assessment of the quality of the information collected. The panel found that the individual attempts to assess the completeness and accuracy of the information were inadequate. The small study conducted for the panel in New Jersey suggested that for occupational fatalities, for which information can be obtained independently of employers, it is possible to discover, at quite modest cost, factors leading to underreporting that can be taken into account in improving the survey.

Recommendation 5: BLS should undertake studies to assess how well employers understand the guidelines for maintaining the OSHA 200 logs and how uniformly they record entries on the logs. These studies might include, but are not limited to, telephone surveys and small test groups.

Recommendation 6: BLS should select a probability sample of establishments and obtain a copy of the OSHA 200 log from each establishment in the sample. BLS should compare these logs against the summary forms submitted by the establishments in the annual survey sample.

Recommendation 7: If the validation study now being carried out by BLS and OSHA in Massachusetts and Missouri proves to be feasible and useful, in terms of being able to gain access to medical records in a sufficient proportion of the establishments, they should be encouraged to consider extending this approach to a broader sample.

Recommendation 8: BLS should conduct studies to obtain independent medical information on occupational injuries, such as for outpatient surgery and admissions to hospitals other than for observation, to determine the extent to which these injuries have been recorded on the OSHA 200

logs in the establishments in which the injured workers were employed.

Recommendation 9: In order to obtain estimates of coverage, BLS should conduct sample surveys of employees to obtain information as to possible injuries sustained in the workplace. These events should be followed back to determine whether they were, in fact, work-related and whether they had been recorded on the OSHA 200 log. Given the unique research opportunity afforded by the 1987 National Health Interview Survey, we urge BLS to apply this kind of case-by-case follow-back.

Recommendation 10: BLS should work with state agencies to carry out studies in which complete rosters of occupational fatalities are compiled from death certificates, medical examiner records, workers' compensation claims, and reports to OSHA and matched against the OSHA 200 logs in the establishments in which these workers were employed.

The panel makes recommendations on two other aspects of the BLS annual survey: communication of survey results to employers and employees and the use of the survey for periodic research.

Recommendation 11: Data from the BLS annual survey should be fed back to companies by industry and size classification and posted so that employers and employees can see how their company compares with an appropriate referent group.

Recommendation 12: Special studies focusing on specific research topics should be conducted by BLS in conjunction with the annual survey, in which OSHA 101s are collected for specific injuries or from specific industries, as determined by BLS.

The BLS Supplementary Data System

The panel recognizes that some of the state programs on occupational safety and health operate excellent data systems based on workers' compensation claims that serve as the basis for their participation in the SDS. Some of the other states that participate in the SDS have only minimal or very poor data systems. Because of this unevenness of quality, the panel recommends a drastic departure from the current arrangement for the SDS, which would result in a much

smaller number of participating states and would attract those that are motivated to do high-quality work.

Recommendation 13: The Supplementary Data System should be refocused and modified to gather data in greater detail on all injuries rather than collecting a minimal data set from a large number of states. This would permit detailed analyses for a wide range of specific injuries. Grants should be made on a competitive basis to states that can meet the criteria for data detail and quality specified by BLS. Competition for grants for data analyses should also be open to other organizations or individuals (e.g., university researchers) and should encourage proposals for new areas of analyses.

THE USE OF OTHER DATA SYSTEMS

Throughout this report we have emphasized that the existing BLS data systems cannot provide data that are useful for measuring the occurrence of most occupational illnesses. Data systems located in other agencies can provide useful information on occupational disease or on the extent of hazardous exposures in the workplace. And other data exist, but they have not yet been incorporated into a system. No attempt has been made to consistently integrate these sources of data to ascertain what can be learned about occupational disease from them.

The National Institute for Occupational Safety and Health seems to be the logical agency to assume this function of coordinating data on occupational disease: its mandate is to carry out research on these diseases; it is located in a health agency (the Centers for Disease Control); it has medical expertise; and it is developing a program on occupational disease surveillance. While NIOSH could assume a coordinating function, collaboration is clearly needed from the other agencies that have data to contribute--the Bureau of Labor Statistics, the Occupational Safety and Health Administration, the National Center for Health Statistics, and state health departments. Periodic publication of a report summarizing and interpreting these data could help provide insight in preventing occupational disease.

Recommendation 14: The National Institute for Occupational Safety and Health should be designated as the lead agency having the responsibility for the development of a comprehensive occupational disease surveillance system that would include the compilation, analysis, and dissemination of occupational illness data. These data would

come from national data bases and state health departments, beginning with data that are already available. As part of this system, NIOSH should support the development of follow-back interventions; should develop standardized methods for the detection of recognized occupational illnesses; and should publish periodic reports summarizing the data on occupational disease from the various sources. To accomplish this, NIOSH should request, and Congress approve, appropriation of additional funds.

In carrying out this coordinating function, NIOSH would need to explore the usefulness of the various national data systems to determine how they can best be modified or adapted to provide the most useful information on occupational disease. NIOSH is already doing this with some of the data systems. For others, some experimentation might be required to determine whether a particular system could be used to advantage, while, for others, experience to date may already indicate that use of the system for this purpose may not be practical.

Recommendation 15: To improve the usefulness of national data bases for surveillance of occupational disease, the panel recommends that the National Institute for Occupational Safety and Health undertake the following coordinating activities:

- *Mortality records:* NIOSH should continue to work with the National Center for Health Statistics and state health departments to move toward coding occupation and industry on death certificates in all states. NCHS will need appropriation of additional funds to accomplish this.
- *Hospital discharge abstracts:* NIOSH should collect hospital discharge data on definite occupational diseases from states from which these data are available and develop ways of encouraging hospitals to obtain occupational histories routinely on admission.
- *The National Health Interview Survey and the National Health and Nutrition Examination Survey:* NIOSH should continue to collaborate with NCHS on these two national surveys to obtain the most effective occupational components possible and feasible.
- *Laboratory report of heavy metals poisoning:* NIOSH should follow closely the experience of state health departments that now maintain laboratory-based reporting systems on occupationally related heavy metals poisoning. If these systems prove to be useful and cost-effective, NIOSH should work with these state

health departments to develop uniform data, working toward a national system by incorporating other states into the system as they begin to develop similar programs.

- *Physician reporting of occupational diseases:* NIOSH should investigate current impediments to physician reporting of occupational diseases and develop ways to overcome these impediments.
- *Cancer registries:* The experience of population-based cancer registries in obtaining information on occupation and in identifying links between occupational exposure and cancer should be reviewed and ways of using these registries as part of an overall occupational disease surveillance should be developed.

Recommendation 16: The panel encourages the National Institute for Occupational Safety and Health to continue and to expand its efforts to develop the occupational disease surveillance capability of state health departments through technical assistance and financial support.

One of the primary purposes of occupational disease surveillance is to obtain information that will be useful for prevention. One aspect of this is the use of the data to make those who may be at increased risk of occupational disease, as suggested by the data, aware of the hazards and of steps that can be taken to reduce risk. As we have indicated in this report, many illnesses go unrecognized as occupationally related because of lack of awareness on the part of physicians. One of the functions served by notifying workers of their risks from workplace exposures is to make them aware so that when they interact with their physicians they can provide a more complete picture of both their symptoms and possible workplace hazards to which they might be exposed. This interaction serves as an added aid to the physician in identifying and diagnosing occupational illnesses.

Recommendation 17: The panel supports the concept of worker notification. This includes the notification of all workers currently exposed to hazardous substances, as well as notification of all surviving subjects of retrospective cohort mortality studies in which there were significant findings.

Even though it is difficult to identify illnesses as resulting from occupational exposures, it is possible to identify some workplace hazards, to obtain some estimates of the extent to which they exist, the numbers of workers exposed,

and the levels and duration of exposure. Some of this information is available in the OSHA Integrated Management Information System as a result of inspections, some is contained in the OSHA Salt Lake City laboratory data system, and some exists in individual company records as a result of samples taken because of OSHA requirements, although the information has never been collected. The following recommendations are intended to systematize the information on hazardous exposures that does exist and to make the data more readily available.

Recommendation 18: OSHA should enter into its Integrated Management Information System all industrial hygiene sampling data collected during OSHA health inspections, including those in states that operate their own occupational safety and health programs.

Recommendation 19: OSHA should require that industry-collected exposure monitoring data for specific substances mandated by OSHA be reported to OSHA, entered into the Integrated Management Information System, and used appropriately by OSHA.

Recommendation 20: NIOSH should compile the industrial hygiene data it collects during its health hazard evaluations and its industrywide studies. The data should be analyzed to characterize exposures in specific industries and occupations.

Recommendation 21: Any future large-scale occupational hazard surveys should include industrial hygiene monitoring measurements.

In the area of occupational fatalities, we have described the approaches that have been used by BLS, the National Safety Council, and NIOSH to estimate the number of fatal injuries. The estimates that these systems produce differ from each other, but the populations they cover also differ. NIOSH has attempted to develop a system that will cover all fatal injuries in the United States but thus far has done so without close consultation with NCHS, which maintains the overall national mortality system.

Recommendation 22: The national vital statistics system should be modified to measure the number of occupational fatalities annually. NCHS and NIOSH should collaborate to assess the completeness of the designation of "injury at work" on death certificates in each individual state and

take steps to correct problems in this designation where they exist.

OTHER DATA SYSTEM ISSUES

Incentives to Underreport Occupational Injuries

As indicated earlier, one of the major uses that OSHA makes of the annual survey data from BLS is to rank the lost-workday injury rates by industry to identify the industries that appear to be the most hazardous. This serves as a basis for establishing priorities for targeting industries for general schedule inspections in the manufacturing sector. Under the current system of targeting, once OSHA has selected industries for inspection and the inspector arrives at a company in a targeted industry, the inspector computes the lost work-day injury rate on the basis of an examination of the OSHA 200 log. If this rate is below the U.S. average for manufacturing, the inspection is terminated at that point. There are two exceptions to this. First, if the inspector notices, for example, a cluster of a particular kind of injury occurring in one part of the plant, the inspector may decide to proceed with a full-scale inspection, even though the lost-workday injury rate is below the U.S. average. Second, a complete inspection is carried out in 1 out of every 10 establishments selected for inspection, regardless of the size of the lost-workday injury rate.

It is this policy of exemptions from complete inspection that has caused considerable criticism on the part of some individual employees, labor unions, and others who feel that this may induce the employer not to record certain injuries on the log and thereby artificially lowering the lost-workday injury rate. There is no clear-cut quantitative evidence, however, to indicate whether there is any widespread tendency toward underreporting related to the OSHA inspection policy.

It is not difficult to understand how this inspection policy can create the impression that employers have an incentive to underreport occupational injuries. They know that their establishment will probably not be inspected if their injury rate is below a value made known to them in advance of data collection. This issue was discussed in great detail at a hearing before the Housing and Employment Subcommittee of the Government Operations Committee on March 19, 1987. One of the members of the subcommittee criticized OSHA for publicizing its criteria for determining whether complete

inspections of a plant would be carried out. He urged that consideration be given to developing a set of criteria for selecting establishments for complete inspections, such that an employer would not be able to determine in advance whether it was possible to escape a complete inspection. A basic problem is that many observers believe that employers have an incentive to underreport injuries and hence suspect the reported data whether or not underreporting actually occurs. Nevertheless, some panel members expressed the opinion that employers should be aware that they will be inspected if their firms have high injury rates and that this will serve as an incentive to employers to take the additional steps to prevent injuries.

