



PILOT STUDY FOR DEVELOPMENT OF AN OCCUPATIONAL
DISEASE SURVEILLANCE METHOD

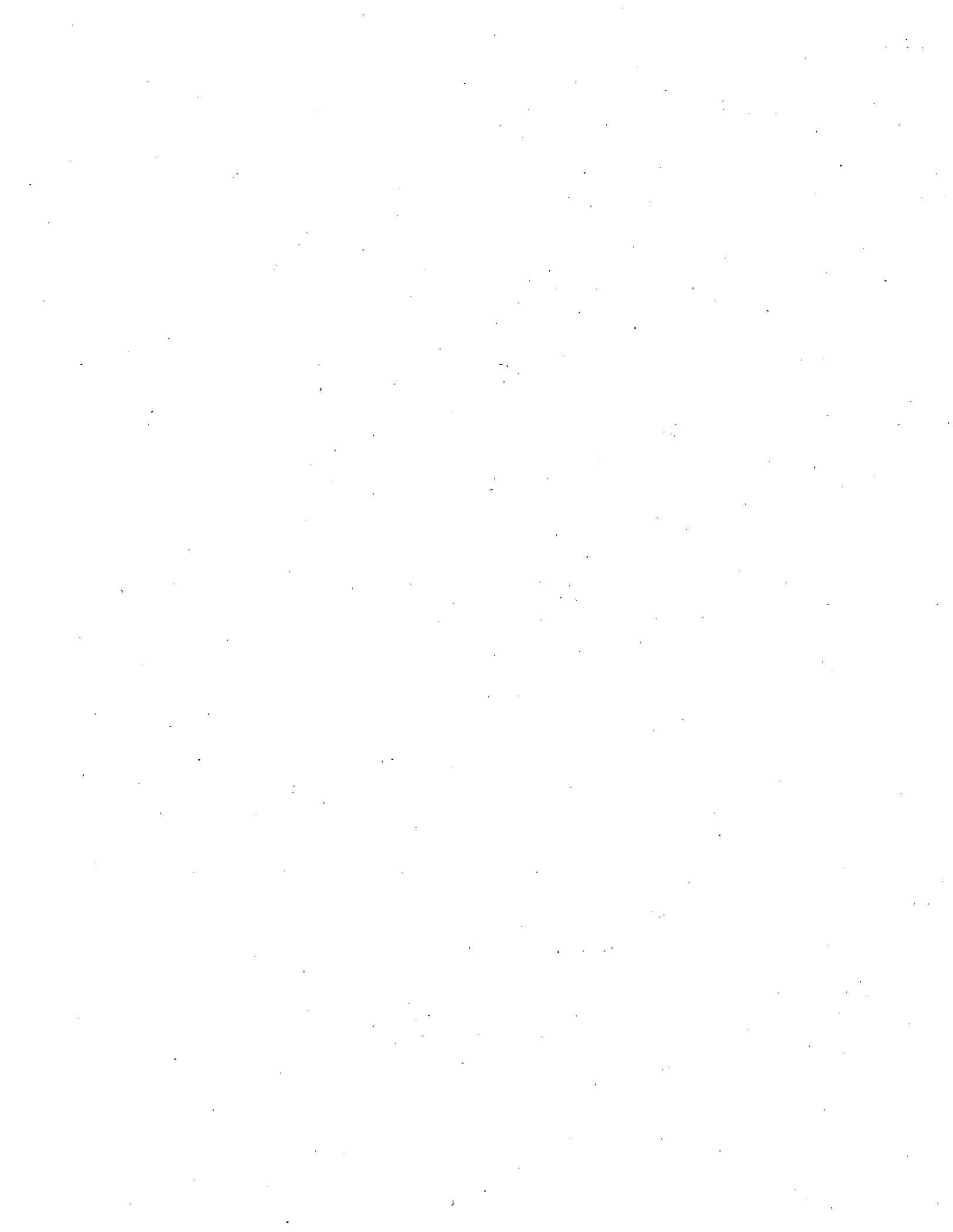
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Preface

The overview of this project's occupational disease methodology, that incidentally may need some new stimulus, was the origin of this effort as a "management" tool not only for NIOSH/OSHA, but also for large industries, union groups, and other non-government units. The origin is the task of asking the worker what he does, what he thinks is happening to him; and then to pose to the investigator: what documentation exists for these worker concepts. The participatory management process is basic to the motive of improved job health (in its broadest meaning). The environmental assessment in this protocol was forced into the personal work setting where the health problem really is, and yet the "science" of it was less the art of sampling, analyzing, designing controls, etc. -- but rather it was visualizing the probabilities of results if a full scale effort had been done. Likewise, the clinician was forced into a projection and probabilistic mode. This scientific compromise is difficult for many to take -- especially if "hard" science is one's bent; but "range-finding" is probably the cornerstone of decision-making, a concept which is especially effective when one has taken the trouble to involve the most critical consumer, the potentially affected worker and his perceptions.

Acknowledgement

This acknowledgement is a broad one that implies many underlying key roles, personal items of indebtedness, and interprofessional rapport -- all of which make for team and community research in worker health. The toxicologist needs a team, the urban planner needs a cadre of disciplines, but the occupational epidemiologist needs an assembly of "community-oriented" researchers -- ranging from those involved in the "nuts and bolts" to theorists. It is not possible to mention by name everyone who provided support and guidance to the study. A list of those who provided support and guidance to the study would be endless. We will, therefore, mention by name only those of our colleagues who participated in the day by day development of the project. First and foremost, our thanks to Susan Berg and her successor, Tomas Aquino, for supervising the field work and maintaining liaison with employers, employees, physicians, nurses and laboratory personnel. No mean feat that. Our thanks also to Doctors Gus Bansmer, Charles McGill, DeAnn Newton, Forrest Rieke, Leon Sealey, and their associates; the laboratory personnel at Tacoma General Hospital and the University of Washington Industrial Hygiene Laboratory. And last, but not least, our heartfelt gratitude to Debbie Cole who handled the programming and computing end and to Cindy Bush who typed and retyped, checked and rechecked this manuscript ad infinitum.

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ABSTRACT

A pilot study to determine the usefulness of a survey method for obtaining data on occupational disease was conducted among workers in selected small industries in Oregon and Washington. The study had two goals: 1) to determine the utility of procedures designed for finding occupational disease in a cross sectional survey; 2) to ascertain how much new data would be generated by this method.

Over 1,100 medical conditions were found among 908 participants: probable occupational, 31 percent; probable nonoccupational, 45 percent; doubtful occupational or can't evaluate, 14 percent; and suggestive history, 10 percent.

Of 346 cases of probable occupational disease, hearing loss was most frequent, 28 percent; then skin, 18; lower respiratory conditions, 14; toxic and low grade toxic effects and nonsymptomatic conditions (mainly elevated blood leads), 14; upper respiratory conditions, 11 percent; and eye conditions, 9 percent. Anemia, diseases of the musculoskeletal and connective tissues and other conditions accounted for the remaining 6 percent.

Of the 908 workers participating in the medical survey, 258 workers were found with 346 cases of probable occupational disease, for a prevalence rate of 28.4 per 100 workers. Occupational exposures were determined for all workers in the survey. Those known to have been exposed to poorly controlled hazards had a higher prevalence rate (39.0).

The survey morbidity data was checked for duplication with records of compensation claims and injury and illness records employers are now required to keep under OSHA (Employer's Log). Of 451 reports of occupational disease, 89 percent were found on the survey only; 2 percent on the Employer's Log; and 3 percent on compensation claims only; 6 percent were duplications.

A nation-wide survey is recommended, based on techniques developed in this study, for an estimate of the extent and kinds of occupational disease not available elsewhere. The results would help delineate problem areas, ascertain adequacy of standards, and may provide new insights into the relationship of occupational exposures and diseases.



PILOT STUDY FOR DEVELOPMENT OF
OCCUPATIONAL DISEASE SURVEILLANCE METHODS

I. INTRODUCTION

A. Occupational Disease Data

Comprehensive federal legislation on occupational safety and health - an on again off again subject for nearly 30 years - was passed at the end of 1970. Several circumstances coincided to make passage of this legislation possible: the continuing increase in industrial accidents; increasing community concern about environmental pollution; public awareness of research into the hazards of new chemicals and other physical agents; the inability of most States to modernize their industrial safety laws and to provide adequate resources for administration and enforcement; an influx of young workers, interested in better working conditions, into unionized industries; prosperity and the expectation that management could pay for needed controls without adverse effects on the economy.

In 1970, the University of Michigan Survey Research Center conducted a study of working conditions (1). Employees were asked a series of questions concerning 19 areas of labor standard problems. These questions dealt with 1) the frequency of problems in each area, 2) the severity of the problems, and 3) the extent to which workers wanted protection against the occurrence of such problems. Based on these three criteria,

the labor standard problems most important to workers were those relating to the general areas of health and safety (including health and safety hazards, unpleasant working conditions, work related illness or injury and wage loss following work related illness or injury). Some other labor standard problem areas workers were asked to rate concerned income, transportation, and discrimination.

Witnesses, testifying on the proposed legislation before committee members (House Education and Labor Committee, Senate Labor and Public Welfare Committee), stressed the lack of information about the nature and extent of occupational disease in the United States. They noted that well-known work hazards, such as lead, mercury and asbestos, continue to cause serious health problems; that there was little or no information about effects of numerous chemicals on workers; in many cases, the means of adequate control of these chemicals were also unknown. The same apparent lack of information prevailed for new energy sources and processes such as atomic energy, laser beams, ultrasonics, microwaves and the use of spray guns in connection with such old hazards as plaster and paints. Exposures to pesticides, herbicides, and fungicides were known to have resulted in illness among farm workers and applicators.

Witnesses also testified to the limitations in information available about industrial injuries. Data concerning industrial safety had been gathered by official and voluntary agencies for years. But even this body of information, consisting of disabling and fatal

work injuries, was considered to be an underestimate of accidents occurring at work. In addition, there had never been an equivalent body of data on non-disabling work injuries (2). Witnesses concluded that the effectiveness of the proposed legislation to a large extent would be contingent on the availability of information concerning the extent and kinds of occupational accidents and disease and where these were concentrated.

As a result, Congress wrote requirements for gathering statistics of occupational injury and disease into the Occupational Safety and Health Act of 1970 (3). These are discussed in this report in Section VI A 2 c. As required by the Act, the Occupational Safety and Health Administration (OSHA) developed a system making mandatory that employers keep records of occupational disease and injury, and report these to the U.S. Bureau of Labor Statistics if included in a nation-wide sample of employers selected annually. In line with its mandate, the National Institute for Occupational Safety and Health (NIOSH) has conducted studies on different methods of estimating the incidence and prevalence of occupational disease in the United States.

B. Background and Purpose of Pilot Study

The Department of Environmental Health of the School of Public Health and Community Medicine at the University of Washington, Seattle, contracted with NIOSH for a study determining the usefulness of a

survey method utilizing cross sectional samples of the work force and medical examination for obtaining data on occupational disease. From June 1971 to July 1972, a feasibility study of this survey method was conducted in Jackson County, Oregon. The results of the feasibility study encouraged the investigators to plan a larger endeavor (pilot study). The pilot study, July 1972 through August 1974, is the subject of this report.

The pilot study had two goals. The first was to determine the utility of a set of medical procedures designed for the diagnosis of occupational disease in a sample of workers in designated small industries. Several attending questions were raised. Are the necessary tools and logistical procedures for identifying certain types of occupational disease in a cross sectional survey available? How valid will information so derived be? Will this method be applicable to a statistical sample so as to make possible calculation of selected occupational disease rates for U.S. industry from which trends may be observed, problem areas delineated, program and research priorities obtained?

A second goal was to ascertain how much new data would be generated by this method, and how much would be a duplication of information available through existing records such as Workmen's Compensation claims or the logs of occupationally incurred injury and disease which employers are now required to keep by the Occupational Safety and Health Act.

II. SELECTION OF ESTABLISHMENTS FOR THE SURVEY

A. Choice of Sample Areas

Three industrial urban areas and one agricultural area were selected as study sites. Tacoma, Seattle and Portland were the urban sites chosen because of their proximity to the University of Washington and the diversity of industries within their borders. In addition, a physician, specializing in occupational medicine in each of these cities, expressed interest in participating in the study. The Director of the Occupational Health Unit in the Oregon Health Department requested that at least part of the study be conducted in Oregon. In Washington, the Director of the Industrial Hygiene Section, Division of Industrial Safety and Health in the Department of Labor and Industries, also expressed interest.