BLS Confidentiality and Development of an Administrative Data System

Another issue that arose repeatedly during the panel's deliberations concerned the question of whether BLS should provide OSHA with the names of firms that had high injury rates, as determined from their individual responses to the annual survey, so that OSHA could inspect them for possible violations. BLS has opposed such a policy, believing that it would destroy the quality of the data obtained in the survey and that it might jeopardize the quality of its other surveys. At the present time, the OSHA 200S, the form used to collect the summary data in the annual survey, contains a statement assuring the individual establishment that the data they provide to BLS will be held as confidential. The panel supports this principle of confidentiality as indicated in the following recommendation.

Recommendation 23: The panel supports the principle that BLS protect the confidentiality of the survey data it receives from individual establishments. Data collected by BLS should not be transmitted to OSHA for enforcement purposes.

This recommendation does not represent a unanimous opinion of the panel. Two panel members believe that BLS should provide OSHA with individual establishment data from the annual survey. One believes strongly that OSHA should have access to the individual establishment data so that it can target inspections toward those establishments with high injury rates. The other believes that the only reason for maintaining confidentiality of the annual survey responses is to deter underreporting. He believes that, because the BLS annual survey data has proved to be of such limited useful-

ness, unless they are used to target individual firms for inspections, the continuation of the data collection effort cannot be justified. He feels that, since some informed observers already believe that the individual BLS survey responses are used for targeting inspections, little will be lost and much might be gained if OSHA had access to this information for targeting purposes.

Even though the panel recommends that the individual establishment data from the annual survey be held confidential, we recognize that OSHA does need individual establishment data for enforcement purposes. An administrative data system based on the OSHA 200 logs might be a feasible alternative to the BLS statistical program for occupational injuries and illnesses. Such a system would not place any additional record-keeping burden on employers; they are already required to record detailed information on every work-related injury and illness, even though they are not required to report it. The panel feels strongly that such a system should be able to meet most of the needs for data specified in Chapter 4 and that it should not be operated in parallel with the BLS data systems but rather as an alternative to them. The advantages of such a system over the current program could be enormous. It could provide systematic detailed data that the current program does not now provide; it could give OSHA more effective ways of using its inspection resources to reduce workplace injuries; and it could provide a more systematic basis for monitoring the quality of record keeping and reporting.

The panel had neither the time nor the specific expertise to explore the issues that would need to be considered for an administrative data system. These issues include: Who would operate the system, BLS or OSHA? What changes would be required in the BLS confidentiality policy or in OSHA's ability to handle data? What kind of staffing and expertise would be required? How extensive should the data set be? Would this be a more effective approach than the current BLS data system? The panel suggests that BLS and OSHA might obtain the necessary outside expertise to investigate the feasibility of developing an administrative data system based on the OSHA 200 logs not only for OSHA but for other users as well, including standard setting, enforcement, program evaluation, and research.

Resources for Inspections for Record Violations

Finally, the issue of the relative roles of BLS and OSHA in investigating the quality of the data recorded by employers arose many times during the panel's discussions. Because

of its position on the confidentiality of the survey data, and because it does not participate in the enforcement process, BLS has been reluctant to establish procedures for checking on the completeness and accuracy of the data obtained in the annual survey. This is especially true for procedures that would require entering establishments to compare the OSHA 200 logs with other information that might be available, such as medical records. BLS has been requesting that OSHA carry out this function, because the 1970 act makes enforcement of the requirement to record occupational injuries and illnesses on the OSHA 200 logs is OSHA's responsibility. However, OSHA is reluctant to devote scarce inspection resources to checking on records. Recently OSHA has been compelled to undertake detailed checking in cases of alleged serious underreporting that has received considerable publicity. This includes the investigations of records at Union Carbide, the Chrysler Corporation, and other major employers. In numerous instances a large number of willful violations in recording information were alleged and the proposed penalties levied were the largest on record. OSHA has also agreed to work with BLS in comparing the logs in samples of establishments in Massachusetts and Missouri with medical records to assess the adequacy of the recording of occupational injuries and illnesses. This pilot study is aimed at evaluating this approach for its potential as an ongoing assessment of the quality of the data used in the annual survey. Because of the experience in the Union Carbide and Chrysler cases, the panel believes very strongly that this kind of checking of the recording of injuries and illnesses must be done. The panel recognizes, however, that OSHA does have limited resources for this purpose and does not want to see these resources diverted from inspections for health and safety hazards. Therefore, the panel recognizes the need for additional resources that will permit more of the detailed investigation of recording.

Recommendation 24: The panel recommends that OSHA request, and Congress approve, resources for ongoing inspections of employer practices in the recording of occupational injuries and illnesses.

OSHA needs good data on workplace injuries and illnesses in order to recognize trends, to establish priorities for standard setting and enforcement activities, and to evaluate its effectiveness in regulating workplace safety and health. None of the existing systems as currently constituted, nor all of them combined, satisfies all of these needs. The panel has recommended several initiatives that, collectively, should significantly improve the quality and usefulness of the data

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available to OSHA. This improvement will be effective, however, only if OSHA develops an ability and a plan to use the data that are available now and in the future to improve their standard setting and enforcement capabilities.

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APPENDIX A

BUREAU OF LABOR STATISTICS FORMS

Occupational Safety and Health Statistics

Bureau of Labor Statistics
 Log and Summary of Occupational
 Injuries and Illnesses

NOTE: This form is required by Public Law 91-608 and must be kept in the establishment for 3 years. Failure to maintain and post can result in the issuance of citations and assessment of penalties. (See posting requirements on the other side of form.)

RECORDABLE CASES: You are required to record information about every injury or illness (death, injury, nonfatal occupational illness, and those nonfatal occupational injuries which involved one or more of the following: loss of consciousness, restriction of work or motion, transfer to another job, or medical attention) other than first aid (See definitions on the other side of form.)

Date of the Incident	Date of Injury or Onset of Illness	Employer's Name	Occupation	Department	Description of Injury or Illness
Enter a four-digit entry number which will facilitate the reporting process.	Enter the date.	Enter first name or initial, middle initial, last name.	Enter regular job title, not secondary activities not performing when injured or at onset of illness. In the absence of a formal title, enter a brief description of the employee's duties.	Enter department in which the employee is regularly employed or a description of normal workplace in which employee is assigned, even though temporarily working in another department at the time of injury or illness.	Enter a brief description of the injury or illness and indicate the part or parts of body affected. Typical areas for this column might be: Amputation of left right leg/hand; Strain of lower back. Contact direction on both hands. E rect muscul—illness.
(A)	(B)	(C)	(D)	(E)	(F)
					TOTALS (Summarize on other side of Form.)

U.S. Department of Labor



For Calendar Year 19 _____ Page _____ of _____

Company Name _____	Form Approved O.S.B. No. 1220-0029
Establishment Name _____	
Establishment Address _____	

Injury Incident	Fatalities					Type, Extent, and Outcome of ILLNESS											Fatalities					Nonfatal Illnesses											
	Nonfatal Injuries					Type of Illness											Illness Related					Nonfatal Illnesses											
	Injuries With Lost Workdays					CHECK Only One Column for Each Illness (On other side of form for continuation or <u>multiple illnesses.</u>)											Illness With Lost Workdays					Illness Without Lost Workdays											
Enter DATE of death	Enter a CHECK if injury involves days away from work, or days of restricted work activity, or both	Enter a CHECK if injury involves days away from work	Enter num-ber of DAYS away from work	Enter num-ber of DAYS of restricted work activity	Enter a CHECK if no entry was made in col-umns 1 or 2 but the injury is accounted for in column 10 below.	Occupational or non-occupational Check one of the following: Respiratory conditions due to toxic agents Poisoning, including the facts of toxic agent used Chemical burn Physical agents Chlamydia meningitis Infectious diseases All other illnesses											Enter DATE of death	Enter a CHECK if illness involves days away from work, or days of restricted work activity, or both	Enter a CHECK if illness involves days away from work	Enter num-ber of DAYS away from work	Enter num-ber of DAYS of restricted work activity	Enter a CHECK if no entry was made in col-umns 8 or 9	Occupational or non-occupational Check one of the following: Respiratory conditions due to toxic agents Poisoning, including the facts of toxic agent used Chemical burn Physical agents Chlamydia meningitis Infectious diseases All other illnesses					Enter DATE of death	Enter a CHECK if illness involves days away from work, or days of restricted work activity, or both	Enter a CHECK if illness involves days away from work	Enter num-ber of DAYS away from work	Enter num-ber of DAYS of restricted work activity	Enter a CHECK if no entry was made in col-umns 8 or 9
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)				

Certification of Annual Summary Totals By _____ Title _____ Date _____

OSHA No. 302

POST ONLY THIS PORTION OF THE LAST PAGE NO LATER THAN FEBRUARY 1.

1985 OSHA No. 200-5

Annual Occupational Injuries and Illnesses Survey (Calendar) Calendar Year 1985

The information collected on this form will be used for statistical purposes only by the BLS, OSHA, and the coordinating State Agencies.

U.S. Department of Labor

Bureau of Labor Statistics for the Occupational Safety and Health Administration

THIS REPORT IS MANDATORY UNDER PUBLIC LAW 91-504. FAILURE TO REPORT CAN RESULT IN THE ISSUANCE OF CITATIONS AND ASSESSMENT OF PENALTIES.

O.M.B. No. 1220-0045
 Approval Exp. 3/31/87

SI _____ CA _____ SU _____

SIC _____

DIT _____

Complete this report whether or not there were recordable occupational injuries or illnesses.

PLEASE READ THE ENCLOSED INSTRUCTIONS

Complete and return ONLY THIS FORM within 3 weeks

<p>I. ANNUAL AVERAGE EMPLOYMENT IN 1985</p> <p>Enter the average number of employees who worked during calendar year 1985 in the establishment(s) covered by this report. Include all types of employees (full-time, part-time, seasonal, temporary, etc.) See the instructions for an example of an annual average employment calculation. (Round to the nearest whole number.)</p> <p>_____</p>	<p>II. TOTAL HOURS WORKED IN 1985</p> <p>Enter the total number of hours actually worked during 1985 by all full-time employees covered by this report. DO NOT include any non-worktime even though paid such as vacation, sick leave, etc. If employees worked less than 1985 hours due to layoffs, strikes, fires, etc. explain under Comments (section VII). (Round to the nearest whole number.)</p> <p>_____</p>	<p>III. NATURE OF BUSINESS IN 1985</p> <p>A. Check the box which best describes the general type of activity performed by the establishment(s) included in this report.</p> <p><input type="checkbox"/> Agriculture <input type="checkbox"/> Forestry <input type="checkbox"/> Fishing <input type="checkbox"/> Mining <input type="checkbox"/> Construction <input type="checkbox"/> Manufacturing <input type="checkbox"/> Transportation <input type="checkbox"/> Communication <input type="checkbox"/> Public Utilities <input type="checkbox"/> Wholesale Trade <input type="checkbox"/> Retail Trade <input type="checkbox"/> Finance <input type="checkbox"/> Insurance <input type="checkbox"/> Real Estate <input type="checkbox"/> Services <input type="checkbox"/> Public Administration</p>	<p>B. Enter in order of importance the principal products, lines of trade, services or other activities. For each entry also include the approximate percent of total 1985 annual value of production, sales or receipts.</p> <p>_____ % _____ % _____ %</p>	<p>C. If this report includes any establishment(s) which perform services for other units of your company, indicate the primary type of service or subject provided. (Check as many as apply.)</p> <p>1 <input type="checkbox"/> Central administration 2 <input type="checkbox"/> Research, development and testing 3 <input type="checkbox"/> Storage (warehouses) 4 <input type="checkbox"/> Other (specify)</p>	<p>IV. MONTH OF OSHA INSPECTION</p> <p>If the establishment(s) covered by this report had either a Federal or State OSHA compliance inspection during calendar year 1985, please enter the name of the month in which the first inspection occurred.</p> <p>_____</p> <p>(Leave this box blank.)</p>	<p>V. RECORDABLE INJURIES AND ILLNESSES</p> <p>Did the establishment(s) have any recordable injuries or illnesses during calendar year 1985?</p> <p>1 <input type="checkbox"/> No (Please complete section VII.) 2 <input type="checkbox"/> Yes (Please complete sections VI and VII.)</p> <p>SEE REVERSE</p>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

REPORT LOCATION AND IDENTIFICATION

Complete this report for the establishment(s) covered by the description below.

Please indicate any address change below.

RETURN REPORT TO:

For Information Call:

OSHA No. 200-5 (Rev. December 1984)

VI. OCCUPATIONAL INJURY AND ILLNESS SUMMARY (Covering Calendar Year 1985)

- Complete this section by copying totals from the annual summary of your 1985 OSHA No. 200.
- Remember to reverse the carbon insert before completing this side
- Leave section VI blank if there were no OSHA recordable injuries or illnesses during 1985
- Note: First aid even when administered by a doctor or nurse is not recordable.

- Please check your figures to be certain that the sum of entries in columns (7a) + (7b) + (7c) + (7d) + (7e) + (7f) + (7g) = the sum of entries in columns (8) + (9) + (13)
- If you listed fatalities in columns (1) and/or (8), please give a brief description of the object or event which caused each fatality in the "Comments" section.

OCCUPATIONAL INJURY CASES						OCCUPATIONAL ILLNESS CASES								
INJURY RELATED FATALITIES** (DEATHS)	INJURIES WITH LOST WORKDAYS				INJURIES WITHOUT LOST WORKDAYS*	TYPE OF ILLNESS							ILLNESSES WITH LOST WORKDAYS	ILLNESSES WITHOUT LOST WORKDAYS*
	Enter the number of checks from the appropriate columns of the log (OSHA No. 200).					Enter the number of checks from the appropriate columns of the log (OSHA No. 200).								
	Injury cases with days away from work and/or restricted workdays	Injury cases with days away from work	Total days away from work	Total days of restricted activity		Occupational skin diseases or disorders	Dust diseases of the lung	Respiratory conditions due to toxic agents	Poisoning (systemic effects of toxic materials)	Disorders due to physical agents	Disorders associated with repeated trauma	All other occupational illnesses		
Number of DEATHS in col. 1 of the log (OSHA No. 200)	Number of CHECKS in col. 2 of the log (OSHA No. 200)	Number of CHECKS in col. 3 of the log (OSHA No. 200)	Sum of the DAYS in col. 4 of the log (OSHA No. 200)	Sum of the DAYS in col. 5 of the log (OSHA No. 200)	Number of CHECKS in col. 6 of the log (OSHA No. 200)	(a)	(b)	(c)	(d)	(e)	(f)	(g)	Number of DEATHS in col. 8 of the log (OSHA No. 200)	Number of CHECKS in col. 9 of the log (OSHA No. 200)
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(7c)	(7d)	(7e)	(7f)	(7g)	(8)	(9)

DEATHS WITH/OUT LOST WORKDAYS—CASES WITH NO DAYS LOST RESULTING IN EITHER: DIAGNOSIS OF OCCUPATIONAL ILLNESS; LOSS OF CONSCIOUSNESS; RESTRICTION OF WORK OR MOTION; TRANSFER TO ANOTHER JOB; OR MEDICAL TREATMENT BEYOND FIRST AID.

VII. REPORT PREPARED BY (Please type or print)

NAME _____

TITLE _____

SIGNATURE _____

AREA CODE _____ PHONE _____

DATE _____

**IF YOU LISTED FATALITIES IN COLUMNS (1) AND/OR (8), PLEASE GIVE A BRIEF DESCRIPTION OF THE OBJECT OR EVENT WHICH CAUSED EACH FATALITY IN THE "COMMENTS" SECTION BELOW.

COMMENTS _____

Bureau of Labor Statistics
Supplementary Record of
Occupational Injuries and Illnesses

U.S. Department of Labor



This form is required by Public Law 91-602 and must be kept in the establishment for 5 years. Failure to maintain can result in the issuance of citations and assessment of penalties.

Case or File No.

F arm Approval
O.M.B. No. 1220-0029

Employer

1. Name

2. Mail address (Rte. and street, city or town, State, and zip code)

3. Location, if different from mail address

Injured or Ill Employee

4. Name (F. first, middle, and last)

Social Security No.

5. Home address (Rte. and street, city or town, State, and zip code)

6. Age

7. Sex (Check one)

Male

Female

8. Occupation (Enter regular job title, and the specific activity he was performing at time of injury.)

9. Department (Enter name of department or division in which the injured person is regularly employed, even though he may have been temporarily working in another department at the time of injury.)

The Accident or Exposure to Occupational Illness

If accident or exposure occurred on employer's premises, give address of plant or establishment in which it occurred. Do not indicate department or division within the plant or establishment. If accident occurred outside employer's premises at an identifiable address, give that address. If it occurred on a public highway or at any other place which cannot be identified by number and street, please provide place references locating the place of injury as accurately as possible.

10. Place of accident or exposure (Rte. and street, city or town, State, and zip code)

11. Was place of accident or exposure on employer's premises?

Yes

No

12. What was the employee doing when injured? (Be specific. If he was using tools or equipment or handling material, name them and tell what he was doing with them.)

13. How did the accident occur? (Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how it happened. Name any objects or substances involved and tell how they were involved. Give full details on all factors which led to or contributed to the accident. Use separate sheet for extended space.)

Occupational Injury or Occupational Illness

14. Describe the injury or illness in detail and indicate the part of body affected. (E.g., amputation of right index finger at second joint; laceration of rib; lead poisoning; dermatitis of left hand, etc.)

15. Name the object or substance which directly injured the employee. (For example, the machine or thing he struck against, or which struck him; the paper or pattern he inhaled or swallowed; the chemical or reflexion which irritated his skin; or in case of strain, laceration, etc., the thing he was lifting, pulling, etc.)

16. Date of injury or initial diagnosis of occupational illness

17. Did employee die? (Check one)

Yes

No

Other

18. Name and address of physician

19. If hospitalized, name and address of hospital

Date of report

Prepared by

Official position

APPENDIX B

REVIEW OF STUDIES USED FOR EVALUATION

This appendix is a review of studies conducted since the passage of the Occupational Safety and Health Act of 1970 that attempt to examine the completeness and accuracy of employer-recorded injuries. These studies were briefly summarized in Chapter 5.

The Insurance Company of North America (INA) studied the accuracy of a stratified sample of 4,000 workers' compensation cases that had been selected in an undescribed manner from the 60,000 INA claims closed between July 1, 1971, and December 31, 1973. For each case, INA staff members used the employer's first report of injury or illness to code six injury-illness characteristics: nature of injury, part of body affected, source of injury, accident type, unsafe act, and unsafe condition. A final report on each case was then prepared using additional information obtained from INA's standard investigation of the case, medical records, and field reports. The six characteristics coded from the final report were then compared with those from the first report.

Overall, the coding on the first report and final report had an agreement frequency of 89.5 percent (21,468 agreements in 24,000 data elements). However, Mazor noted that INA's use of only standard insurance investigation procedures in providing data for each case's final report, with no in-depth special investigations, could affect the validity of the findings.

This study could not have detected whether there was any underreporting of cases by employers. INA examined only cases that had already been reported through employer's first reports of injury or illness, making no attempt to investigate whether employers were actually reporting all occupationally related cases to the insurance company through employer-maintained records.

Safety Sciences researchers examined the accuracy of employer-maintained injury records in determining whether these records were of sufficient value to be used in the development of a NIOSH injury information system. Within

15 states and the District of Columbia, an attempt was made to select 32 establishments, stratified by employment size and required to have at least two OSHA-recordable injuries during 1974, in each of the 25 two-digit SIC categories designated as having the highest number of injuries occurring annually. In addition to reviewing the record-keeping systems at each establishment, researchers requested an interview with the two employees representing the most recent lost-workday case and the most recent non-fatal-without-lost-workday case. Record-keeping systems were reviewed in 617 establishments and interviews were conducted with 1,099 injured employees.

The quality of the injury data on the OSHA 101 form or equivalent (94 percent of the establishments visited used a surrogate for the 101) was assessed by comparing how the information on the employer record would have been coded with how the employee's description of the accident would have been coded. For nature of injury, 75 percent of the 1,099 cases were in agreement, although only 57 percent of the cases had involved unambiguous coding, i.e., the remaining 18 percent had required inferences from the employers' records. For part of body affected, source of injury, and accident type, the overall agreement on coding was 90, 76, and 73 percent, respectively. If those cases on which inferences were made are excluded, the proportions in agreement were 83, 44, and 30 percent of the cases, respectively.

In evaluating the quality of the data, Safety Sciences researchers noted the following limitation inherent in the design of this project: "no attempt was made to detect *deliberate* misrepresentations in injury reporting. Rather, the aim was to study the errors, omissions and failures in clarity occurring in the ordinary course of injury recordkeeping." Since the researchers interviewed employees only about cases that had been identified on an employer-maintained injury record, no underreporting of occupational injuries by employers could have been detected in this study.

Discher et al. (1975) conducted a pilot study to assess the feasibility of an occupational disease surveillance method that included medical examinations, employee interviews, and industrial hygiene walk-through surveys. One of the stated goals of this study was to ascertain how much data would be generated by this survey method that were not already available through workers' compensation claims or OSHA 200 logs.

A sample of 140 establishments, having 8-150 workers and located in 4 study sites in Oregon and Washington, was selected from 4 predetermined categories: lead-using industries, chlorinated hydrocarbon solvent-using industries, agriculture, and all other hazardous nonagricultural industries.

Field staff conducted the study from July 1972 through August 1974: industrial hygiene surveys were completed in 136 of the 140 establishments, but the medical survey was limited to production workers present on the day of the survey at establishments selected not at random but from those with perceived hazardous exposures.

Medical examinations were conducted on 908 employees and questions were included in the medical history to ascertain whether the employees had experienced serious and/or minor accidents or injuries on the job in the preceding 12 months. Workers' compensation claims and OSHA 200 logs covering the equivalent time period were then reviewed for each of the 2,040 employees who were eligible to participate in the medical survey.

For these 2,040 employees, only 908 of whom participated in the entire medical survey and another 173 who completed the questionnaire, 1,005 occupational injuries were detected by at least one of the three sources: 42 percent (419/1005) by medical survey only, 7 percent (72/1005) by OSHA 200 log only, 12 percent (122/1005) by workers' compensation claims only, and 39 percent (392/1005) by more than one of the three sources.