Agriculture has been excluded from almost all social legislation (unemployment compensation, National Labor Relations Act, child labor laws, wage and hour laws, etc.), and when included, frequently as a special case with special exemptions (4). Congress unequivocally included agriculture, known to be at high risk to occupational injury and disease (5), under the Occupational Safety and Health Act. Because of past exemptions, there were few available health and safety standards that could be applied to agriculture. With the exception of California, little long term study had been made of the health effects of the various exposures on agricultural workers in the United States. After the study plan had been designed, NIOSH asked the investigators to

include a small sample of farms in order to gain some experience on the applicability of the proposed method of occupational disease surveillance to agriculture. Yakima County was chosen because of the variety of its crops and because of the large numbers of seasonal farm workers employed in that area.

B. Sample

1. Derivation of the Sampling Frame

a. Nonagricultural establishments

Specific industrial categories were selected from the Standard Industrial Classification Manual (6) on the basis of their hazards as determined from the literature and the experience of members of the study staff. (Appendix I shows all inclusions.) The list, provided by the U.S. Bureau of Labor Statistics, comprised the sample of employers in the selected industrial categories in Multnomah County (Portland), King County (Seattle), and Pierce County (Tacoma) required to report their occupational injury and illness experience in 1973. Since the data to be generated by the study were to be compared with the information in the Employer's Log, the U.S. Bureau of Labor Statistics was interested in having the comparison made for establishments in its sample.

The sampling frame was limited to places of work having 8 to 150 workers. These limits in size assured that the environmental and medical surveys could be completed in a short time.

b. Agricultural establishments

The Yakima office of the Department of Employment Security supplied a list of apple, cherry, asparagus, hops and sugar beet growers in the area. (These crops were chosen because of the labor intensive activities taking place at the time of year planned for field work.) Since the Department of Employment Security keeps confidential identifying information, growers on the list were denoted by code. Information about growers included the number of seasonal workers hired during April, May and June of the preceeding year and the crop grown at that time. The sample farms were chosen at random by the investigators and their codes sent to the local Employment Security officers in Yakima. These officials then contacted the selected growers, first by a letter describing the study and asking them to participate, then by personal visit to some of them. Every grower selected for the sample refused to participate. Since only one month (June) was set aside for the agricultural phase of the study and this month was rapidly approaching, the investigators (at the suggestion of one of the state legislators from Yakima) approached officials of the pertinent grower associations and asked them to obtain volunteer participants for us from their membership; this they did.

2. Size of Sample

The study was to be limited to 140 places of work and 1,400 workers. Of these, 20 places and 100 workers were to be assigned to agriculture.

The remaining 120 places were distributed as follows: Portland, 48; Seattle, 48; and Tacoma, 24. This distribution was based on the amount of industry and number of workers in these areas.

The 1,300 workers were to be assigned on the same basis: 520 in Portland; 520 in Seattle; and 260 workers in Tacoma. The nonagricultural places of work were chosen at random from strata derived from the list supplied by the U.S. Bureau of Labor Statistics.

(See II B 1 a)

3. Stratification of the Sample of Work Places

To assure that the results would yield cases of occupational disease of special interest to NIOSH, the sample was stratified according to target groups: lead using industries, chlorinated hydrocarbon solvent using industries, and agriculture. All other hazardous industrial categories in the sample formed the fourth stratum called other nonagricultural industries. Industries falling into the lead and chlorinated hydrocarbon solvents strata were over sampled compared to the fourth stratum -- other nonagricultural industries.

The size of the agricultural sample was determined by the number of farms which the industrial hygienist thought he could survey in a month, 20. Protocols were written for lead, chlorinated hydrocarbon solvents, and agriculture. These included procedures to be followed by the physicians to ascertain the effects on workers who were exposed to these hazards (Appendix IIa, b, c).

4. Sample Inclusions for Environmental and Medical Surveys

All 140 places of work were to be included in an environmental (walk-through) survey. These places were selected at random not so that small plant prevalence estimates could be made, but mainly to obtain industrial diversity.

The places of work later chosen for the medical survey from this group were not selected randomly. Since the medical survey was limited to 1,400 production workers, not all the workers in the 140 plants could be included. A limited number of plants were chosen and all the workers in these places were asked to participate. The plants included in the medical survey were those in which workers were exposed to the target hazards and/or other hazards inadequately controlled as determined by the industrial hygienist.

The lead and chlorinated hydrocarbon solvent strata were over sampled for the medical survey as well as the walk-through survey.

III. STUDY PROTOCOL

A. Advisors to Study Staff

Advisory committees for the nonagricultural phases of the study were assembled in Oregon and Washington to provide guidance and good public relations. Labor, industry, pertinent official agencies, medical schools and industrial physicians were represented on the committees.

Each committee met once with the study staff; subsequent contacts were informal and with individuals as required.

Because of the poor political climate between growers and farm workers in the Yakima Valley, the study staff anticipated that a formal advisory committee would be nonproductive and instead made contacts with and obtained backing for the project on an individual basis. The following persons provided support: all state legislators from the Yakima Valley; officials of the State of Washington Departments of Agriculture, Employment Security, Public Health, Labor and Industries, Governor's Task Force on Agricultural Labor; medical and executive directors of the Toppenish Farm Workers Clinic; directors and members of the fruit trees, hops and sugar beet associations.

B. Notification of Employers

1. Letter

A letter was sent to each employer in the nonagricultural sample about 10 to 12 days before the first phase of the survey was begun. (No letter was sent to the agricultural participants because they were contacted directly through their associations.) The letter described the study and its authority under the Occupational Safety and Health Act. Employers were told they would get a report summarizing conditions in their plants and making recommendations for improvements; that these recommendations could be of help to them in evaluating changes necessary under the Occupational Safety and Health Act and in their contacts with State and Federal

officials. They were told that if their establishments were included in the medical survey, the report would include a summary of pertinent health findings, but in no case would this summary identify individual workers. (Appendix III)

2. Mandatory Participation

At the start of the study, voluntary participation of employers was sought as had been done successfully during the pretest in Jackson County, Oregon. This policy met with more difficulty than expected in Tacoma, but not enough to change the approach. During the field work in Portland, however, enough employers refused to cooperate in the medical survey to seriously compromise the study. NIOSH then informed the recalcitrant employers by mail that their participation was mandatory under the law. This letter was usually sufficient.

C. Walk-Through Survey

1. Interview with Employer or Management Representative

The industrial hygienist contacted management 10 to 20 days after the letter was mailed. At first (in Tacoma) he went to the place of work without an appointment, because of concern that management might initiate measures of concealment or take other actions that would bias the results of the walk-through survey. However, the necessary contacts were not always present, necessitating re-visits and time consuming changes of plans. Since the number of establishments to be visited during a short time period precluded repeat

visits, the industrial hygienist began to phone ahead for an appointment. Despite the advance notice of the walk-through survey, he found no evidence of dissembling at any establishment. Upon arrival, the industrial hygienist offered a copy of the letter as a reminder of the purpose of the visit. He next interviewed management using the NIOSH National Occupational Hazard Survey form. Selected questions from the form were asked to ascertain the nature of the business, number of workers employed, industrial hygiene and medical services provided, biological monitoring and other items pertinent to the study and relating to health and safety in the place of work. Prior to termination of the interview, the industrial hygienist obtained the names of employees working in the production areas, their job titles, and working shifts when applicable.

2. Assessment of Hazards

Once the preliminary interview was completed, the industrial hygienist proceeded with the hazards survey. With the exception of noise, hazard evaluations were based upon subjective judgment. The industrial hygienist maintained consistency in evaluation in two ways: by using the same technique of information gathering and the same exposure parameters in all establishments. The techniques of information gathering follow. He prepared a sheet on which he identified all workers, their occupations, the potential hazards to which they were exposed, the controls that existed to minimize these hazards and his evaluation of the adequacy of these

controls. He tried to obtain information about all tasks including those of a sporadic nature and those not presently being performed. In the smaller establishments, he obtained information about each employee concerning exposures and tasks, the duration of each exposure and the number of repetitions per week. In the larger establishments, he found that many employees with the same job title were performing nearly identical tasks; hence, he observed and discussed the tasks of representative employees within each job title. For example, perhaps the tasks of two or three assemblers of a group would be discussed in detail, but the remaining assemblers would be briefly observed to note what they were doing at the moment of observation. If any activity appeared to be atypical or not to fall within the job description for that job title, the management representative or the employee was questioned. In both large and small establishments, all employees were observed long enough to ascertain the nature of the task performed at the moment of observation. The industrial hygienist's degree of confidence in the results was influenced by his evaluation of the frankness and knowledge of those being interviewed.

Information gathering included the following exposure parameters: identification of the physical and chemical agents in the work environment; physical form of the agent (gas, liquid, solid, combinations); duration of exposure per week per job task; assessed magnitude of exposure; number of tasks per day and per week; toxicity or other potential hazards associated with exposure; means of protection provided or whether afforded by happenstance (such as limited time).

The assignment of the exposure rating "adequate, inadequate, or marginal" was made within a few days of the completion of the walk-through survey. The basis for the rating was twofold: The exposure parameters and the industrial hygienist's assessment of expected health effects. An apparent violation of an exposure standard (e.g., the American Conference of Governmental Industrial Hygienists' list of Threshold Limit Values) was not equated necessarily with an expected health effect, i.e., a particular solvent vapor exposure may have been adjudged as slightly exceeding the exposure standard but insufficient to produce a health effect. Such an exposure was given an "adequate" rating despite the fact that for purposes of conformance with good industrial hygiene practice (which attempts to prevent disease with a reasonable margin of safety) the exposure control would have been considered inadequate.

Noise was the only hazard for which there was an objective evaluation. A General Radio Type 1565B SLM meter, calibrated with a Hewlett-Packard Calibrator Model 15117A, was used to make measurements. Exposure was considered marginal at 85 dBA for 4 or more hours a day, 20 or more hours a week. At 95 or more dBA for the same time period, the exposure control was rated as inadequate.

D. Medical Survey

1. Notification of Employer

The field supervisor notified the employer of the forthcoming

medical survey and made arrangements to conduct the medical survey with as little disruption to production as possible.

2. Employees

a. Workers in production areas only

Because of budgetary considerations, only workers in the production areas were included in the survey. In this way, limited study resources were spent where the most hazardous conditions existed.

b. Contact with workers

Whenever possible, the field supervisor, and sometimes the study coordinator with him, met with the workers as a group (during coffee break, special breaks or lunch if they ate together at the same time) and individually to discuss the study. In a few instances production schedules or the attitude of management made this procedure impossible; in which case the shop foreman or shop steward gave the workers information and materials concerning the study. Union officials were informed of the study for those establishments which were unionized. All workers in the medical survey received a handout (Appendix IV) describing the study, its purpose, assurance of the confidentiality of the data, and asking for cooperation.

3. Logistics

The logistics involved in scheduling the medical survey required much ingenuity on the part of the field supervisor. Many recommendations at the conclusion of this report are concerned with avoiding the logistical problems of the pilot study. Based on the experience of the pretest in Jackson County, Oregon, the investigators planned for workers to be seen in the offices of the participating physicians. In Jackson County, the distances were trivial; 30 minutes at most was allowed for the round trip and 30 minutes for the examination. The physician and his staff were flexible and willing to arrange their time to accommodate the working schedules of those involved in the study. The places of work involved were small and the field supervisor could schedule two or three workers a day and still complete the survey at a given plant within a week. Also, the employers were interested and willing to make allowances for the time involved. In the pilot study, a number (far too few) of employers were greatly interested in the study; the majority of employers, while willing to participate, were critical of the time involved; and a minority participated only because they had no choice under the law. Some places of work were close to the physicians' offices, but many were not. In addition, the plants were larger than those in the Jackson County pretest; if only two or three workers could be scheduled a day, as some employers insisted, then completion of the survey at such plants could take weeks or even months.

This problem was resolved by conducting the medical survey in-plant, except for those places of work in which there were less than 20 workers and which were near the physicians' offices. A team consisting of a physician, nurse, and a paramedical person (usually the field supervisor) set up a clinic in the plant. On the average each examination lasted about 30 minutes, but because of the assembly line set-up (10 minutes with the paramedical person, 10 with the nurse and 10 with the physician) five and even six workers could be examined hourly. Necessary equipment was brought into the establishment. In Seattle, the physician brought a mobile X-ray unit to the plant. In Tacoma and Portland, workers who needed X-rays had to be asked to come to the physician's office on their own time. Many did not as shown in Table 11b. The industrial hygienist conducted the audiometry tests in a mobile unit. (Audiometric testing will be discussed under the heading Special procedures, Section III E 4 b.)

4. Reimbursement

With the exception of agriculture, all examinations were conducted during regular working hours. Many of the agricultural workers were paid by piece work, and could not afford to take time off for the medical survey. All were anxious to complete their jobs and start new jobs elsewhere. To encourage participation, agricultural workers were given \$10 for participating during nonworking hours.

Employers were not reimbursed for lost time or other economic losses associated with time off of workers for medical examinations.