Discher et al. discussed five possible reasons why 42 percent of the occupational injuries in this study of selected industries were reported only by employees in the medical survey and were never recorded by employers: (1) The study was begun during the first full year of the annual survey, and not all employers may have been following the requirements to maintain records. Employers at 22 of the 64 establishments in the medical survey did not have an OSHA 200 log available because they said they had had no work-related injuries or illnesses; however, 10 of the 22 establishments had filed workers' compensation claims during this time period. (2) Injuries may not have fulfilled the criteria necessary for an employer to record the incidents, e.g., injuries only involving first aid would not be recorded on the OSHA 200. (3) Employees may have received medical treatment for injuries but never filed a claim or notified the employer of the incidents. (4) Employees may have incorrectly recalled when the injuries occurred, i.e., the injuries may have actually occurred more than 12 months prior to the administration of the questionnaire. (5) Injuries, self-reported by employees on the medical questionnaire, were usually not recent enough to be verified by medical examination. Thus, an undetermined number of injuries that had been reported by employees in the survey may not have even been recordable by employers.

Arthur D. Little (1981) analyzed data from a project conducted by OSHA to investigate the feasibility of deriving

injury data for targeting purposes from workers' compensation first reports of injury or illness instead of from OSHA 200 logs. Compliance officers visited 251 establishments, involving three area OSHA offices, between August 1 and November 30, 1981. For each establishment, officers recorded the number of cases for which first reports had been completed and the number of lost workday cases that had been recorded on the OSHA 200. For the 212 establishments with complete data, 81 percent (171/212) had a greater number of workers' compensation first reports than lost-workday cases, 2 percent (4/212) had fewer first reports than lost-workday cases, 7 percent (14/212) had an equal number of the cases, and 11 percent (23/212) had no cases of either type.

At least part of the excess in workers' compensation first reports is due to the inclusion of first aid cases and medical treatment cases that did not involve lost-workdays, and thus would not have been recordable as a lost-workday case on the OSHA 200 log. However, the discrepancy could also be due in part to employers who either did not record all occupational injuries on the OSHA 200 or did not correctly identify those that involved lost workdays. OSHA did not design the study to examine this issue and the analysis does not present sufficient data to determine whether employers were underreporting occupational injuries on the OSHA 200 logs.

Fine et al. (1984) examined the use of preexisting data sources for surveillance of cumulative trauma disorders of the upper extremities. For three large automobile manufacturing plants, researchers collected data including type of treatment and location and nature of the disorder from four data sources: OSHA 200 logs, a registry of awarded workers' compensation claims, a registry of medical leaves of three days or longer, and plant medical records of "all disorders or injuries which might be work related."

Incidence rates calculated from medical record data in two of the plants were 4-5 times greater for acute trauma and 68-93 times greater for cumulative trauma disorders of the upper extremities than those coded from the OSHA 200 log. Incidence rates calculated from medical record data were 20-23 times greater for acute trauma and 7-31 times greater for cumulative trauma than those coded from workers' compensation claims. However, as Fine et al. point out, some of the variation in incidence rates "obviously occurs because the sources differ on how severe the disorder must be in order for it to be counted and whether the causal role of work is considered before it is counted." Unless an injury is determined to be work-related and involves either medical treatment beyond first aid, loss of consciousness, restriction

of work or motion, or transfer to another job, the injury would not be recordable on the OSHA 200 log. Fine et al. do not provide the data to determine how many of the disorders detected on medical records were actually OSHA recordable.

Ruser (1986) compared the estimates of numbers of occupational injuries from the National Health Interview Survey (NHIS) and from the BLS annual survey. The large discrepancy between the estimates (11.3 million in 1981 for the NHIS versus 5.4 million in 1981 for the annual survey) was described as being due, at least in part, to different groups of workers being covered and different concepts being measured in the two surveys.

The NHIS estimate represents all workers in the civilian noninstitutionalized population, whereas the annual survey estimate includes only private-sector workers who are not self-employed and who do not work in households or on farms with fewer than 11 employees. Ruser selected private nonagricultural, nonhousehold, and nonself-employed workers as the largest group of comparable workers. His NHIS estimate of the number of occupational injuries for these workers (8.9 million) was still significantly larger than the annual survey estimate (5.2 million).

Ruser pointed out that the discrepancy in estimates between the NHIS and the BLS annual survey that remained after the categories of workers were made more comparable may be explained, in part, by differences in the concepts being measured by the two surveys: differing definitions of what constitutes a work injury; the NHIS counts the number of injury conditions whereas the annual survey counts the number of injury cases; and incomparabilities between the annual survey's days away from work and the NHIS measures of lost workdays. Ruser concluded that, without obtaining additional data to reconcile conceptual differences between surveys, it is impossible to make valid comparisons of estimates of numbers of work injuries from the NHIS and the BLS annual survey.

Karlson and Baker (1978) identified 161 occupational injury deaths to Wisconsin residents during 1976 from death certificates and workers' compensation records. The study included Wisconsin residents who died out-of-state, but excluded injury deaths to nonresidents and deaths from diseases and unknown causes. Death certificates identified 76 percent (123/161) of the occupational injury deaths, i.e., the death certificates had a "yes" response to the question, "Injury at work?" Workers' compensation records identified only 91 (57 percent) of the 161 work-related injury deaths, but the 70 deaths that were not identified included some employees who were not covered by workers' compensation in

Wisconsin: farmers and members of their families working on the farm accounted for 34 of the 70 fatalities, and deaths among self-employed individuals or workers whose employer was located out-of-state also would not have been reported to workers' compensation in Wisconsin.

Karlson and Baker reported that 92 occupational injury and illness deaths in Wisconsin in 1976 were estimated by the BLS annual survey. Remember that the annual survey does not cover self-employed individuals; employers of domestics; farmers with fewer than 11 employees; and federal, state, and local government agencies. Data are not presented in this study to enable the deduction of those cases from the 161 identified occupational injury fatalities that would not be BLS reportable, so that a more accurate comparison could be made between the annual survey estimate of deaths and the death certificate/workers' compensation identification of deaths in Wisconsin in 1976.

Baker et al. (1982) identified 148 fatal occupational injuries that occurred in Maryland in 1978 using four sources: medical examiner records, workers' compensation claims, cases reported to the Maryland OSHA office, and death certificates that indicated "injury at work." The Office of the Chief Medical Examiner had records for 96 percent of the 148 cases, whereas no other single source "identified more than two thirds of all the cases that were eventually identified."

As discussed in the review of the Karlson and Baker (1978) article, however, not all occupational injury deaths are reportable to workers' compensation or to OSHA, e.g., the 22 fatal occupational injuries involving self-employed individuals and the 29 involving public employees would not have been reportable according to OSHA requirements or through the BLS annual survey. As in the Karlson and Baker study, data are not presented to enable the deduction of those cases from the 148 identified fatal occupational injuries that would not be BLS reportable, so that an accurate comparison could be made between the BLS annual survey estimate of deaths in Maryland in 1978 and the medical examiner/death certificate/Maryland OSHA case report/workers' compensation identification of deaths.

System Sciences (1980) examined employer compliance in North Carolina with the OSHA requirement to report work-related deaths within 48 hours. For 1978 and 1979, the fatalities that the North Carolina OSHA had investigated were categorized by OSHA's source of notification: 68 percent (107/157) were reported to OSHA by employers but could have been reported by other sources as well, 8 percent (13/157) were the result of an unsolicited copy of a medical examiner's report, and 24 percent (37/157) were reported by other sources, including news reports or workers' compensa-

tion claims. In addition to the 157 cases investigated by the North Carolina OSHA office, 16 cases were identified through medical examiner records, "which, on a judgment basis, would have been investigated had OSHA been aware of them." When these are included, the proportion reported to OSHA by employers reduced to 62 percent (107/173).

This study examines only the number of fatalities that were, or would have been, investigated by OSHA. However, OSHA does not investigate all reportable fatalities. For example, OSHA does not investigate fatalities that are routinely investigated by other agencies, e.g., highway accidents are investigated by the Department of Transportation and homicides are investigated by the local police. Data are not presented to indicate the number of reportable fatalities identified by medical examiner records that were not reported according to OSHA requirements or were not reported in the BLS annual survey.

Parkinson et al. (1986) identified traumatic workplace deaths in Allegheny County, Pennsylvania, from a review of death certificates issued in 1983 and 1984. For each death, data were collected from investigations routinely conducted by the coroner's office and by OSHA, and included autopsy results, toxicologic analyses, type of industry, and conditions associated with the cause of the accident.

Of the 41 traumatic workplace deaths in Allegheny County in 1983 and 1984, 44 percent (18/41) of the cases were not within the jurisdiction of OSHA (e.g., cases involved self-employed, municipal, or mining workers) and therefore were not reported to or investigated by OSHA. However, 96 percent (22/23) of the deaths that occurred within the jurisdiction of OSHA were reported by the employer to OSHA.

APPENDIX C

TRAUMATIC OCCUPATIONAL FATALITIES IN NEW JERSEY

Martha Stanbury, Marcia Goldoft, and Kathleen O'Leary

INTRODUCTION

In fall 1986 the Panel on Occupational Safety and Health Statistics asked the New Jersey Department of Health to perform a pilot study to explore possible underreporting of occupational injuries. This pilot study was carried out as part of the panel's evaluation of the accuracy and quality of occupational safety and health statistics. National occupational safety and health statistics are calculated by the Bureau of Labor Statistics primarily from employer-maintained records of injuries and illnesses among employees. This pilot study was designed to look at the accuracy of reporting of traumatic occupational fatalities by ascertaining whether fatal cases identified by the New Jersey occupational fatality surveillance system in 1983 were recorded in employers' occupational illness and injury records.

The decision to investigate traumatic fatalities was based on two factors. First, unlike illnesses and nonfatal injuries, there are several easily accessible data sets independent of employer records from which traumatic occupational fatalities can be identified. Fatalities identified in these data sets can then be compared with fatalities in employers' records. Second, a computerized surveillance system for traumatic occupational fatalities was already established in the New Jersey Department of Health. Within a short period of time, that data base could be adapted and applied to this study.

Martha Stanbury and Kathleen O'Leary are staff members of the New Jersey Department of Health. Marcia Goldoft is a staff member of the Centers for Disease Control, U.S. Public Health Service, assigned to the New Jersey Department of Health.

DATA COLLECTION

A fatal occupational injury case was defined as a death resulting from a workplace injury excluding cases due to homicide, public roadway and boating accidents, and airplane crashes. These cases had already been excluded from the New Jersey surveillance system for reasons unrelated to this study.

Identification of Fatal Cases

Three sources of information on occupational fatalities in New Jersey were examined: death certificates, state medical examiner's records, and the OSHA inspections data file (the Integrated Management Information System). The complete list of cases fitting the case definition was compiled by merging and matching cases from each of the three data sets.

Every death caused by an occupational accident is given a special code on the death certificate by a nosologist from the New Jersey Department of Health. Standard procedures for the nosologists include phone or letter follow-up when information on the death certificate is insufficient to establish if the injury occurred at work. All cases coded as occupational injuries were identified from the death certificate data tapes for the year 1983. Death certificates were pulled on all those cases so that additional, noncomputerized data of interest could be collected. These included name and address of last employer, usual occupation, usual industry, a brief description of how the injury occurred, date, and geographic location of injury.