E. Medical Procedures

1. Questionnaires

Each respondent was required to complete a questionnaire (Appendix V) providing demographic information (race, sex, date of birth), description of current job and exposures, past occupational exposures and medical history. The occupational exposure history was added to the questionnaire as a result of the pretest experience in Jackson County, Oregon.

Many probably occupationally incurred conditions diagnosed during the pretest appeared to be causally related not only to current, but also to past exposures. For example, a worker with a pattern of hearing loss implicating noise as the cause had not been exposed to noise on the current job long enough to sustain the loss in hearing shown on audiometry. The job history may have indicated, however, enough previous exposure to noise to produce the pattern of hearing loss shown on the audiogram. Another example was the worker with a chronic respiratory condition who had an occupational history of protracted exposure to known respiratory irritants, but no current exposure, possibly because of physician's orders.

During the pretest, the physician administered part of the Questionnaire on Respiratory Symptoms (Medical Research Council's Committee on Research into Chronic Bronchitis, Great Britain 1966) to workers exposed to respiratory irritants. The specific questions about previous exposures on dusty jobs were useful to the physician

in helping to determine the occupational aspects of certain respiratory conditions. These questions were incorporated into the new occupational history part of the questionnaire. In addition, questions on the occupational exposure history form used by the medical staff of the Boeing Company in Seattle were also included after the Boeing physicians inferred that new employees generally appeared to be aware of many of the substances they were exposed to in the past.

The medical history section combined two concepts: whether the worker has or had within a given time period any of the given signs, symptoms and conditions; and, whether the worker thought that these were job connected. Since not enough is known about the biological response to many industrial agents, a multi-symptom approach seemed appropriate. Most of the questions were taken from the Cornell Medical Index used as a standardized history of symptoms and known diseases and as a guide to subsequent interview and examination. Of 195 questions in the Cornell Medical Index, 58 were chosen for their possible value to the physician in making a diagnosis of occupational disease. One purpose of the questionnaire was to save physician time and minimize the cost of the medical survey. If the worker had already indicated the answers on the questionnaire, the physician need only probe positive answers. Another possible use of the questionnaire was to provide new insights. If the worker associated a physical reaction with the job, this could suggest new areas for investigation. The use of the questionnaires gave some assurance that no pertinent signs

or symptoms would be overlooked by the physician. Some people may feel constrained about answering questions put to them by a physician, and such people need the opportunity to answer questions freely. This was provided by the questionnaire.

2. Manual of Medical Procedures for Diagnosing Occupational Disease

Each participating physician was given a Manual of Medical Procedures for Diagnosing Occupational Disease prepared by the study staff. Every hazard encountered by the industrial hygienist in the environmental survey was entered on a loose leaf sheet with a description of possible health effects, route of entry and diagnostic procedures. The Manual contained criteria for skin, eye and respiratory system examinations, criteria for diagnosing occupational disease and hearing loss, a definition of disability, general laboratory procedures and references. The Manual served as an aid to the physician in diagnosis and as a means of standardizing medical procedures among all the physicians in the study.

3. Forms

a. Authorization to release medical information

Every participant in the medical survey was required to sign an authorization form (Appendix VI) , stating whether or not the results of the examination should be released to a private physician, and if yes, giving the name and address of the physician.

b. Informed consent

Participants were informed about the study in a number of ways. The handout (Appendix IV), referred to earlier in this report, described the study, its background and purposes, the confidentiality of individual findings, and the voluntary nature of participation. Wherever possible, the investigators supplemented the handout by discussion with the workers. Just before the examination, each participant was apprised of exactly what would be required in the way of medical procedures. This information was checked off on a voluntary consent form (Appendix VII) and signed by the participant and the member of the medical team who did the explaining. Several workers agreed in general to the examination, but refused certain procedures, such as blood studies or chest X-rays.

c. Summary form for physicians

A summary form (Appendix VIII) for the physician's use was placed on top of the participant's file. Entered on this form, in addition to the participant's name and occupation, were the occupational hazards, positive answers from questionnaires, weight, height, blood pressure, visual acuity and whether or not the participant was taking medication. As a reminder to the physician, the indicated special procedures, determined by the worker's exposures, were also entered on the form. There was room on the form for X-ray and laboratory findings and the physician's observations and diagnoses.

4. Medical Examination

a. Basic procedures

The medical examination was designed to ascertain the effect of specific occupational exposures on workers. Certain basic procedures, however, were required for everyone: height, weight, blood pressure, visual acuity and an inquiry into current use of medication. These basic checks along with age and sex were useful to the physician: for example, height is necessary in interpreting the pulmonary function test; recent loss of weight in interpreting systemic effects of disease; and age in determining effects of noise on hearing; the use of medication may explain current symptoms.

b. Special procedures

The remainder of the examination was tailored to the specific exposures of each worker. For example, workers exposed to lead had blood and urine samples taken for analytic studies; those exposed to dust had chest X-rays and spirometry; those exposed to excessive noise had audiometry tests. Workers exposed to lead (Appendix IIa), chlorinated hydrocarbon solvents (Appendix IIb) and pesticides (Appendix IIc) were required to undergo specific tests and answer specific questions directed to the determination of the health effects of these hazards. All workers who had a pulmonary function test (spirometry) also completed a questionnaire directed at detecting respiratory disease (Appendix IX).

The industrial hygienist had to test the hearing of those workers exposed to excessive noise at least 16 hours after the last noise exposure, in order for any observed hearing loss to be considered a permanent and not a temporary effect. This proved to be a logistical impossibility in many cases. Each hearing test, including form preparation, took about 10 minutes; workers objected to coming to work more than 15 or 20 minutes before their shifts. As a result, only two or possibly three workers could be tested before each shift. If many workers in a plant required hearing tests, this procedure could not be completed within a reasonable time period. Therefore, the following plan was adopted. If management was willing and able, the workers were assigned tasks in non noisy areas until they had their hearing tests. If not, the tests were given before work as far as possible and then into the shift. If the results indicated some loss in a worker who just came from a noisy area, the test was to be redone at another time. If the test could not be rescheduled, the results were classified separately under the heading "possible threshold hearing loss, cannot evaluate." (Appendix X)

A Tracor Model ARJ-4A automatic audiometer calibrated with a B & K Type 4152 Artificial Ear conforming to ANSI Standard S3.6-1969 specifications was used for the hearing tests (21). Background noise attenuation was afforded by use of an Eckous-tic Audiometric Booth in accordance with ANSI Standard S3.1-1960 criteria.

In two establishments, employers were engaged in a hearing conservation program and had available recent audiograms for their employees. To save time, the industrial hygienist asked for and received copies of the audiograms of those workers who were exposed to excessive noise. The audiograms were then reviewed by the medical consultant to the study.

5. Laboratory Tests

A clinical laboratory in Tacoma performed all the routine clinical laboratory procedures necessary for the Tacoma, Portland and Seattle medical surveys. This laboratory was selected for its extensive quality control program. The Yakima samples were analyzed in the Grandview Medical Clinic because of difficulty in getting unspoiled specimens to Tacoma during the hot summer months. Cholinesterase testing in connection with pesticide exposures of agricultural workers was performed by a state laboratory. Bioassay procedures (blood lead, for example) requiring special analytic techniques, that typical clinical laboratories are not equipped to handle, were done at the Industrial Hygiene Laboratory of the Department of Environmental Health, University of Washington.

6. Criteria for Diagnosis

a. Occupational disease

Since the medical examination was limited to a one time contact with each worker, definitive diagnoses could not be established.

Instead the examining physician determined whether a condition was "probable occupational," "doubtful occupational," "can't evaluate," "suggestive history" or "probable nonoccupational."

Probable occupational disease - Manifestations of disease are consistent with those known to result from excessive exposure to a given injurious agent; this injurious agent is present in the patient's working environment and significant contact in course of usual duties is likely.

Doubtful occupational disease - 1) Manifestations of disease are not entirely consistent with those known to result from excessive exposure to an injurious agent or 2) manifestations of illness are consistent with those known but no significant contact with alleged injurious agent can be established.

Suggestive history - Manifestations of disease as given in history are consistent with those known to result from excessive exposure to a given injurious agent; this exposure currently exists or has taken place; there is no objective evidence of disease at the time of the medical examination.

Cannot be evaluated - An association between disease and occupational factors has never been clearly established; e.g., cardiovascular disease, respiratory infections, mental and psychoneurotic episodes.

Probable nonoccupational - Manifestations of disease but no relationship to occupational exposures.

b. Hearing loss

The results of audiometry were age adjusted for each worker to mitigate effects of increasing age on hearing.

Probable occupational hearing loss was defined as a pattern of loss approximately equal in both ears; loss in frequencies of 3000 or more is greater than in the speech frequencies

(500, 1000, 2000); significant number of years exposed to noise on job, both current and past; no off the job exposures to noise such as guns, motor cycles, saws; and no prior head injury (with unconsciousness).

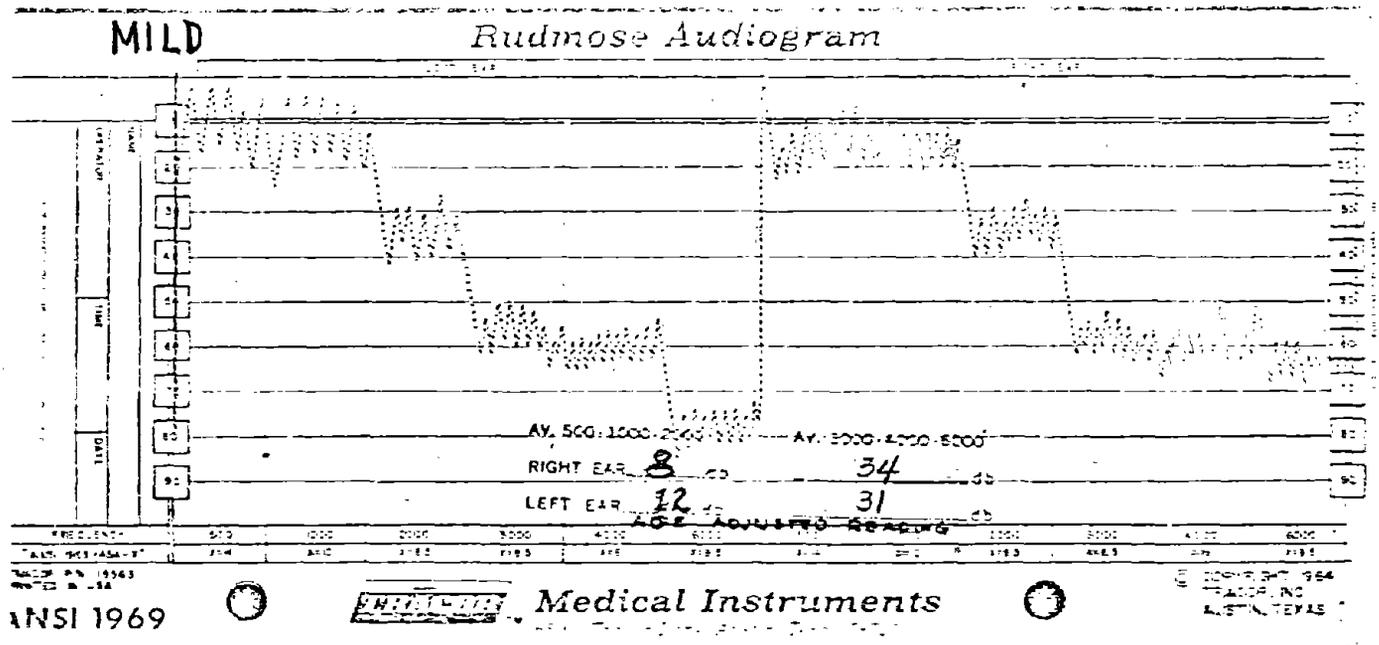
Age adjusted loss of hearing was classified as:

- mild - a bilateral loss in the speech frequencies of between 0-15 average decibels in 500-1000-2000 frequencies; but a significant loss (averaging greater than 25 db) in the higher frequencies.
- moderate - level of bilateral loss in speech frequency sufficient to suggest early impairment (both ears with 15-30 average decibel loss in 500-1000-2000 frequencies.
- advanced - level of bilateral loss about an average of 30 or more decibels in 500-1000-2000 frequencies; would be at risk for many functions in industry, e.g., not likely to hear a command or warning signal.

Examples of these loss of hearing categories are provided.

Example 1, Mild Hearing Loss

About three fourths of the loss of hearing cases were considered to be mild on medical review with an average loss of 9 decibels in the 500-1000-2000 frequencies and 35 decibels in the 3000-4000-6000 frequencies.

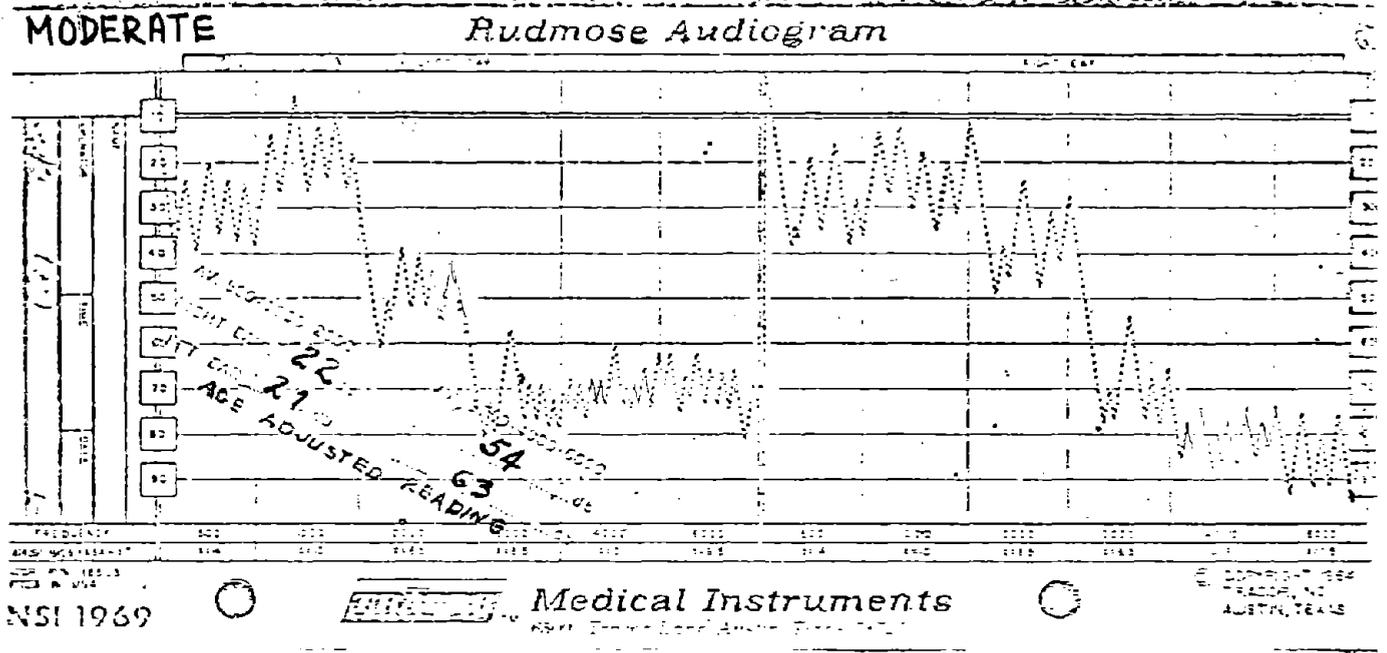


Age 65, male, occupation forklift operator.

Time since the most recent noise exposure was more than 16 hours; the duration of the most recent noise exposure was between 4 and 7 hours.

Example 2, Moderate Hearing Loss

About 24 percent of the workers with hearing loss were put into the moderate category with an average loss of 20 db in the 500-1000-2000 frequency range and 64 db in the 3000-4000-6000 range.

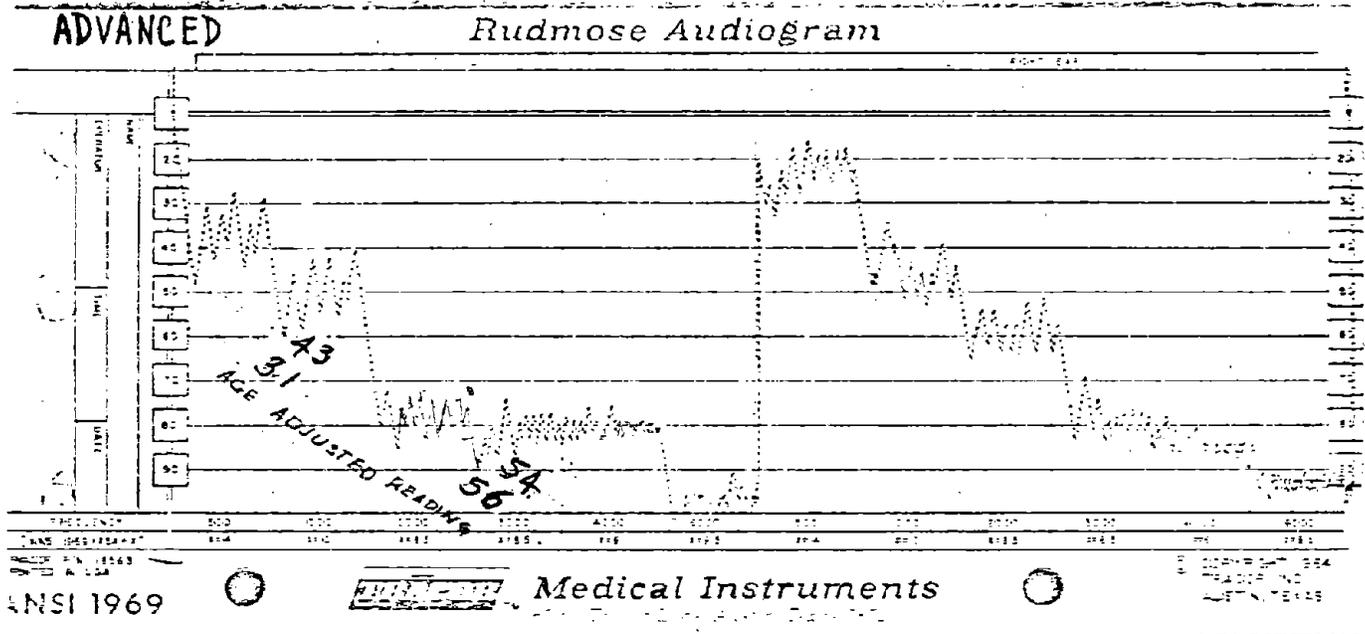


Age 49, male, occupation welder.

Time since the most recent noise exposure was more than 16 hours; the duration of the most recent noise exposure was between 4 and 7 hours.

Example 3, Advanced Hearing Loss.

About 3 percent of the workers in the series were diagnosed as having advanced hearing loss, average loss 37 db in the 500-1000-2000 frequency range and 64 db in the 3000-4000-6000 range.



Age 61, male, occupation foreman - sheet metal, used to be a riveter. Duration of most recent noise exposure 2 - 3 hours. The tester noted that this worker was very hard of hearing.

F. Comparison with Other Data Sources

A major purpose of this study was to ascertain how much new data about occupational illness and injury were generated by this method and how much was duplicated information available through Workmen's Compensation claims and the Employer's Logs. (The Employer's Log is a record of all work related injuries and illnesses which every employer covered by the Occupational Safety and Health Act is required to keep.)

The findings about occupational disease were the major concern of the investigators. The U.S. Bureau of Labor Statistics asked that occupational injury also be included as a check on the completeness with

which the Employer's Logs were kept. Two questions in the medical history pertained to injuries:

59 - Did you have a serious accident or injury on the job in the past 12 months? for example, broken bone, brain concussion, deep cut requiring stitches, back injury, particle in eye, smashed finger?

60 - Did you have a minor accident or injury on the job in the past 12 months? for example, sprain, bruise, minor cut?

The physician was asked to probe positive answers at the time of the examination and determine the nature of the accident. Occupational disease was, of course, diagnosed by the physician, based on objective evidence. Workmen's Compensation claims and the Employer's Logs were reviewed for both injury and disease for the period of the survey as well as one to one and a half years prior to the survey in order to cover the time period in questions 59 and 60 and get a measure of acute occupational illness as well.

The search of the Employer's Logs and the Workmen's Compensation claims was made for every worker who was listed as a potential participant in the medical survey.

G. Service to Participants

1. Employers

Each participating employer was sent a report of the findings concerning exposures and their controls. If the place of work was in the medical survey, a summary of health effects, carefully worded so that individual workers could not be identified was also included in the report. Recommendations for correcting problem areas were part of the letter.

2. Employees

Employees in the medical survey were notified of the results by mail, as were the private physicians of the employees if so authorized. Each employee with health problems, who had no private physician, was urged to get a physician and authorize a release of the data.

3. Other Participants

Meetings are planned with all the physicians and other medical and public health personnel who participated in the study, to review the experience and to discuss findings and their implications for occupational health. An abridged version of this report will be sent to medical personnel who participated, as well as to members of the advisory committee and those private physicians, workers, employers and state officials who have requested copies.

IV. FINDINGS

A. Sample

1. Changes Concerning Workers and Employers

The information about employers and the number of employees included in the sampling frame was derived from unemployment insurance tax returns filed by employers for the first quarter of 1971 (January through March), a recession period in the Northwest. By the time the field work started in January 1973,

economic conditions had begun to improve in this geographic area. Table 1a shows the extent of the change in the 121 nonagricultural sample establishments from the time of listing to the time of the walk-through survey -- an overall increase in employment of 8 percent. Since a breakdown on production and nonproduction workers was not available, there is no information on the change in numbers of production workers, the group included in the medical survey.

The walk-through survey was completed in 136 establishments rather than 140 which had been set as a goal. In Tacoma, 23 establishments participated instead of 24 because one employer would not cooperate. This occurred at the beginning of the study when voluntary participation was still the rule. In Seattle, 49 places of work were surveyed in place of 48 because what appeared on the list as one establishment was actually several plants; two were surveyed. In Portland, 49 instead of 48 participated for the same reason. Eighteen growers (instead of 20) agreed to participate, and then three were excluded before the survey started leaving only 15. Because of unseasonal warm weather conditions, two growers completed their harvest of asparagus earlier than expected, and the workers were gone before the industrial hygienist could plan the walk-through survey. The third grower backed out because he worried that the survey would "upset" his workers.

Table 1b shows the number of workers at the time of the walk-through survey and the number considered to be candidates for the medical survey. The 2,040 employees shown at medical survey

time included a number of workers who were no longer employed by the time the medical survey started. They were still enrolled because, in many instances, the medical survey was over before the field supervisor learned they were no longer at the place of work. In addition, the 2,040 included workers who replaced those who left, or who were additions to the work force. Many of these new workers wished to participate in the medical study, and were included. In 10 places of work, employing about 300 workers, hearing tests only were given (Table 1b), largely because there was no time left to conduct the medicals.

2. Stratification of Industry

As shown in Table 2, of the 392 workers exposed to lead as denoted by the industrial hygienist, 59 percent were in establishments assigned to the lead using industries stratum; 40 percent in establishments assigned to the halogenated hydrocarbon solvent using industries, and 1 percent to the stratum, other nonagricultural industries. Of 33 establishments assigned to the lead using industries stratum, 11 were designated to be without lead hazards by the industrial hygienist. These were publishing and printing plants using photographic equipment instead of typesetting and one nonferrous castings plant. As noted earlier, places of work were assigned to a stratum according to standard industrial classification (6). Those categories assigned to the non lead using industries, but in which the industrial hygienist found lead exposures were:

- 2851 - manufacture of paints, varnishes, lacquers, enamels and allied products
- 3446 - manufacture of architectural and ornamental metal works
- 3494 - manufacture of valves and pipefittings, except plumbers' brass goods
- 3564 - manufacture of blowers and exhaust ventilation fans
- 3841 - manufacture of surgical and medical instruments and apparatus
- 5599 - aircraft and automotive dealers

Of 283 workers exposed to halogenated hydrocarbon solvents, 38 percent were in establishments assigned to the halogenated hydrocarbon solvent using industries, 59 percent in establishments assigned to other nonagricultural industries, and 3 percent to the lead using industries stratum. Of the 40 establishments assigned to the halogenated hydrocarbon solvent using industries, only 16 were found to have any halogenated hydrocarbon solvent exposures by the industrial hygienist during the walk-through survey. The standard industrial classifications (6) categories in which halogenated hydrocarbon solvent exposures were found, but which were not assigned to that stratum were:

- 2992 - manufacture of lubricating oils and greases
- 3069 - fabricated rubber products, not elsewhere classified
- 3429 - manufacture of hardware, not elsewhere classified
- 3532 - manufacture of mining machinery and equipment, except oil field machinery and equipment
- 3691 - manufacture of storage batteries
- 4210 - trucking, local and long distance

5599 - aircraft and automotive dealers

7530 - automobile repair shops

B. Walk-Through Survey

1. Establishment Data

The industrial hygienist's interview with management showed that few health services and little environmental or biological monitoring were available in these 136 places of work (Table 3): 17 percent of the places had industrial hygiene services in the past year; 41 percent had arrangements with a physician or clinic for medical care; over half claimed to have had at least one employee trained to provide emergency treatment; nearly half recorded some health information about new employees. In a few places of work, certain categories of employees had periodic medical examinations: beauticians and truck drivers, primarily, who are required by law to have periodic medical examinations. In less than 25 percent of these 136 establishments was type of absence recorded, and in 47 percent absence was recorded without showing type. These 136 places appeared to be typical in most respects of small places of work throughout the nation, as indicated by other studies (7), (8).