By law, all fatalities that occur at work must be reported to the county coroner or medical examiner, who then must forward a summary report to the state medical examiner. Summary information includes name of the decedent, descriptive information about the circumstances of the injury and medical cause of death, and, sometimes, name of establishment where the death occurred. None of these data is computerized. The occupational-relatedness of each case can be identified on the summary report in one or more of three places: in the narrative section, the line that identifies place of incident, or the box indicating whether the incident was work-related. Because the box was coded incorrectly in 25 percent of the cases, the other two sections were reviewed to determine possible occupational cases. Summary reports of all occupational fatalities for the study period were manually sorted from the year's approximately 20,000 summary sheets in the state medical examiner's office. Medical examiner reports were matched with death certificate

cases. Death certificates were pulled on each case not previously identified by the death certificate search.

In New Jersey almost all employers in the private sector are covered by OSHA (Section 4[b][1] of the OSH Act). Every fatality that occurs in a covered workplace must be reported to OSHA within 48 hours. OSHA is required to do an inspection of all traumatic deaths reported to it. Information on all inspections, including fatality inspections, are computerized in a data file maintained by OSHA in Washington, D.C. Because OSHA does not cover all workplaces, this data base necessarily does not identify all cases identified in the other two sources. However, it may identify cases missed in the other two sources.

Some of the information in the OSHA inspection file is considered confidential. Nonconfidential information may be obtained through a Freedom of Information request. Name of the decedent is considered confidential; name and address of employer is not. The data base gives the date the inspection was opened but not the date the incident occurred.

As a Freedom of Information request, a list of all fatality inspections of New Jersey establishments for 1983 was obtained. An additional request to OSHA for name of decedent was denied. A request for date of incident was approved.

Creation of the Fatality Surveillance Data Set

The death certificate cases and medical examiner cases were merged into one file that included personal identifiers, descriptive information about the injury, and all available information on employer. OSHA inspection cases were then matched with cases in the other files. A match was made when there was reasonable correspondence regarding incident date, nature of injury, and/or name of company. When a match could not be made, employers with current telephone numbers were telephoned and asked to provide name of the decedent.

Name of employer, address of employer, and Standard Industrial Classification (SIC) codes were added from the OSHA inspection file to the surveillance data set. Employers of cases not in the OSHA data set were assigned three- or four-digit SIC codes when there was sufficient information to do so. If information on employer was insufficient, industrial categories of employers were based on coding done by New Jersey nosologists that group industries into nine broad categories (agriculture, mining, construction, manufacturing, transportation/public utilities, trade, services, government,

other, and unspecified). These categories correspond closely to the broad divisions of the SIC coding scheme.

Employers' OSHA Logs

Not all employers that are covered by OSHA are required to keep records of occupational illness and injuries. Employers with fewer than 11 employees or who have been assigned certain SIC codes normally do not have to keep records. (It should be noted that regardless of size or SIC code, any employer covered by OSHA whose employee dies on the job must report the fatality to OSHA within 48 hours of the death.)

Employers required to keep records must do so on a form called an OSHA 200 log (see Appendix A). All fatalities must be recorded in the log regardless of length of time between injury and death. The log includes name, occupation, department within establishment, description of injury, and date of death.

On the basis of information in the surveillance data base, the employers of cases who were covered by OSHA were divided into three categories: (1) those not required to keep an OSHA log based on SIC code or number of employees, (2) those with insufficient information to make the determination, and (3) those required to keep the log.

Telephone directories were used to find current phone numbers for all employers in the latter two categories for 1983 fatalities. If no current phone number was available, a search for the location of the company was conducted using Department of Labor and Industry files on New Jersey companies and the New Jersey Industrial Directory. If after this search no current phone number could be found, the company was assumed to be defunct. Employers with current telephone numbers were contacted by telephone.

The initial telephone contact was made in order to determine if the employer was required to keep a log based on SIC code and number of employees. If so, an appointment was made to inspect the log. Any employer who claimed exemption from OSHA record-keeping requirements was queried regarding the reasons for the exemption.

Two related considerations affecting the design of this study were confidentiality of data and access to the employers' logs. There are financial penalties for nonrecording of recordable illness and injuries in logs; knowledge of such penalties could give employers a disincentive to cooperate with this study. In order to deal with this, OSHA was asked to agree to honor confidentiality agreements made in connec-

tion with this research. OSHA agreed not to seek access to information obtained during this study.

Each employer with whom a visit could be scheduled was given a letter of introduction, a copy of a confidentiality agreement to be signed by the employer and by the New Jersey Department of Health, and if requested, a copy of the letter from OSHA stating that OSHA agreed to honor the confidentiality agreement. The interviewer from the New Jersey Department of Health then requested access to the employer's OSHA log for 1983. Briefly, if the name of the case in our file matched that in the log, all information in the log regarding that case was copied. If the case did not appear in the log, the interviewer discussed the case with the employer in order to ascertain why it did not get recorded (e.g., the employee really worked for another company, there were differences of opinion as to whether the injury was job related). If the employer identified another employer as the one responsible for recording the fatality, the second employer was contacted and interviewed according to the protocol.

RESULTS

On the basis of all three sources of occupational fatality information, a total of 66 fatalities in New Jersey in 1983 were identified. In order to identify employers required to keep OSHA logs, first, employers of fatal cases were grouped according to whether they were covered under the jurisdiction of OSHA based on SIC codes and/or industrial groupings. There was sufficient information on employers to determine OSHA coverage for 59 of the 66 fatalities. (Of the 7 with insufficient information on the employer to determine OSHA coverage, enough information was available to indicate that 3 were involved in construction, 2 were laborers, 1 may have been a gas station attendant, and 1 was a gardener.)

Table C-1 shows that for 1983 fatalities, 14 of the 59 cases (23 percent) were not covered and 45 of the 59 cases (76 percent) were covered by OSHA. Two of the 45 covered cases had the same employer. Thus, there was a total of 44 employers covered by OSHA (i.e., under OSHA jurisdiction and therefore required to report fatalities to OSHA but not necessarily required to maintain OSHA logs.)

Tables C-2 C-3, and C-4 show the results of the evaluation of OSHA 200 logs for those 44 covered employers. Thirty-four of the 44 employers were interviewed, and 27 (79 percent) were required to keep OSHA logs under the law. Of those 27 employers, only 17 (63 percent) correctly

Table C-1: Occupational Fatalities in New Jersey in 1983 According to Whether Employers Were or Were Not Covered by OSHA

Fatalities covered by OSHA	45	(76%)*
Fatalities not covered	14	(24%**)
Total Cases	59	(100%***)

* Two cases had the same employer: the total number of covered employers was 44.

** Includes 4 military, 3 self-employed, 4 railroad workers, and 3 state or municipal workers.

*** Unable to determine whether the employers were covered in 7 cases because of absence of information on employer. Therefore the total number of fatal cases in New Jersey was 66.

Table C-2: Availability of OSHA Log Information from Employers Covered by OSHA

Employers from whom OSHA log information was obtained	34	(77%)
Employers from whom OSHA log information was not available:	10	(23%)
Employers without current phone	6	(14%)
Correct employer not identified	3	(7%)
Access to OSHA log refused	1	(2%)
Total covered employers	44	(100%)*

* One employer had two fatalities.

Table C-3: Results of Interviews with Employers Covered by OSHA Regarding Requirements to Maintain OSHA Logs

Employers exempt from record keeping (less than 11 employees)	7	(21%)
Employers required to keep OSHA logs	27	(79%)
Total employers interviewed	34	(100%)

Table C-4: Review of Employer OSHA Log Reporting of 1983 Fatalities: Employers Required to Keep Logs

Employers who recorded cases in existing logs	17	(63%)
Employers who did not record cases in existing logs	5	(19%)
Employers who did not record cases as required; log was not kept	5	(19%)
Total employers required to keep logs	27	(100%)*

***One employer had two fatalities.**

recorded the fatal cases. A clustering of record-keeping problems were found within the construction industry.

Table C-2 shows the availability of OSHA log information from the 44 covered employers: 10 of the covered 44 employers (23 percent) could not be interviewed for various reasons; 6 employers did not have current phone numbers; 3 of these were in construction, 1 in manufacturing, 1 in services, and 1 in transportation. For an additional 3 cases, the employers were incorrectly identified and the correct employer could not be located; 2 of the 3 were in construction. One employer refused to meet with the interviewer, saying he was "too busy."

Of the 34 covered employers from whom OSHA log information was obtained, 7 (21 percent) claimed they were exempt from record keeping because they had less than 11 employees (see C-3). Independent sources indicated that in fact one of those places had 20 employees. Of these 7, there was no clustering of employers into any particular industrial grouping.

Of the 27 employers (19 percent) required to keep logs, involving 6 cases, 5 did not keep the logs. In 1 case, the employer of a construction company said that he had more than 10 employees at certain times of the year, but he thought he was exempt from record-keeping requirements because his usual number of employees was less than 11. With the employer that had 2 fatalities, despite the fact that OSHA did the fatality inspection, this construction company, with about 20 employees, was simply unfamiliar with OSHA record-keeping requirements. The owner of another construction company, with 30 employees, and in business for over 20 years, had never heard of an OSHA 200 log. In the case of a transportation company, OSHA did not inspect the fatality, but it did do a routine inspection in 1986 and told the company that it should be keeping a log. (The company asked the interviewer for proper forms and an instruction booklet.) Finally, one construction company stated that the employee responsible for keeping the OSHA log had left in 1982, and no one had kept a log since then (Table C-4).

Of the 27 companies (19 percent) required to maintain logs, 5 that did have logs did not have the fatality recorded in the log. One case involved a construction worker whose employer claimed that the company who contracted the work should have recorded the case. The other company could not be located. In another case, the employer, a manufacturer, was told by OSHA in 1984 that he should be keeping a log and was asked to reconstruct the 1983 log from other records. The fatality did not get into that reconstructed record. In the next case, the fatality occurred one day after the opening of a warehouse; the company said they did not

start keeping a log until a month after the opening. One employer at a manufacturing establishment denied that the decedent had been employed there or that any such incident had occurred. The interviewer spoke with the informant listed on the death certificate, the landlady of the decedent, who reaffirmed the name of the employer. Finally, the person with whom we spoke at a very large national corporation in trade was not able to account for the omission of the fatality from the OSHA log, even though she acknowledged the incident and the presence of OSHA inspectors "within days" of the death (see Table C-4).

Of the 27 employers (63 percent) required to keep logs, 17 properly recorded the fatalities in their logs (see Table C-4): 3 were in construction, 10 in manufacturing, 1 in transportation, 1 in services, and 2 in trade.

DISCUSSION

There clearly were cases of nonrecording within the small group of employers whose logs were evaluated. In total, 11 of the 28 cases, involving 10 of 27 employers (37 percent), that should have been in a log were not. Of the 11 fatalities, 6 were not recorded because the 5 involved employers were not keeping logs. Five fatalities were not recorded in existing logs.

Our impression of employers from interviews was that ignorance or carelessness rather than willful intent accounted for the failing of many companies to follow OSHA's record-keeping requirements. To emphasize this point, 6 companies asked the interviewer to provide them with copies of an OSHA 200 log and record-keeping guidebook.