2. Exposure Data

The industrial hygienist noted 11,873 exposures for 3,693 workers in 136 places of work, an average of 3.2 exposures per worker (Table 4). With exception of Tacoma, the places of work included in the medical survey generally have somewhat more exposure to

inadequately and marginally controlled hazards than do those places of work not in the medical survey.

As shown in Table 5a, most controls for the 11,873 exposures were considered to be adequate (72 percent). This was true for all hazard groups, except for the halogenated hydrocarbons, 62 percent adequate; phenols and related compounds, 36 percent adequate; and noise, 33 percent adequate.

As shown in the text table, 20 percent of the exposures that were uncontrolled (no control) were rated adequate. For the most part, ear protection, as a control of excessive noise, was considered marginal. Out of 1,556 workers who were exposed to excessive noise, 203 were offered ear protectors on the job. The industrial hygienist found that these were not always used when needed and that, in most places of work, management did not enforce their use.

	<u>Total</u>	<u>Adeq.</u>	<u>Inadeq.</u>	<u>Marg.</u>	<u>Unknown</u>
Total	100.0 (11,873)	72.4	5.2	19.2	3.2
No Control	100.0 (1,523)	19.2	33.0	33.8	13.9
Happenstance, L.T.	100.0 (5,984)	81.4	0.6	16.6	1.4
Design, L.T.	100.0 (81)	88.9	-	11.1	-
Ear Protection	100.0 (203)	13.8	1.0	82.8	2.5
Protective	100.0 (1,430)	87.7	0.6	11.6	0.1
Clothing					
Respirator	100.0 (216)	84.2	6.5	8.8	0.5
Forced Ventilation	100.0 (897)	75.7	3.9	19.5	0.9
Natural Ventilation	100.0 (1,210)	81.0	0.8	16.9	1.2
Other and Unknown	100.0 (329)	-	-	-	-

Source: Tables 5a

L.T. - limited time

There were no controls for about 13 percent of the 11,873 exposures and another 50 percent of the exposures were considered controlled, only because the workers were exposed to them for a limited number of hours per week: limited time, happenstance.

The 11,873 hazards were distributed among nearly 100 substances.

The text table shows the distribution among major hazard groups.

<u>Hazard</u>	<u>Percent</u>	<u>Hazard</u>	<u>Percent</u>
Total	100.0 (11,873)		
Noise	20.0	Phenols	3.0
Aliphatic Solvents (gasoline, Stoddard Solvent)	6.0	Iron, steel (ferric or ferrous compounds)	2.0
Plastic and plastic materials	4.0	Benzene, toluene, xylene	2.0
Abrasive dust	3.0	Welding fumes	2.0
Lead and its compounds	3.0	Halogenated hydrocarbons	2.0
Lubricating oils and greases	3.0	Paint, varnish, thinners	2.0
Gases	3.0	Acids	2.0
Ambient heat	3.0	Ultra-violet	2.0
Alcohols and ethers	3.0	Vibration, repeated motion	2.0
		Remainder	33.0 ^a

^aThe remainder were under 2 percent, mostly less than 1 percent.

Source: Table 5a

As shown in Table 5b, about 20 percent of the 11,873 hazards were in use more than 20 hours a week. For only five of the hazardous agents was the percentage greater than 20. These are shown in the text table.

<u>Hazard Group</u>	<u>Exposures</u>	<u>>20 hours per weeks (percent)</u>
Iron and its compounds	291	24.7
Lubricating oils and greases	377	27.0
Ultra-violet	274	33.2
Noise	2,332	54.0
Vibration	191	68.1

Source: Table 5b

C. Medical Survey

1. Demographic Variables

About 84 percent of the workers participating in the medical survey were men, 16 percent, women. They were largely white, 92 percent (Table 6a). The classification used for race was white, black, American Indian, Oriental and other. The majority of workers who did not identify themselves as white checked other. As far as could be ascertained "other" included largely Chicanos and workers of Philippine descent. The median age for the men in this series was 33.6 and the women, 34.2.

Somewhat over 20 percent of the men worked in their current place of work more than 10 years, compared to 7 percent of the women. Over half the men over age 50 worked in their current place of work over 10 years compared with 38 percent of those aged 40 to 49, 19 percent aged 30 to 39, and less than 1 percent aged 20 to 29 (Table 6b).

2. Questionnaire

a. Administrative data

Every worker participating in the medical examination (908) completed a questionnaire. Another 173 workers completed the questionnaire but did not continue on to the medical examination because they had left their jobs, or were not available at the time of the examination because of illness or vacation, or were in one of 10 plants in which only hearing tests were conducted, or they refused to take the physical examination. The authorization form to contact the private physician was completed at the same time as the questionnaire; 5 percent of the employees who completed the questionnaires did not fill out the authorization form. The informed consent document was signed by the participant at the time of the examination; 4 percent of the participants did not sign the form (Table 7). To some extent, the authorization form and the informed consent documents are indices of how well the field staff have done their jobs of informing participants about the study, their roles in it, and the voluntary nature of participation.

b. Occupational history

The response to the occupational exposure history (Appendix V) was poor; in 17 out of 27 exposure questions over 20 percent of the participants left blanks which were classified as "unknown." Even when the question was answered, years of

exposure was frequently left blank. For 10 items, the unknowns ranged from 10 to 20 percent: other dust, engine exhaust products, noise, heat, asbestos, carbon tetrachloride, epoxy resin, fiber glass, welding fumes, lead, and solvents (Table 8).

c. Medical history

Nearly 90 percent of the 1,081 workers who completed questionnaires gave one or more positive responses and nearly 85 percent of those with positive answers said that one or more of these positive responses were work related (Table 9a). There were on the average over 6 positive answers per worker and 3 of these were considered job related (Table 9b). As shown in Table 9c, the positive answers with the greatest proportion job relatedness (caused by or aggravated by job) concerned the following areas: eyes (questions 2, 3, 4); upper respiratory system (question 5, 6, 7), muscles, bones and joints (questions 35, 36, 38, 39); skin (questions 41, 43, 44); headaches (question 47); general fatigue (questions 54, 55); and of course those areas directly relating to work (questions 59, 60, 61, 62, 63, 64).

3. Diagnostic Procedures

Every participant in the medical examination was required to have five checks: height, weight, visual acuity, blood pressure, and usage of current medication. Additional indicated diagnostic procedures depended on occupational exposures. The basic checks

and the additional indicated diagnostic procedures constituted the minimum procedures. The physician could order additional diagnostic tests if these were indicated by the interview and examination. Tables 10a and 10b show the extent to which required and indicated procedures were completed.

4. Conditions Reported by Occupational Relationship

Over 1,100 medical conditions were found among the 908 employees who participated in the medical examination. Of these 1,116 conditions, 31 percent were diagnosed as probable occupationally incurred; 14 percent were judged to be in the doubtful occupational disease or can't evaluate category; 10 percent were in the suggestive history of occupational disease category; and 45 percent were judged to be nonoccupational (Table 11a).

Of the 346 cases of probable occupational disease among the 908 participants, hearing loss due to noise appeared most frequently, 28 percent; followed by skin, 18 percent; lower respiratory conditions, 14 percent; toxic, low grade toxic effects and nonsymptomatic conditions (mainly elevated blood leads), 14 percent; upper respiratory conditions, 11 percent; and conjunctivitis and other eye conditions, 9 percent. Anemia, diseases of the musko-skeletal and connective tissues and a number of other conditions accounted for the remaining 6 percent.

The 258 workers with 346 cases of probable occupational disease accounted for a prevalence rate of 28.4 workers with probable

occupational disease per 100 workers (Table 11c). A brief review of the more important probable occupational disease conditions follows.

The 96 workers with loss of hearing probably due to occupational noise among the 908 who completed the medical examination were augmented by 66 workers with the same diagnosis from a group of the workers participating in the hearing test only. (Table 11b). Among participants in the medical survey and the hearing test only known to be exposed to noise the prevalence rate of mild hearing loss per 100 employees was 14.0, moderate hearing loss 4.4, and advanced hearing loss 0.4. For workers exposed to noise rated marginally or inadequately controlled, the rate was somewhat higher (Table 11d).

For those participants in the medical survey which the industrial hygienist identified as being exposed to hazards which could effect the skin, the rate of skin conditions per 100 workers was 8.3. Where the hazard was rated as inadequately or marginally controlled, the rate increased to 13.4 skin conditions per 100 workers (Table 11d).

Among the 517 participants in the medical survey known to be exposed to hazards which were respiratory/systemic irritants, 63 workers had probable occupational respiratory/systemic conditions, for a rate of 12.2 conditions per 100 such workers. The 63 workers comprised those with respiratory (chronic bronchitis, asthma, other obstructive airway and upper respiratory conditions) and systemic conditions (low grade toxic and toxic).

Of these 517 participants, 141 were exposed to respiratory/systemic irritants rated as marginally or inadequately controlled; for this group the rate increased to 16.3 per 100 workers. (Table 11d)

The 27 nonsymptomatic conditions were all increased absorption of lead in the blood; the 13 low grade toxic effects and the 7 anemias were ascribed to lead exposures. In some of the anemias, blood lead levels had returned to normal but there was a history of recent lead toxicity. Anemia is among the last of the pathology to return to normal in recovery from lead poisoning. Of the 9 frank toxicities, 6 were attributed to lead, 2 to nitroglycerin and 1 to a combination of solvents (ethylene dichloride and methyl ethyl ketone) (Table 11a).

Doubtful occupational disease and cannot be evaluated were combined in Table 11a, but they are defined differently. See Section III E 6 a. As shown in Table 11a, respiratory conditions (51.6 percent) and loss of hearing (22.5 percent) accounted for three quarters of the conditions in this category. Over 40 percent of the anemia and other diseases of the blood, 21 out of 49 were assigned to "can't evaluate and doubtful."

See Section III E 6 a for definition of suggestive history. The conditions falling into this category were determined on the basis of answers in the occupational and medical history questionnaire as well as by patient interview with the physician. Skin, respiratory and eye conditions were more frequently mentioned in this category (Table 11a).

Respiratory conditions, hypertension and refractive errors were the largest categories among the nonoccupationally related conditions. Among the 908 workers, the nonoccupationally related rates per hundred workers for these categories are:

Respiratory conditions, excluding upper	16.8
Hypertension	15.1
Refractive errors	9.1

D. Comparison of Survey Data with Other Sources of Data

The names of the 2,040 workers eligible for the medical survey were checked against Workmen's Compensation claims and the records employers are required to keep under the Occupational Safety and Health Act (Employer's Log). (See description of method in III F.) An unduplicated count from all sources (survey, claims, log) showed 1,456 probable occupationally incurred conditions among these 2,040 workers; of these, 451 were considered to be occupational disease and 1,005 occupational injuries (Table 12a).

Of the 451 reports of probable occupational disease, 89 percent were found through the survey and not duplicated elsewhere; 2 percent were found only on the Employer's Log and 3 percent through Workmen's Compensation claims. Another 6 percent were found through more than one source, mainly a match of log and claims (Table 12b). A few cases of probably occupationally incurred dermatitis diagnosed on the survey were also found on the Employer's Log or on Workmen's Compensation

claims. Most of the probable occupational disease reports found on the logs and claims were acute conditions such as welding flash conjunctivitis, cellulitis, tendonitis, pneumonitis and insect bites. One lead poisoning was found on a Workmen's Compensation claim. This worker did not participate in the medical survey because he was off work and under treatment for this condition at the time.

Of the 1,005 occupationally incurred injuries, 42 percent were reported only on the medical questionnaire, 7 percent came from the Employer's Log only; 12 percent through Workmen's Compensation claims and 39 percent from more than one source, mainly the Employer's Log and Workmen's Compensation claims (Table 12a).

V. DISCUSSION OF FINDINGS

A. Basic Considerations

1. Changes in Universe

As previously discussed (II B 1 a), the sampling frame or universe was composed of a list of establishments of selected Standard Industrial Classification categories and known number of workers in Tacoma, Seattle and Portland for the period January - March 1971. By the time the survey took place in 1973, the universe differed from that of the first quarter of 1971 in terms of the number of workers employed (an 8 percent increase). There may have also been some changes in procedures and materials of production used. Stability of the universe is a problem for social surveyors.

In this study, the primary concern was with obtaining enough diversification of hazards to test the tools for diagnosing occupational disease; therefore, the changes in the universe probably had little effect on the outcome of the study. In extrapolating the results of such a survey to the population, however, consideration will have to be given to changes in the universe.

2. Sample

a. Selection

The sampling frame was stratified and the places of work were then chosen at random. All the establishments in the sample were surveyed by the industrial hygienist, but on account of budgetary considerations, not all could be included in the medical survey. Those establishments included were chosen arbitrarily because they used certain hazardous materials in their production process or because they were known to have had a diversity of hazards and poor controls. Even though extrapolation of data from the medical survey was not possible, there were findings of interest and these will be considered, within bounds of their statistical limitations.

b. Stratification

The reasons for stratification were discussed in Section II B 3. As shown in Table 2 the strata were not useful. Over 40 percent of the workers exposed to lead were found in places of

work outside the lead using industries stratum and 62 percent of workers exposed to halogenated hydrocarbon solvents were found in places of work not assigned to the halogenated hydrocarbon solvent using stratum. Medical participation was very poor among agricultural workers. For these reasons, the strata were dropped from further analysis. Lead and halogenated hydrocarbon solvents are summarized in the exposure and medical conditions tabulations. Agriculture is included in the totals.

3. Consistency and Completeness of Procedures

Minimum criteria were established to assure qualitative consistency and completeness of data. In a cross sectional survey, there are usually no procedures for retrieving missed opportunities; and often because of the limited (one time) nature of the medical data acquisition, a definitive diagnosis could not be made (for diagnostic criteria, see Section III E 6 a). In order to minimize missed diagnoses, all of the following requirements had to be met:

- a. all hazards had to be noted during walk-through survey;
- b. occupational exposures and medical history questionnaires had to be completed;
- c. basic procedures (height, weight, visual acuity, blood pressure, question on current medication) had to be done;
- d. special tests and questionnaires had to be completed as required;

- e. the physician had to probe all positive answers to the questionnaire, make an examination based on the worker's exposures and answers to questions; ask for additional tests if they were indicated.

Omission of any procedures increased the possibility of missed information. As a result, bias in the study tends towards under-recognition of probable occupational disease, ranging from missed diagnoses to ascribing the relationship of the disease to doubtful or nonoccupational instead of probably occupational because of missing data.

B. Walk-Through Survey

1. Limitations of One Time Survey

a. Not all workers present

Not all workers were present on the day of the walk-through survey; therefore, their work was not observed by the industrial hygienist and their exposures were not reported. Absent workers could have been working out of the plant, such as truck drivers, or on vacation, or out ill. The latter are of interest because their illnesses may have been related to their jobs. The industrial hygienist sometimes, but not consistently because he did not always know, noted the reasons for their absences. Where appropriate, he made assumptions regarding exposures of absent workers.

b. Couldn't assess all exposures

Another limitation of the cross sectional survey is that the industrial hygienist was able to assess, with any degree of accuracy, only those materials and procedures in use at the time of the walk-through survey. Although someone from management accompanied the industrial hygienist and explained procedures and materials used in the work place, some exposures were missed because of the brief nature of the walk-through or because they were not mentioned.

In one such incident of missed exposures, the physician learned of a lead problem at a boat building plant from workers participating in the medical examination. The physician asked for special blood and urine lead studies and his concern proved to be justified. Two workers were found to have had elevated blood leads, one had a concurrent mild anemia and other symptoms of plumbism. The industrial hygienist never saw the procedure in which lead was used, nor was he told about it during the walk-through and interview.

2. Evaluation of Hazards

a. Subjective vs. objective evaluation

Noise was the only exposure judged by objective standards. All other exposures were evaluated subjectively according to

predetermined criteria. (This was discussed in Section III C 2.) About 72 percent of all exposures were considered to be adequately controlled, but only 33 percent for noise was so considered (Table 5a). Prevalence rates for selected medical conditions and exposures were higher where exposures were rated inadequate or marginal (Tables 11c and 11d).

b. Occupational exposure history

As noted earlier, analyses of the pretest data indicated the need for an occupational exposure history to help explain conditions which could not be explained by the short duration or absence of exposures in a current job; for example, a worker with evidence of asbestosis but no current asbestos exposure. The results of the occupational history questionnaires, however, were disappointing. For most exposures, 20 percent of the workers left blanks. Occupational exposure history is of considerable importance and recommendations for improving this part of the questionnaire will be made in Section VI B 4.

C. Considerations in Diagnosing Occupational Disease

For some conditions, determination of an occupational relationship may be relatively simple. Loss of hearing is an example. If the pattern of hearing loss on audiometry is consistent with exposure to noise, and if the occupational history indicates noise exposure of sufficient duration, then the diagnosis of hearing loss probably

occupationally incurred may be made with a reasonable degree of confidence. The same is true for such conditions as asbestosis and silicosis; these findings on medical examination are fairly characteristic and occur only with exposure to asbestos and silica. Such exposures are usually occupational.

When the condition is one that may be caused by occupational exposure, but is also widespread in the population, then the decision as to its occupational origins may be more difficult. Dermatitis, conjunctivitis and especially respiratory disease are examples of such conditions. In the series of 289 respiratory conditions (excluding upper respiratory) 17 percent were ascribed to be probably of occupational causation; 26 percent were assigned to the doubtful, can't evaluate category; 4 percent to suggestive history; and 53 percent to nonoccupational. Without reference to occupational relationship, respiratory disease appeared in large proportions of workers in some places of work. However, the number of plants and workers involved were too small for interpretation. Almost all participating workers, 93 percent, had spirometry, and nearly 90 percent of all workers completed the respiratory questionnaire. Some respiratory conditions assigned to doubtful might have been assigned to probable occupational disease had fuller information from the occupational exposure history and the respiratory questionnaire been available. Future studies of similar data

sets may clarify the relative value of a detailed occupational exposure history in assisting the physician's judgment as to causal factors.

Some conditions are not generally related to occupational exposures. Anemia is such a condition except for certain specific instances. For example, excessive lead exposure may result in anemia; 7 of the 47 cases of anemia were considered to be of occupational origin and all the workers with this diagnosis were exposed to lead. Of the 767 men in this study who completed medicals, 43 (or nearly 6 percent) were found to be anemic (mostly borderline). This compares with 3 percent among the 141 women in the study. All the workers with this condition had various industrial exposures, most had more than one exposure. The exposures most frequently reported for them were:

Lead	22
General dusts	9
Heat	7
Sulfuric acid	7
Wood dust	7
Creosote	7
Sodium dichromate	7
Arsenic	7
Pentachlorophenol	7
Bronze	6
Infrared	6
Cresylic acid	6
Methyl ethyl ketone	5
Naphtha	5

In one plant five workers with a diagnosis of anemia were exposed to a combination of pentachlorophenol, creosote, sodium dichromate, arsenic

and wood dust. One additional worker with anemia in the plant had the same exposures without the wood dust.

In another plant, four workers with a diagnosis of anemia were exposed to cresylic acid. Three of these workers were also exposed to kerosine, carbon monoxide, oxides of nitrogen, and cutting oil. The fourth worker was exposed to engine oil and grease as well as the cresylic acid.

D. Comparison of Findings with Existing Data

1. Uniqueness of Findings

A major purpose of the study was to ascertain how much and what kind of new information about occupational disease may be generated by the survey method. The findings of the survey were compared with two sources of information about occupational disease and injury: Workmen's Compensation claims and the logs of occupational illness and injuries which all employers are required to keep under the Occupational Safety and Health Act. The search for claims and log entries was made for all workers who were eligible to participate whether they did or not. Had the nonparticipants been excluded, the case for the uniqueness of the survey's findings would have been even stronger for occupational disease and injury reported for the nonparticipants would have been eliminated. It was important to know, however, how much information about occupational

disease was missed by the nonparticipation of workers. Of the 451 reports of probable occupational disease, 399 (nearly 90 percent) were reported only through the survey. These were largely chronic and non-disabling. Employers tend to record on their logs occupationally related conditions for which claims have been filed or acute conditions for which the date of onset is known.

Occupational injuries are more apt to be reported on the Employer's Log and through Workmen's Compensation claims because they tend to be acute and need immediate attention. But even in this area 42 percent of the 1,005 cases recorded were obtained from the survey questionnaire. There are several reasons why this large body of injuries was not found in the Workmen's Compensation files or on the Employer's Log. If the injury did not at the very least require medical attention, a claim would not be filed. The worker may not have bothered to file a claim even though he required medical treatment. The employer tends to record on the log mainly injuries for which claims have been filed. (This was apparent on many of the Employer's Logs reviewed for the study.) The worker may have been mistaken as to the time period in which the injury occurred, it having actually occurred before the time period included in the comparison of data. Injuries reported by questionnaires were not substantiated by objective examination because except in a few instances of sequelae, recovery from past injuries were complete. The answers on the questionnaire indicate, however, that a large body of unreported occupational accidents may exist.

The Employer's Log was not available at 22 of the 64 establishments in the medical survey. The excuse given was that there were no work related injuries or illnesses to report. Workmen's Compensation claims were found for workers in 10 of the 22 establishments without Employer's Logs.

2. Rates of Occupational Disease

The observed rate of 28.4 workers with probable occupational disease per 100 workers appears to be high, but there is no other body of data with which it may be compared. The State of California has been computing occupational disease rates based on Workmen's Compensation claims since 1955. These are usually acute conditions requiring medical intervention and which may also be disabling. The occupational disease rate produced in California has generally been regarded as an incidence rate, i.e., the reported condition having its onset during a calendar year.

The rate produced in the pilot study is a prevalence rate which includes all probable occupationally incurred conditions prevailing at a given period no matter when the date of onset. (The definition of probable occupational disease used in this study was also used in a 1964 study to validate the California data (11)). Also in the pilot study the medical sample was not randomly selected, and every attempt was made to find occupational disease among the participating workers.

The study rate could be expected to be higher than the incidence rate; but how much higher should it be? In fact, the incidence rate for California production workers in manufacturing industries similar to those of the pilot study was about 15 per 1,000 workers (9) as compared to the prevalence rate in the study, 284 per 1,000 workers. It is doubtful that a typical disease would persist in a work population for one or two decades. Therefore, this difference in rates indicates a vast reservoir of unreported occupational disease and argues for a periodic national occupational disease survey to determine both prevalence and incidence.

3. Reports from Workers

In a survey of working conditions of nonagricultural, private sector employees conducted by the Survey Research Center of the University of Michigan for the Department of Labor (1), 13 percent of workers reported a work related injury or illness in the past 3 year period. Of these conditions, (N=253), one third were occupational disease, indicating a much greater proportion of occupational disease than the 4 percent reported from employer summaries for 1972 among nonfarm private sector workers (12).

VI. RECOMMENDATIONS AND DISCUSSION

A. National Study

1. Recommendations

The survey techniques developed in this study should be applied to a nationwide sample of industry for an estimate of the extent

and kinds of occupational disease in the United States not currently available from existing sources. The data derived from such a survey would be used to delineate possible problem areas and ascertain possible inadequacies in health standards; they may provide new insights into the relationship of occupational exposures and disease processes, thus leading to full scale epidemiological and/or toxicologic studies to confirm such inferences.

2. Discussion

a. Need for information about occupational disease

Sufficient information about incidence and prevalence of occupational disease is nowhere available, as was noted in 1966 by consultants to the Division of Occupational Health in a special report to the U.S. Surgeon General. "It is almost inconceivable that this nation with its vast resources and technical skills, has never developed a comprehensive picture of the work environment to determine the relationship with the health status of its productive work force. Nor are all the health hazards to which its workers today are exposed identified clearly to determine the presence and trends of disease observed" (16) Little has changed since that statement was written in 1966.