The six fatalities whose five employers should have been keeping logs but were not clustered in the construction industry. No such clustering was observed regarding nonrecording of cases in existing logs.

It is not possible to know whether the accuracy of information on fatalities in employers' logs of those employers whom we could not locate was different from that in logs of employers we were able to interview. It should be noted that 8 of the 17 fatalities (47 percent) whose employers either were not known or could not be located were in construction. Because we observed a clustering of record-keeping problems among the construction companies, we imagine that accuracy of logs on the group not located probably was similar to that among the group we observed.

It is also not possible to know whether homicide victims and transportation-related fatalities were recorded more or

less accurately in OSHA logs than unintentional, nontransportation-related fatalities.

Although we cannot generalize from these findings, they do demonstrate that a significant number of unintentional, nontransportation traumatic occupational fatalities in New Jersey in 1983 that should have been recorded in employers' OSHA 200 logs were not. A repetition of this study by another state health department that includes homicides and transportation fatalities would be useful.

ACKNOWLEDGMENTS

We are indebted to Stacey Van Laanen, who traveled throughout New Jersey to interview employers, for her great patience and perseverance. We also wish to acknowledge the assistance of Kenneth Rosenman and Nancy Hall for their contributions to the original design of the New Jersey occupational fatality surveillance system.

APPENDIX D

RECOMMENDATION FOR REVISION OF CHAPTER XX OF THE TENTH REVISION OF THE INTERNATIONAL CLASSIFICATION OF DISEASES (ICD)

BACKGROUND

The basic national statistics on occupational injuries and illnesses in the United States are derived from an annual survey of a sample of approximately 280,000 establishments of a total of about 5 million. These establishments are required to maintain logs of all occupationally related injuries and illnesses as part of the regulatory process established by the passage of the Occupational Safety and Health Act of 1970. Because the national data have been derived from records maintained by employers as part of the regulatory process, there have been many allegations that employers underreport both injuries and illnesses. As a result, the Bureau of Labor Statistics has contracted with the National Academy of Sciences to conduct a study to assess the quality of the national statistics on occupational injuries and illnesses and to make recommendations for improving these statistics.

A basic approach to assessing the quality of the national statistics is to develop independent estimates of numbers of occupational injuries and illnesses against which to compare those derived from the national survey. Two categories of serious injuries for which this might be possible are fatal injuries and those requiring inpatient hospitalization. If it were possible to use death certificate data classified by cause of death to identify hospitalized occupational injury cases, these sources would provide a basis for national estimates that are independent of those based on employer reports. Both causes of death given on death certificates and diagnoses on hospital records are almost universally coded by the International Classification of Diseases (ICD) in the United States.

CURRENT PROBLEM

Unfortunately, the Ninth Revision of the ICD does not lend itself to identifying readily those injuries that are occupationally related. The latest draft of Chapter XX of the proposed Tenth Revision of the ICD is an improvement over the corresponding chapter in ICD-9, but it still requires two codes used in combination to identify an occupational injury. The category, Y96 "work-related factors," is the only way of indicating occupational relatedness in this draft of the Tenth Revision. Thus, to code an injury to an employee due to a cut by a hand saw in a plant would require the use of the codes X26.2,Y96. This requires that the coder remember to use the code, Y96, to indicate that the injury occurred to an employee at work. Furthermore, the resulting combination of two codes would unduly complicate data handling. The purpose of this document is to make a recommendation for a specific change in Chapter XX (External Causes of Morbidity and Mortality) of the proposed Tenth Revision of the International Classification of Diseases to deal with this problem.

RECOMMENDATION

The Panel on Occupational Safety and Health Statistics recommends that the codes for external causes of morbidity and mortality be modified to ensure the identification of each occupationally related injury with a single code. This might be accomplished through the use of a fifth digit as follows:

- 0 - Not occupationally related
- 1 - Occupationally related
- 9 - Unknown as to whether occupationally related

or through an alternative four-digit scheme. We are cognizant of the fact that there are problems associated with either of these approaches, but we believe that the need for systematic coding of these injuries is so great that serious consideration should be given to accomplishing this objective.

RATIONALE AND NEED

A revised code that indicated occupational relationship for injuries that is simple and allows for unknowns would have a high probability of routine use. The resulting occupational mortality and morbidity data would fill a need for information for injury prevention and control for years to come. It would permit, for example, analysis of trends in occupational

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fatalities and analysis of changes in the demands on the medical care system created by occupational injuries. Such analyses can be carried out now only on a limited basis through special data collection coding efforts. The proposed change would make the needed data available in ongoing data systems.

APPENDIX E

A COMPARISON OF THE BLS ANNUAL SURVEY TO WORKERS' COMPENSATION FOR WISCONSIN IN 1984 AND 1985

Lawrence P. Hanrahan

INTRODUCTION

The Bureau of Labor Statistics (BLS) is directed by the Occupational Safety and Health Act of 1970 to compile and analyze occupational safety and health statistics for the nation. This task is accomplished by requiring employers to maintain records on occupational injuries and illnesses. A sample of employers is then requested to participate in the Annual Survey of Occupational Injuries and Illnesses. Survey respondents consist of a stratified random sample of employers to represent all private industries in the states and territories. The sample is stratified by industrial group (Standard Industrial Classification - SIC) and employment size, since the number and rate of recorded injuries and illnesses are highly correlated to these two factors. Excluded from the survey are self-employed individuals, farmers with fewer than 11 employees, employers regulated by other federal safety and health laws, and federal, state, and local government agencies. The sample is designed to produce injury and illness data at the 2-digit SIC level for agriculture, forestry, and fishing, at the 3-digit SIC level for oil and gas extraction, construction, transportation, and public utilities, wholesale and retail trade, finance, insurance, real estate, services, and at the 4-digit SIC level in manufacturing (U.S. Department of Labor Bulletin 2278: "Occupational Injuries and Illnesses in the United States by Industry, 1985," May 1987). Sample units are then made to represent all units in their employment size-industry class by constructing a weighting factor. The weight is calculated by taking the

Lawrence Hanrahan is a member of the panel.

inverse of the sampling ratio for the industry-employment size class group from which the unit was selected. Weights are further adjusted to account for nonrespondents. Data from each reporting unit are then multiplied by the corresponding adjusted weight and aggregated to obtain a total for the estimating cell (U.S. Department of Labor Bulletin 2278). For each reporting unit, weights are constructed to reflect both state and national sampling strata.

The BLS annual survey is the only nationwide, uniformly collected data base for estimating the burden of occupational injuries in the United States. However, the level of event detail at which these data are collected greatly limits the utility of the data base for specifying priority areas to target injury prevention efforts. Only total numbers of injuries are enumerated: the data cannot differentiate among amputations due to punch presses or saws, lower extremity crushing injuries caused by in-plant vehicle collisions with pedestrians, back injuries from overexertions during manual materials handling operations, falls from ladders, etc. (see Appendix A for the OSHA 200s survey form).

An attempt to bridge this information gap is made by the Bureau of Labor Statistics in their Supplementary Data System (SDS) program. The SDS program consists of 33 state labor departments who provide a uniform set of detailed information on occupational injuries and illnesses as reported to the state workers' compensation departments. Data in the SDS file is an abstract from the workers' compensation first reports of injury or illness. These workers' compensation reports are not unlike the OSHA 101 report form (see Appendix A). Indeed, the states' workers' compensation first report form may be substituted for the OSHA 101 form to adhere to the OSHA record-keeping regulations if the workers' compensation first report contains the information requested on the OSHA 101 form. Information reported on the injury event includes details such as the occupation, age, and sex of the injured and the source, type, nature, part of body, and associated object or source of the injury event and outcome.

There is concern over the utility of the SDS program as a national system for injury enumeration because not all states participate and because of its reliance on state workers' compensation systems, which can vary considerably in regulation and coverage from state to state. Each state has its own criteria for reporting an incident, and rules vary in what constitutes a compensable claim both in terms of the injury event itself and insurance coverage of the states' work force. One principal concern is the variability of the waiting periods that most states utilize to manage claims volume. The waiting period, or days that the injured is away from

work before a claim is filed, can vary between one and eight days. These inconsistencies limit the uniformity of the data acquired from each state, making interstate comparisons difficult and the acquisition of national injury incidence rate estimates problematic.

Wisconsin participates in the Supplementary Data System as well as the Annual Survey of Occupational Injuries and Illnesses. While Wisconsin workers' compensation has a three-day waiting period for filing a claim, workers' compensation insurance coverage of industry through out the state is essentially complete. Thus the workers' compensation file of reported injury events are representative of the entire state.

A study was conducted to examine the extent of comparability between the BLS Annual Survey of Occupational Injuries and Illnesses (OSHA 200s) and the workers' compensation (SDS) system in Wisconsin. While differences in reporting criteria exist between Wisconsin workers' compensation and the annual survey, a degree of concordance should exist between the two systems: the workers' compensation reports from a company may be generally thought of as a subset of the company's BLS annual survey reportable injury incidents. Thus, while one would anticipate that the workers' compensation system would tend to have overall lower injury rates than those reported on the BLS annual survey, the relative risk or injury rate comparison among industry groups may be comparable between the two data-gathering programs. With each system specifying the same relative injury risk by industry, the workers' compensation or SDS program then becomes preferable to the annual survey, as it has the added advantage of being able to specify an injury event detail that can target research, prevention, and regulatory efforts in occupational safety and health.

This study was intended to explore the possible efficacy of using, at least in Wisconsin, the workers' compensation information to derive industrywide injury risk estimates that are currently generated from the OSHA 200s program. This, in turn, will help to determine whether the details on injuries, contained in the workers' compensation system, can be used with assurance as though they were representative of the total industry in the state. The investigation is limited to a match of each BLS annual survey respondent's injury and illness reported instance totals to its workers' compensation reported total of injury and illness events. Specific event occurrences are not compared to see if they are reported in each of the counting systems. Thus the comparisons are of a summary or global nature; similar or identical counts for an establishment could theoretically reflect two

independent sets of enumerated events. The detailed examination of events for tabulation in each reporting system would be the ideal method for ascertaining reporting concordance. However, this level of detail is beyond the resources of this investigation.

METHODS

The data tape of the BLS-OSHA Annual Survey of Occupational Injuries and Illnesses was accessed for the years 1984 and 1985 in Wisconsin. Four-digit SIC, reported employment, hours worked, and employer identifier (unemployment insurance (UI) account number) were written to a file along with the total number of injuries and illnesses that were fatalities, and the total (injury plus illness) lost-workday cases. Total days away from work and total days of restricted activity (injury plus illness) were also obtained. These data were then matched to the workers' compensation (WC) case history file by UI account number. The total number of WC cases for each employer was written to the file. Line listings of these data were produced and edited by the staff of the Wisconsin Workers' Compensation Division. Editing consisted primarily of reconciling data matching across multiple unit employers (e.g., the 200s survey may sample only one location of an employer who has multiple locations, and workers' compensation may or may not differentiate among them; or all multiple units are surveyed, but workers' compensation does not differentiate among them, etc.). The tape was then sent to the Wisconsin Division of Health for statistical processing. The employer identification numbers (UI account numbers) were removed before this transmittal to ensure data confidentiality.

No attempt was made to separate illnesses from injuries; only frequency totals were compared between the two systems. Incidence rates for each reporting unit were calculated using the BLS formula:

$$\text{Incidence rate} = (\# \text{ cases} / \text{total hours worked}) \times 200,000.$$

This formula estimates the total number of reported events per 100 full time workers per year. OSHA lost-workday case rates were calculated using the total lost-workday cases mentioned (injury plus illness) while the workers' compensation case rate was determined using the total WC cases listed. The 4-digit SIC code was converted to one of eight large industry division categories: finance, services, retail trade, agriculture, manufacturing, transportation, wholesale trade, or construction.

Agreement between the two reporting systems was assessed using several descriptive statistical methods. An industry division rate was calculated using the total aggregate number of reported events for the division on the annual survey divided by the total hours worked in the division. A workers' compensation industry division rate was similarly constructed using the total WC reported events divided by the total industry division hours worked. These eight industry rates computed under the two reporting methods were then compared using Pearson and Spearman correlations. A BLS annual survey-WC rate difference was constructed for each industry division. Similarly, an annual survey to workers' compensation rate ratio was determined for each industry group to assess incidence rate level between the two reporting systems. Each of these descriptive statistics was then repeated incorporating the state weights provided by the annual survey to expand the results from a sample of reporting units to a statewide estimate of effect.

Reporting agreement between the two systems was then examined within each of the eight industry divisions by a cross-tabulation. Concordance between the annual survey and workers' compensation within each division was specified for each reporting unit in one of four possible categories: (1) both systems report zero rates; (2) the systems are equal and have nonzero cases rates; (3) greater cases rates are reported on the OSHA 200s; or (4) greater rates are reported to workers' compensation.

This analysis was then repeated using the state weights to expand the tabular sample data up to a statewide estimate of effect. Within each industry division Pearson and Spearman correlations were computed on case frequencies and on rates reported in each system. The Pearson correlations were then recomputed using estimates based on the application of the state weights to expand the sample-based observations to statewide estimates. Finally, mean differences in frequencies and rates were computed within each industry division and division average lost-workdays were computed as an index of case severity within each of the eight industry groups. Tests for statistical significance were not performed because of distributional issues and the fact that the large sample size would yield statistically significant results even for very small correlations. The latter is of little or no interest for this purpose.

RESULTS

A total of 5,816 establishments were included in the analysis. They accounted for 50,799 lost-workday cases on the OSHA 200s form and 38,771 cases reported to workers' compensation. Approximately 2.7 percent of respondents were in agriculture, 10.5 percent construction, 4 percent finance, 47 percent manufacturing, 9.7 percent retail trade, 14 percent services, 5.9 percent transportation, and 6.2 percent wholesale trade.

Table E-1 presents the data used to calculate the two sets of rates--those based on the OSHA logs and those based on workers' compensation cases. The measures of correlation between the two systems in cases reported across the eight industry groups were 0.98 and 1.0, respectively, for the Pearson and Spearman correlations. From Table E-1, the industrywide average difference between the annual survey rate and the workers' compensation rate was 1.34 per 100 workers per year. The average rate ratio between the annual survey and the workers' compensation system was 1.31, indicating that the annual survey reported, on average, a rate that was 31 percent greater than the workers' compensation rate. This rate ratio was further seen to decrease monotonically over the range of industry divisions ranked from low to high risk. In the safest division (financing), the annual survey/WC rate ratio was 1.69, indicating that the annual survey rate was 69 percent greater than the workers' compensation rate. In construction, the most hazardous division, the rate ratio was 1.06, indicating that the annual survey rate was only 6 percent greater than the WC rate. Repeating the analysis using weighted data to take the sample design into account, the resulting Pearson correlation is 0.95. Table E-2 displays the data used in the weighted analysis. The weighted analysis produced results which were very similar to those from the unweighted analysis. From Table E-2, the weighted all industry average rate difference between the two systems was 1.31 per 100 workers per year, and the average annual survey /WC rate ratio was 1.32, indicating a 32 percent greater rate in the annual survey compared with the workers' compensation rate. The monotonic decrease of annual survey/WC rate ratio over the hazard ranked industry divisions is again seen in the results shown in Table E-2.

The mean difference in frequencies and rates between the two reporting systems were examined for each division, (mean differences in frequencies are not displayed in any of the tables). The rates were very similar for wholesale trade, transportation, retail trade, finances, and agriculture. Frequencies were consistently different in each division, with

TABLE E-1: Ranking of Industry by BLS Lost Workday Rate: Unweighted Analysis

Rank	Industry Division	N Units	BLS Cases	WC Cases	Total Hrs Worked	BLS Rate	WC Rate	BLS-WC Rate Dif	BLS/WC Rate Ratio
1	Finance	231	505	298	104,227,707	0.96903	0.57182	0.39721	1.69643
2	Services	819	4,572	2,849	227,758,289	4.01478	2.50178	1.51301	1.60477
3	Retail Trade	568	2,457	1,808	116,727,034	4.20982	3.09783	1.11200	1.35896
4	Agriculture	158	315	244	12,537,718	5.02484	3.89226	1.13258	1.29098
5	Manufacturing	2,726	36,958	28,758	1,163,614,989	6.35227	4.94287	1.40940	1.28514
6	Transportation	343	3,169	2,475	9,792,765	6.47212	5.05475	1.41737	1.28040
7	Wholesale Trade	360	1,599	1,191	42,193,648	7.57934	5.64540	1.93394	1.34257
8	Construction	611	1,224	1,148	28,175,397	8.68843	8.14895	0.53948	1.06620
All	Industry	5,816	50,799	38,771	1,793,162,441	5.66586	4.32432	1.34154	1.31023

TABLE E-2: Ranking of Industry by BLS Lost Workday Rate: Weighted Analysis

Rank	Industry Division	N Units	BLS Cases	WC Cases	Total Hrs Worked	BLS Rate	WC Rate	BLS-WC Rate Dif	BLS/WC Rate Ratio
1	Finance	231	761.4	465.7	200,304,721	0.76024	0.46496	0.29528	1.63506
2	Retail Trade	568	4,737.8	4,122.1	257,456,816	3.68044	3.20214	0.47829	1.14937
3	Services	819	12,112.6	8,127.7	508,207,134	4.76680	3.19859	0.68327	1.49028
4	Agriculture	158	367.2	315.6	15,115,553	4.85910	4.17583	0.68327	1.16362
5	Transportation	343	3,935.3	3,121.4	151,010,667	5.21202	4.13399	1.07803	1.26077
6	Wholesale Trade	360	3,243.3	2,679.7	117,680,924	5.51197	4.55421	0.95776	1.21030
7	Manufacturing	2,726	48,721.0	36,408.3	1,535,808,680	6.34467	4.74126	1.60341	1.33818
8	Construction	611	2,036.3	2077.4	53,096,816	7.67006	7.82495	-0.15489	0.98021
All Industry		5,816	75,914.9	57,317.9	2,838,681,312	5.34860	4.03834	1.31026	1.32445

the exception of the construction division. Repeating this analysis using weighted data, the only major difference was in manufacturing for rates and frequencies. All the other divisions exhibited a close tracking of rates and frequencies. This is perhaps explained by examination of the tabular data in Tables E-3 (unweighted analysis) and Table E-4 (weighted analysis).

The distribution of rate concordance for each division is displayed in one of four categories: (1) both systems report zero rates; (2) the systems are equal and have non-zero cases rates; (3) greater cases rates are reported on the OSHA 200s; or (4) greater rates are reported to workers' compensation. In the unweighted analysis of Table E-3, 36 percent of respondents overall reported zero rates to both systems; 12 percent of respondents reported an equal rate in each system; for 35 percent of the responses, greater rates were enumerated on the OSHA 200s, while in 17 percent of the instances, greater rates were reported to workers' compensation. Finance at 63 percent has the highest percentage of zero concordant cases, while manufacturing (19 percent) has the lowest. Construction (15 percent), wholesale trade (14 percent), and manufacturing (14 percent) have the highest percentages in the BLS=WC category, while services (7.5 percent) and finance (5.6 percent) are the lowest. Manufacturing is highest (48.7 percent) in reporting more cases on the OSHA 200s, while construction (17.7 percent) is the lowest. Finally, construction (19.9 percent) has the greatest percentage for reporting more cases to workers' compensation, while finance (8.6 percent) is the lowest. Table E-3 indicates substantial variability in the pattern of agreement across industry divisions.

The weighted analysis (Table E-4) displays a somewhat different picture. Weighting has the effect of essentially doubling the number of units that report zero cases to both systems (73.8 percent in Table E-4 versus 36.6 percent in Table E-3). This may explain the better agreement seen on mean difference calculations discussed above. Manufacturing has the lowest percentage for zero case concordance (45.7 percent) in the weighted analysis, and it is the only division exhibiting a substantial magnitude on frequency and rate differences in the weighted mean differences analysis.

The number of units reporting identically to both systems decreases to 6.5 percent on weighted analysis (versus 12 percent in Table E-3). The number of units with greater BLS reporting is now only 11.6 percent, and only 8 percent show greater WC reporting. The highest case reporting concordance (BLS=WC) is in manufacturing (13 percent), while the lowest is in finance (1 percent). Manufacturing (28 percent) is highest for reporting more cases to BLS, while finance (4.7

TABLE E-3: Distribution of Lost Workday Cases by Industry and BLS/Workers' Compensation Comparison: Unweighted Analysis

Frequency Percent Row Pct Col Pct	Agriculture	Construction	Finance	Manufacture	Retail Trade	Services	Transportation	Wholesale Trade	Total
0 Cases	80	287	147	530	303	459	167	156	2129
	1.38	4.93	2.53	9.11	5.21	7.89	2.87	2.68	36.61
	3.76	13.48	6.90	24.89	14.23	21.56	7.84	7.33	
	50.63	46.97	63.64	19.44	53.35	56.04	48.69	43.33	
BLS=WC	15	94	13	387	55	62	31	52	709
	0.26	1.62	0.22	6.65	0.95	1.07	0.53	0.89	12.19
	2.12	13.26	1.83	54.58	7.76	8.74	4.37	7.33	
	9.49	15.38	5.63	14.20	9.68	7.57	9.04	14.44	
BLS>WC	33	108	51	1330	114	208	95	97	2036
	0.57	1.86	0.88	22.87	1.96	3.58	1.63	1.67	35.01
	1.62	5.30	2.50	65.32	5.60	10.22	4.67	4.76	
	20.89	17.68	22.08	48.79	20.07	25.40	27.70	26.94	
BLS<WC	30	122	20	479	96	90	50	55	942
	0.52	2.10	0.34	8.24	1.65	1.55	0.86	0.95	16.20
	3.18	12.95	2.12	50.85	10.19	9.55	5.31	5.84	
	18.99	19.97	8.66	17.57	16.90	10.99	14.58	15.28	
Total	158	611	231	2726	568	819	343	360	5816
	2.72	10.51	3.97	46.87	9.77	14.08	5.90	6.19	100.00

TABLE E-4: Distribution of Lost Workday Cases by Industry and BLS/Workers' Compensation Rate Comparison: Weighted Analysis