This survey method would identify certain occupationally incurred chronic conditions, evidence for which is available

at any time. These conditions range from potentially lethal to relatively benign. Chronic respiratory disease due to asbestos and a great variety of other fibrogenic or noxious inhalants may eventually cause death. Loss of hearing due to noise or eye cataracts due to infrared radiation have serious implications for safety and for quality of life. Lesser conditions, such as dermatitis, can be unsightly and may cause discomfort. Increased lead absorption in the blood may be symptomless, but it serves as a warning that, if exposures continue, serious illness may result; moreover, the long-range implications of high levels of lead stored in the blood are unknown. The extent of such conditions among the employed population is nowhere available. (Acute conditions are not identified in a cross sectional survey except by coincidence.)

b. Commitment to a national survey

Three problems connected with a national survey are: its cost, the need for commitment over a long time period, and difficult logistical problems. Commitment and cost depend upon priorities set by NIOSH. Logistical problems will be discussed in a later section of this report. The remainder of this section deals with the legal authority for such a study and a review of other possible sources of information about occupational disease, their advantages and disadvantages.

c. Legal basis

The National Institute for Occupational Safety and Health and the Occupational Safety and Health Administration were given mandates by Congress to develop means of measuring the extent and nature of the occupational safety and health problem (3).

i. Congressional Findings and Purpose

"by providing for appropriate reporting procedures with respect to occupational safety and health . . . and accurately describe the nature of the occupational safety and health problem;" (Section 2 (b)(12))

"by providing medical criteria which will assure . . . that no employee will suffer diminished health . . . as a result of his work experience;" (Section 2 (b)(7))

"by exploring ways to discover latent disease, establishing causal connections between disease and work in environmental conditions, and conducting other research relating to health problems, in recognition of the fact that occupational health standards present problems often different from those involved in occupational safety; . . ." (Section 2 (b)(6))

ii. Statistics

The Secretaries of Labor, and HEW in consultation,

"shall develop . . . an effective program of collection, compilation, and analysis of occupational safety and health statistics." (Section 24 (a))

iii. Inspection, Investigation and Recordkeeping

"The Secretary . . . shall prescribe regulations requiring employers to maintain accurate records of, and to make periodic reports on, work-related deaths, injuries and illnesses" (Section 8 (c)(2))

iv. Research and Related Activities

"The Secretary of Health, Education and Welfare also is authorized to establish such programs of medical examinations and tests as may be necessary for determining the incidence of occupational illness and susceptibility of employees to such illness."

(Section 20 (a)(5))

d. Possible surveillance sources

Two approaches for obtaining information on the extent and spectrum of occupational disease are: generating new data or using data from records whose main purpose is something else. The surveillance method described in this study generated a large body of occupational disease not elsewhere reported. The value of this system was discussed at the beginning of this section (Section VI A 2 a). Records from

which occupational disease information may be obtained as a byproduct are of several kinds: physicians' records (office, clinic, hospital); insurance records (Workmen's Compensation claims, Social Security Disability Insurance); and vital records (death certificates). In addition, employers are required to keep records of work injuries and illnesses; employees may file requests for investigation on which they describe the hazards and their effects.

i. Records of private physicians

To what extent do the records of private physicians provide an accurate estimate and description of occupational disease? Much depends on the perceptions of the worker. Does the worker seek medical attention upon the appearance of a health problem or only when ability to work is impaired, or at some point in between? Does the worker suspect a relationship between exposures at work and the health problem? Does the worker tell the physician of his/her suspicions? The clinician's primary concern is the restored health of the patient. If the disease is serious and the cause obvious, the physician will probably note the connection in the case history. If the disease is serious and the cause is not obvious, the physician may seek the cause in order to effectively treat the patient. In this case, the information will most likely be recorded. Often, however, the clinician may be

able to provide adequate treatment without fully understanding the cause of the disease. If the cause of such an illness were occupational, the information would not be recorded. Records of industrial physicians are more likely to indicate cause, when occupational, than the records of other private physicians.

Comparability of information from the records of private physicians would be problematic. Terms such as disabling, lost time, and even chronic are defined differently by the thousands of physicians across the country. Acquisition of information from records would be difficult because of the dissimilarity of record systems for data retrieval purposes and problems of medical confidentiality. Physicians are required to report occupationally incurred disease in many states, but the rules under which they report vary widely. Such reporting is conspicuous mostly by its absence, and most states have made little or no attempt to enforce the law or analyze such few reports as they do receive (13).

ii. Workmen's Compensation claims

To date, the most oft used source of information about occupational disease has been Workmen's Compensation claims. Its usefulness has been limited to a few states where occupational disease reporting is of particular

interest, for example, to the state health officer.

Analysis of these data are especially well developed in the State of California. These claims tend to be of acute conditions requiring immediate medical attention and they provide clues to the manner in which occupational hazards may cause acute illness; however, the report form is primarily for administrative use and not completely suitable for morbidity reporting (11).

Every state has its own Workmen's Compensation law; coverage of workers and of occupational disease conditions vary. At one extreme, any disease arising out of, or during, the course of employment is considered occupational; at the other extreme, only one or two conditions, such as silicosis, may be considered occupational. The National Commission on State Workmen's Compensation Laws (19), has recommended that all states meet certain basic requirements concerning coverage of workers and conditions by 1975. After 1975, the National Commission has recommended that Federal support be made available, if needed, to guarantee compliance with these essential recommendations.

A national data system based on Workmen's Compensation claims, if developed, would be limited largely to acute reactions caused by accidental occurrences, or misuse of industrial materials and processes, but would not provide essential data on disease processes caused by usual working conditions.

iii. Social Security Disability Insurance

The Social Security Administration has reported on the occupational characteristics of disabled workers by disabling conditions (17). These data provide information about persons no longer in the labor force because of disabling conditions; the disabling causes may refer to working conditions which no longer exist. Job histories and data on occupational exposures are also lacking.

As such, Social Security data do not provide the information needed for the surveillance of current working conditions. But because of the absence of more current information, these data on disabling conditions are carefully scrutinized for possible occupational relationships suggesting the need for further disease investigation.

iv. Employers' records

Under the Occupational Safety and Health Act, employers must maintain and make available on request records of all occupational injuries and illnesses which require care greater than first aid. A sample of employers, chosen annually, are required to report summaries of their records to the U.S. Bureau of Labor Statistics. The first annual report based on these data showed that occupational injuries accounted for 96 percent of the total reported cases in nonagricultural industries in

the United States; occupational illness constituted 4 percent (12). Occupational illnesses may not be recognized as such, or may not require immediate treatment; they are, therefore, not reflected in the statistics. This is borne out by the comparison of findings of occupational disease in the pilot study with information entered on the Employer's Logs (Tables 12a and b).

Efforts to extend the coverage of log reporting may have merit, but the employer would not be expected in many cases to understand allegations of illness of employees and record entries would be of questionable quality without physician reports and exposure documentation.

v. Employees' complaints

Under the Occupational Safety and Health Act, an employee may request an inspection of the work place if she/he believes that a violation of a safety or health standard exists. The employee describes the hazard and its effect. The form used has been standardized and OSHA will analyze these data for surveillance purposes. This program is still in the formative stages and its usefulness has yet to be established. NIOSH likewise performs certain investigations upon formal request, and thus far these data have not been organized to provide morbidity information.

vi. Mortality data

Mortality records are a possible source of information about occupational health, and are widely used in epidemiological studies, usually in combination with other data. There are serious limitations to the usefulness of death records as a source of information about occupational disease. The cause of death may not even hint at its occupational antecedents; for example, heart disease, instead of cor pulmonale. The occupation recorded for the decedent is generally the last occupation which may not be the same as the occupation related to the disease. For example, an ex-miner who eventually dies of silicosis may spend the last years of his life as a security guard. Security guard is given as his occupation on the death certificate. Then, important variables, such as smoking history, are missing from the death certificate. Even if the recorded information on the death certificates were greatly improved, followup would still need to be combined with the mortality data to make meaningful studies. Mortality may be due to exposures no longer extant and, therefore, may no longer reflect current working conditions. Many occupational diseases are not fatal and may never show up on death certificates, such as: hearing loss, Raynaud's disease, and dermatitis.

While the National Center for Health Statistics has successfully used the death certificate as the source of much mortality information, it has never produced routine occupational mortality data because of the difficulties already discussed and because of the extra cost involved.

vii. Conclusions

Traditionally, in health surveillance, descriptive epidemiologic data sources -- such as death records, physician reporting systems, disease registries, and disability records -- serve as a guide in measuring the impact of control programs. When such data fail to provide guidance, more rigorous approaches are used, such as analytic epidemiology.

Since existing sources of occupational disease information have many limitations and are generally not carefully analyzed, they may not be useful in planning occupational health control programs; therefore, there is a need for studies generating new data concerning the incidence of occupational disease and injury, especially those more common conditions that, for the most part, do not constitute major and immediate threats to life. These less threatening conditions are of significance for the health surveillance of the work force because they occur frequently, may not be

recognized as occupational in nature, and may have serious implications for the well being of the workers. Two analytic approaches to occupational disease and injury in the American work force can be outlined: the retrospective and prospective cohort studies.

The retrospective cohort study is perhaps the most classic analytic approach. A cohort starting at some period of time in the past is identified, such as an old roster of employees at risk, and followed up to the present time. The death records are searched for decedents in this group; survivors may be asked to complete health status questionnaires or this information is obtained from personal physicians. The resultant information is incorporated into a data set for analysis.

The prospective cohort study includes a morbidity study of a roster of currently employed workers. The first step in such a study may be a baseline clinical assessment of a worker group; information of this sort can be designed to provide prevalence data. Current exposure and disease indicators are included in the analysis. This cohort is then followed over a period of time, using as a baseline the carefully measured information on health and exposures obtained at the time of the initial morbidity study. This method is preferred to the retrospective cohort study where

information obtained about their probable exposure and health status at some earlier period of time is less reliable.

The pilot study utilized a prevalence morbidity approach. The roster used was that of currently employed workers in selected industries. Data on each worker included current exposures, results of a current medical examination, a limited occupational exposure history and a limited medical history. Using these data, the physician made a diagnosis and a determination as to the probability of an occupational relationship. Because the physician had only one opportunity to examine each worker, the diagnoses and prevalence rates have some degree of difficulty in interpretation. With followup the diagnosis could be confirmed, new conditions identified over time, and disease incidence determined. Thus the prevalence morbidity approach can be designed to identify worker groups where in depth cohort studies should be undertaken, and the pilot study provides a framework for organizing such surveillance.

B. Various Considerations for a National Study

1. Logistics

a. Recommendation

A mobile unit equipped to perform all the necessary medical procedures should be available for the survey. The staff

should consist of a full time physician, one or two paramedical persons, and an interviewer who can also serve as a paramedical person once the interviewing is completed. A two to three person field team should precede the mobile van to make arrangements with management for the walk-through and medical survey. The walk-through survey may be delegated to the NIOSH regional industrial hygienist or to other experienced industrial hygienists. Responsibility for laboratory analyses should be central. A central staff should be responsible for administration and data processing.

b. Discussion

The medical procedures and methods for ascertaining occupational exposure are basically sound, but need continuing refinement. The need for surveillance has been demonstrated. The original logistical procedures did not work as well in the larger study as they did in the small study in Jackson County, Oregon. In order to complete the study, logistical changes were made.

i. Scheduling appointments

The major logistical change, conducting the medical examination in plant instead of at the physician's office, has already been discussed (Section III D 3). The mobile unit circumvents the need to move equipment from place to place and to set up a clinic anew in each place of work.

ii. Physician commitments

In the Jackson County pretest, the availability of the physician off hours, as well as during his usual hours of work, in order to accommodate employees, was one factor in the success of the pretest. This need for flexibility in appointments was discussed before the pilot study began with the four physicians involved, and their understanding of the matter obtained. It was not reasonable to expect, however, that a busy practitioner could put aside ongoing commitments to the extent needed by this one time study. Such commitments by physicians made for problems in scheduling medical examinations in some areas. The assignment of a full time physician travelling with the mobile unit will eliminate the problem of juggling the needs of the study with other obligations of the physician.

iii. Quality control

The study staff discussed procedures with the physicians meeting together, and then with each physician separately, to insure standardization of medical procedures. Minimum procedures for each worker, based on exposures, were determined by the field supervisor before the examination; each physician was given a copy of a Manual of Medical Procedures for Diagnosing Occupational Disease. Physicians could require additional procedures whenever they decided these were

indicated. We could not monitor each examination as it took place to make sure that the minimum procedures were carried out, nor could we ask workers to return to complete procedures which had been omitted. The severity of this problem varied from physician to physician, as indicated by Tables 10a and b. The proposal assumes that the assigned physician and staff would complete a training program.

iv. Laboratory results

All clinical laboratory work for Tacoma, Portland, and Seattle participants was performed in one laboratory in Tacoma. Results were prompt. Cholinesterase testing for agricultural workers was done by the State Health Division Laboratory. No problems occurred except for questions as to the basis for normal ranges. The Department of Environmental Health Industrial Hygiene Laboratory at the University of Washington conducted the bioassays. Because of shortages in personnel and equipment, this laboratory fell months behind in analyses, and many specimens deteriorated before they could be read. In addition, this laboratory lacked written procedures for many of the analyses required. As a result, medical review in one area was held up for at least three months until the bioassays were completed on the remaining specimens. (The more serious problems of this laboratory have been alleviated since this study started.)

v. Conclusion

The mobile unit operation would solve many problems of control, standardization and scheduling of the medical examinations. NIOSH has a number of mobile units set up to do specific disease surveys, and also much experience in using such units. The occupational disease national surveillance study would not be limited to any particular diseases. The acquisition of both specialized and more generalized diagnostic equipment would be required.

One physician and the field staff would be assigned to the survey full time, working in the same place with the same equipment. The responsibility for laboratory analyses would also be centralized. The medical survey would be scheduled to follow the environmental phase closer in time. A control group of two or three persons in NIOSH, or in the office of a contractor, would be responsible for choosing the sample, letters to employers and employees, data processing, analysis of data and the final report.