Frequency Percent Row Col Pct	Agriculture	Construction	Finance	Manufacturing	Retail Trade	Services	Transportation	Wholesale Trade	Total
BLS<WC	55.92	432.74	99.01	1122.52	540.99	392.2	174.33	279	3096.71
	0.14	1.12	0.26	2.90	1.40	1.01	0.45	0.72	8.00
	1.81	13.97	3.20	36.25	17.47	12.67	5.63	9.01	
	14.62	12.80	3.50	12.90	8.25	3.49	8.42	7.83	
BLS>WC	37.29	272.71	134.43	2464.5	260.67	753.88	260.84	320.02	4504.34
	0.10	0.70	0.35	6.36	0.67	1.95	0.67	0.83	11.63
	0.83	6.05	2.98	54.71	5.79	16.74	5.79	7.10	
	9.75	8.06	4.75	28.32	3.98	6.71	12.60	8.99	
BLS=WC	28.23	294.41	29.82	1134.38	263.12	312.14	100.46	381.82	2544.71
	0.07	0.76	0.08	2.93	0.68	0.81	0.26	0.99	6.57
	1.11	11.57	1.17	44.58	10.34	12.28	3.95	15.00	
	7.38	8.71	1.05	13.04	4.01	2.78	4.85	10.72	
O Cases	261.06	2381.9	2564.33	3979.98	5492.31	9781.29	1535.18	2580.79	28576.8
	0.67	6.15	6.62	10.28	14.18	25.26	3.96	6.66	73.80
	0.91	8.34	8.97	13.93	19.22	34.23	5.37	9.03	
	68.25	70.43	90.69	45.74	83.76	87.02	74.13	72.46	
Total	382.5	3381.76	2827.59	8701.38	6557.09	11239.8	2070.81	3561.63	38722.6
	0.99	8.73	7.30	22.47	16.93	29.03	5.35	9.20	100.00

percent) is again lowest. Agriculture (14.6 percent) leads manufacturing (12.9 percent) and construction (12.8 percent) for reporting more cases to workers' compensation, while services (3.5 percent) and finance (3.5 percent) are tied for the lowest percentage.

The correlations between the BLS and WC systems within the divisional groups are summarized in Table E-5, and the weighted correlations are summarized in Table E-6 (Spearman correlations are not appropriate for weighted data, therefore only Pearson correlations are displayed in Table E-6).

Correlations are consistently strong when comparing frequencies in the unweighted (Table E-5) and weighted (Table E-6) analysis. However, when rates are examined, a drop in the strength of the association occurs for both weighted and unweighted analyses. Viewing scatterplots was helpful in explaining these discrepancies. When plots were examined, instances could be seen in which one system reports a rate of zero and the other system reports a rate of 25 or more (examples of this were seen in agriculture, construction, and manufacturing rate plots). When rates are calculated, the difference between the zero-reported cases and anything greater than one is likely to be inflated, which in turn decreases the correlation. In addition, smaller units (low hours worked) reporting one or more cases in one system could result in a relatively high rate, which, when compared to zero cases, again decreases the correlation.

DISCUSSION

When occupational injury and illness incidence rates are constructed at the industry division level, excellent agreement occurs between the BLS-OSHA 200s program and the workers' compensation system (Tables E-1 and E-2). If the purpose of the 200s program is to rank risk generally among industry groups, then either reporting system will most likely arrive at the same result in Wisconsin given that a sufficient sample size is obtained. If the two systems were relatively comparable within each industry division, then the workers' compensation (SDS) program in Wisconsin could be used to take advantage of the added benefit of detailed classifications as to injury occurrence and outcome (e.g., source, type, nature, part of body, etc.). Detailed information as collected in the SDS program is vital for targeting in-depth injury epidemiology investigations for research, prevention, and regulatory occupational safety, and health programming efforts. Comparability between the two systems within an industry division would require that the number of injury cases be about equal and that at least sample case-by-case

TABLE E-5: Within Industry Division Correlations Between BLS Annual Survey and Workers' Compensation Frequencies and Rates: Unweighted Analysis

Industry Division	Frequency		Rate	
	Pearson	Spearman	Pearson	Spearman
Agriculture	0.90	0.76	0.62	0.62
Construction	0.93	0.81	0.57	0.67
Finance	0.88	0.73	0.56	0.65
Manufacturing	0.90	0.86	0.61	0.73
Retail Trade	0.95	0.65	0.41	0.55
Services	0.92	0.80	0.49	0.68
Transportation	0.91	0.76	0.53	0.66
Wholesale Trade	0.93	0.74	0.42	0.64

TABLE E-6: Within Industry Division Correlations Between BLS Annual Survey and Workers' Compensation Frequencies and Rates: Weighted Analysis

Industry Division	Frequency Pearson	Rate Pearson
Agriculture	0.89	0.68
Construction	0.92	0.51
Finance	0.86	0.25
Manufacturing	0.86	0.43
Retail Trade	0.93	0.43
Services	0.91	0.59
Transportation	0.91	0.34
Wholesale Trade	0.92	0.59

investigation reveal that the numbers represent the same cases.

Differences between the two systems are due to a variety of factors. Wisconsin has a three-day waiting period (three days away from work as a result of injury or illness) as a prerequisite for filing a WC claim. Because the annual survey does not have a waiting period, one would expect more cases to be reported under the annual survey since any injury/illness resulting in under three lost-workdays would be OSHA recordable. As expected then, the annual survey had an average rate that was 31 percent greater than the workers' compensation rate (Tables E-1 and E-2). Under Wisconsin workers' compensation law, a worker may initiate a claim by requesting a hearing. Typically, diseases (e.g., pneumoconioses) or hearing loss cases are filed by the worker. Worker-initiated claims account for 3.5 percent of the WC caseload in 1984 and 1985. Cases such as these are unlikely to be reported on the annual survey. However, the workers' compensation totals would still attribute these additional cases to the employer unit. Finally, all reported cases to workers' compensation are included in the reporting unit totals. These cases could include instances of medical treatment of a nature that is not OSHA recordable or even WC compensable, but they were nonetheless initially reported to workers' compensation to discharge the employer's potential reporting responsibility.

That 12 percent of surveyed units reported identically to each system raises the question of whether workers' compensation reporting case criteria are being mistakenly substituted for the BLS record-keeping rules at units reporting identically in the two systems. It is conceivable that a facility could experience only injuries resulting in more than 3 lost-workdays; however, one would still expect less severe but OSHA recordable events occurring as well in institutions with hazards sufficient to cause three days or more lost-workday cases. Only further detailed analysis of in-plant record-keeping practices can resolve this issue.

A greater number of cases is expected to be reported to the BLS annual survey, since this may merely reflect reporting differences between the survey and Wisconsin workers' compensation. The reporting of more cases to workers' compensation is not expected, but again when it does occur, it may be indicative only of WC reported medical-only cases or employee-initiated claims. While a favorable level of agreement was found between the two systems in Wisconsin, other SDS reporting states may experience an even greater degree of agreement when the workers' compensation reporting criteria are more similar to the OSHA record-keeping criteria. For example, states with WC systems having no lost-workday

waiting periods could be expected to track the annual survey even better. But in states with even greater WC waiting periods than in Wisconsin, one would expect far less agreement with the OSHA system. Actual concordance between the two systems would be best determined by examining the OSHA 101s from a sample of reporting units and comparing them to the WC first reports. However, this approach was beyond the resources of the current study.

Excellent agreement is seen between both systems when frequency counts are correlated within the industry division level; however, a decrement in concordance is seen when incidence rates are calculated. Factors that decrease agreement between the two programs possibly include small case frequencies and/or low hours worked yielding high rates when compared with zero cases.

The pattern of agreement varies significantly across industrial groupings (Tables E-3, E-4, E-5, and E-6). This is likely to be partially related to their incidence risk rank as a group (e.g., finance with high zero concordance has the lowest incidence rank) and possibly case severity. More hazardous industries are more likely to have more severe injury instances that meet Wisconsin workers' compensation reporting criteria. For example, the lost-workday average in finance was 11.2 days, while in construction the average was 20.5 days. The all-industry average was 14.8 lost workdays. A higher average lost-workday per case (i.e., more severe injuries) would yield a greater proportion of cases meeting the WC reporting criteria. The monotonic decrease seen in the OSHA/WC rate ratio (Tables E-1 and E-2) may be further evidence of this phenomenon. The finance division, having the lowest risk, has the highest ratio (1.69), indicating a 69 percent greater reporting rate on the annual survey when compared with workers' compensation. Thus, many more injuries are recorded on the annual survey, but they may not be severe enough to be compensable under WC criteria. In the highest risk division (construction), the relative ratio is only 1.06, a 6 percent greater reporting rate on the annual survey compared with workers' compensation. Thus, it would appear that in construction a greater proportion of the injuries occurring are also severe enough to be WC compensable, hence the two systems more closely parallel each other for rate estimation.

While the Wisconsin workers' compensation system was able to achieve the same relative ranking of industries for injury rate when compared to the BLS annual survey, further in-depth study of case report (i.e., OSHA 101s and WC first reports) data is necessary to precisely determine the degree of real concordance between the systems' reporting of indi-

vidual injury events. On the basis of the results of this study, we might draw the following conclusions:

- (1) Either of the two systems (OSHA logs or workers' compensation) will yield the same relative ranking of injury rates across the eight major industry groups. Therefore, either could be used in Wisconsin for establishing priorities for intervention among the major industry groups.
- (2) For those industry groups with rate ratios (OSHA rate/WC rate) close to unity, the WC system might be used for Wisconsin to obtain detailed information on injuries. These are the industry groups that probably have the more severe injuries. For the other industry groups, the WC data may be much less representative of the injury picture as provided by the annual survey. However, the more severe, or higher priority, injuries might still be likely to be captured by the WC system, and these could then be studied using the detail from that system.
- (3) These results are specific to Wisconsin. They cannot be extrapolated to other states or to the nation without further examination of data from other states because of variation among states in workers' compensation coverage, regulations, waiting period before a claim can be filed, and quality of the data themselves.

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APPENDIX F

BIOGRAPHICAL SKETCHES

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BRUCE W. KARRH is vice president for safety, health, and environmental affairs for E.I. duPont de Nemours and Company. He has served on numerous advisory committees and panels for various groups and government agencies. In addition, he is a trustee of Thomas Jefferson University; and the Medical Center of Delaware; director emeritus of the National Fund for Medical Education; director of the Chemical Industry Institute of Toxicology; fellow of the American College of Preventive Medicine, the American Academy of Occupational Medicine, and the American Occupational Medical Association.

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EARL S. POLLACK (study director) was formerly chief of biometry at the National Cancer Institute. Prior to that he was deputy director and director of the Division of Biometry and Epidemiology at the National Institute of Mental Health. His research interests are in chronic disease epidemiology and in the analysis of observational data from large health and medical data bases. He is a fellow of the American Statistical Association and a fellow and member of the Board of Directors of the American College of Epidemiology. He received B.S. and M.A. degrees in statistics from the University of Minnesota and a Sc.D. in biostatistics from Harvard University.

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ROBERT S. SMITH is professor of labor economics at the New York State School of Industrial and Labor Relations, Cornell University. His research interests are in the area of labor market regulation, particularly with respect to the Occupational Safety and Health Act of 1970 and workers' compensation. Previously, he has worked at the U. S. Department of Labor, has served as a consultant for several governmental agencies, and served on a National Institutes of Health task group on occupational lung disease. He received a B.A. degree from Claremont McKenna College and a Ph.D. in economics from Stanford University.

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