The highest degree of worker cooperation should be insured by conducting the study during regular working hours, presumably without loss of pay. However, money should be available to pay workers whose wages are derived from piece work and who would have to participate in the study after working hours or who for logistical reasons have to travel to the mobile unit.

2. Employers

a. Recommendations

- i. Employer participation should be mandatory as provided by the law.
- ii. NIOSH should give consideration to the question of reimbursement of employers for their participation.
- iii. Every employer in the study should receive a full report based on the environmental and medical survey.

b. Discussion

i. Participation

The pretest in Jackson County, Oregon, was successfully conducted with the voluntary participation of the employers, and therefore, similar employer response was anticipated for the pilot study. The majority of employers chosen for the medical survey in the pilot study agreed to participate, although many voiced objections to the time involved. Enough employers refused, especially in Portland and Seattle, to threaten the outcome of the study. Since there was a legal basis for mandatory participation of the employers, NIOSH determined to enforce this requirement under the law, beginning at the time of the survey in Portland. NIOSH officials sent a letter to each recalcitrant employer pointing

out those sections of the law which make employer participation mandatory.

ii. Reimbursement

Among the recalcitrant employers, money was the major issue. They argued that, since their workers continued to get paid while participating in the survey, and the study staff and NIOSH officials were paid for conducting the study, why not they? Reimbursement of employers for their participation in the survey is complex. On what basis would they be paid? Production loss is one possibility, but how would this be measured? Reimbursement of wages paid to workers while they were participating in the study is another, but this is not satisfactory because wages are only a part of the employers' costs. Another possibility is a set amount per hour. How much? Should employers be permitted to deduct the cost of the survey, to them, from their taxes as a business expense? How would they measure the costs? Not reimbursing employers in some manner could turn out to be impolitic. This subject needs further exploration.

iii. Agriculture as a special case

Inclusion of agriculture in any social legislation is a novelty, and still unacceptable to the growers as a group. Knowing this, the study staff sought voluntary cooperation of growers, as a time saving approach, in

order to complete this phase of the survey in the very short time allotted in the pilot study. To do otherwise would have involved lengthy negotiation and politicking. An attempt to choose participants at random failed and the growers were solicited through their associations. This method is, of course, unacceptable for a national survey.

iv. Follow through

A report of findings should be sent to the employer as soon as possible after the conclusion of the survey. This report should summarize environmental and health problems, but not identify any workers. Wherever necessary, recommendations for improvement and changes should be given. This report should be of assistance to employers in their subsequent dealings with officials under the law.

3. Employees

a. Recommendations

- i. A special effort should be made to overcome low participation rates of workers.
- ii. The medical survey should be conducted during regular working hours.

- iii. Each employee should be notified of the results of the medical examination.

b. Discussion

i. Low participation

Human participants in studies funded by federal monies must be apprised that their participation is voluntary and must be fully informed about the study and their part in it. To meet these conditions, each employee had to sign a statement indicating that she/he was fully informed about the nature of the study, agreed to participate, and was aware that she/he may withdraw at any time. Employee participation was solicited in several ways. The handout (Appendix IV) appealed on two levels: altruism, "You have been chosen because you are representative of workers doing certain jobs and exposed to certain working conditions. If you fail to keep your medical examination, we will have that much less information about workers such as yourself"; self interest, ". . . the results will be made available only to you and your personal physician, if you wish. The results will not be made available to your employer. If you have no physician, and the findings suggest you should see one, you will be so advised . . . the examination is free." Cooperation was also solicited

by speaking to workers directly, and by obtaining union support in those places of work which were unionized.

Over 90 percent of the eligible employees participated in the medical survey of the pretest in Jackson County, Oregon, but only 67 percent of the 1,300 worker goal set for nonagricultural workers was reached, and only 40 percent of the 100 agricultural workers. There was no discernible pattern of participation. Participations was low in some places of work where there was wholehearted approval of the study by management and unions as well as in establishments where management made known their disapproval of the study.

Based on the pretest experience, a high participation rate was anticipated; and therefore the procedures did not include a routine followup of nonparticipants. Given the low participation rates in this study, a hurried attempt was made to find out the reasons. The negative attitude of some employers and the time limitations of the staff precluded followup in all the establishments. Among the nonparticipants queried, the most frequent response was, "just don't want to." In addition, answers consisted of "invasion of privacy," "questionnaire too long," to "under medical care and my doctor told me not to participate," "just out of hospital, had enough." Some workers could have been reluctant to admit to their difficulties in

reading and understanding the questionnaire; the impression of the field supervisor was that these were very few. A few workers questioned the confidentiality of the data; they were convinced that the information would be made available to the employers. Worst participation came from those places of work having a rapid turnover of workers, and there were several such establishments. The obvious disapproval of the study on the part of some management personnel may have influenced the participation of workers.

Farm workers constituted a special problem. The examination could not be held during regular working hours because of the demands of the job and because so many workers were paid piece rates and would not be earning money if they stopped working. Instead, farm workers were offered \$10 for participating in the medical on their own time. This did not work either because the clinic could not remain open evenings just for these workers. During the season, the working day for many agricultural workers in the Yakima Valley starts at dawn and ends at 6 or 7 in the evening, and sometimes later; the working week may be seven days. Other researchers among agricultural workers in the same area have indicated that a 40 percent participation rate may be considered to be good.

Several community wide studies have shown that a large proportion of the sample persons may not participate in

medical examinations. Nonresponse rates for these studies have ranged from about 30 to 40 percent (14). The results of such surveys triggered a number of studies investigating the attitudes and beliefs of nonparticipants (15); none of these studies pertained to workers in the context of this study. The different studies have shown conflicting results, even for persons of the same background, indicating that the same groups in different context may respond differently to survey and interviews. The desirability of a pretest directed toward reasons for nonresponses of employees when contacted at work should be considered.

ii. Survey during regular working hours

NIOSH has the right under the law to conduct medical examinations of employees during regular working hours. The exercise of this right is essential to the success of any subsequent surveys of this nature.

iii. Notification of health findings

Employees taking part in the medical examination should be notified of the results of the examination, and, on authorization, so should their private physicians. Employees should be apprised of any conditions at the time of the medical examination to the extent that this is possible (pending results of laboratory tests and chest X-rays).

4. Questionnaire

a. Recommendations

In the interests of increasing the accuracy of occupational exposure history data, we recommend that an interviewer administer the occupational history part of the questionnaire. The interviewer should be well-versed in chemical, physical, and mechanical hazards of various industries, and should receive special training in interviewing techniques, especially techniques of probing so as to remind respondents of past jobs and exposures. A pretest is desirable to ascertain the best procedures and the best questions for obtaining an accurate occupational exposure history.

b. Discussion

The occupational and medical history questionnaires were self-administered, mostly on the workers' time for budgetary considerations and logistical convenience. The medical history section of the questionnaire was easily answered by almost all respondents. Other studies have shown that the frequency of symptoms is not increased by an interviewer (18). The details of illness will, of course, be ascertained by the physician. As noted earlier (see Section IV C 2 b), the occupational exposure history was poorly completed. Complete occupational exposure history is of great importance to the physician in

making his diagnosis and every attempt needs to be made to increase the completeness and accuracy of these data.

5. Manual of Medical Procedures for Diagnosing Occupational Disease

a. Recommendations

The Manual of Medical Procedures for Diagnosing Occupational Disease should be completed to include a comprehensive list of industrial hazards, each one noting possible local and systemic effects, routes of entry, diagnostic procedures and recommended treatment. The Manual should be in loose-leaf form so that new hazards or new information may be entered as required. Available criteria documents and those now being developed under contract to NIOSH and the proposed revision of Occupational Diseases, A Guide to Their Recognition (20) will also be useful in this respect.

b. Discussion

The Manual of Medical Procedures for Diagnosing Occupational Disease was designed to give the participating physicians a ready reference for making a diagnosis based on hazardous exposure and to insure that all participating physicians followed the same procedures, as a minimum. Each hazard noted by the industrial hygienist was entered on a loose-leaf page, along with possible local and systemic effects of this exposure, routes of entry, diagnostic procedures. General criteria (skin, eyes, respiratory system, hearing, etc.) and an index

are also included. This Manual, if enlarged and completed to include recommended treatment, has great potential usefulness, not only in the surveillance study, but to physicians in general, and industrial physicians in particular. In the index, common as well as technical terms should be listed.



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TABLES

Table 1a

Occupational Disease Surveillance Study
 University of Washington - Department of Environmental Health

PERCENT CHANGE: TOTAL EMPLOYEES AT WALK-THROUGH SURVEY
 OVER TOTAL EMPLOYEES REPORTED BY U.S. BUREAU OF LABOR
 STATISTICS AS OF JANUARY - MARCH 1971 BY AREA AND STRATUM

Area and Stratum	Number of Plants	Total Employees Walk-Through	Total Employees B.L.S.	Percent Change
TOTAL	121 ^a	4,366	4,048	7.9
Tacoma	23	717	689	4.1
Seattle	49	1,430	1,267	12.9
Portland	49	2,219	2,092	6.1

a - Total does not add to 140 because 18 agricultural units were not derived from the U.S. B.L.S. list and one employer in Tacoma refused to participate.

Table 1b

Occupational Disease Surveillance Study
 University of Washington - Department of Environmental Health

PARTICIPATION IN MEDICAL SURVEY BY PARTICIPATION
 IN WALK-THROUGH SURVEY BY AREA

Area	Workers at Walk Through Survey	Worker Participation in Medical Survey			Questionnaire and Hearing Test Only	Questionnaire and Hearing Test Only	Hearing Test Only
		Workers Eligible for Medical Survey	Did Not Participate	Questionnaire only			
TOTAL	1,850	2,040	730	106	908	65	231
Tacoma	225	246	51	15	165	9	6
Seattle	588	651	162	29	348	20	92
Portland	732	827	266	62	355	36	108
Yakima	305	316	251	0	40	0	25

Note: The number of questionnaires completed totals to 1,079 instead of 1,081 because of a processing error which was too expensive to correct.

¹Excludes workers in plants not participating in the medical survey.



Table 2
Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

EMPLOYEES EXPOSED TO SELECTED HAZARDS BY PLANTS, AREA AND STRATUM

Selected Hazard and Area	Total ¹		Lead Using Industries Stratum		Halogenated Hydrocarbon Using Industries Stratum		Other Nonagricultural Industries Stratum	
	Plants	Employees	Plants	Employees	Plants	Employees	Plants	Employees
Lead	30	392	22	230	5	157	3	5
Tacoma	3	19	1	8	1	8	1	3
Seattle	12	216	8	68	3	147	1	1
Portland	15	157	13	154	1	2	1	1
Halogenated Hydrocarbon Solvents	26	283	1	9	16	108	9	166
Tacoma	3	15	0	0	3	15	0	0
Seattle	14	96	0	0	9	78	5	18
Portland	9	172	1	9	4	15	4	148

¹Includes all participants in the walk-through survey.

Table 3

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

HEALTH SERVICES AVAILABLE IN ESTABLISHMENT BY NUMBER OF
EMPLOYEES IN PRODUCTION AREA

Health Services in Establishments	Employees in Production Area					
	Total	≤ 7	8-19	20-49	50-99	≥ 100
All Plants	136	27	50	35	19	5
Industrial hygiene services during past year						
Yes, industrial hygienist	20	1	7	3	5	4
Yes, other	3	0	2	0	1	0
No	113	26	41	32	13	1
Employment of or arrangement with physician or clinic						
Yes, employed full time	0	0	0	0	0	0
Yes, employed part time	0	0	0	0	0	0
Yes, on call	0	0	0	0	0	0
Yes, at clinic	17	1	8	6	1	1
Other	39	5	11	13	9	1
No arrangements made	80	21	31	16	9	3
One or more nurses at facility to provide care						
Yes	0	0	0	0	0	0
No	136	27	50	35	19	5
Employee trained to provide emergency treatment						
Yes	72	9	22	22	15	4
No	46	13	22	9	1	1
Unknown	18	5	6	4	3	
Record health information about new employees						
Yes, all employees	56	7	15	16	14	4
Yes, executive and/or managerial only	2	0	1	1	0	0
Yes, other employees	4	0	0	4	0	0
No	74	20	34	14	5	1

Table 3 (con't.)

Health Services in Establishments	Employees in Production Area					
	Total	≤ 7	8-19	20-49	50-99	≥ 100
Before new employees hired or placed, is medical required						
Yes, all employees	9	0	2	4	2	1
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	16	1	6	5	3	1
No	110	26	41	26	14	3
Unknown	1	0	1	0	0	0
Provide periodic medical examination						
Yes, all employees	4	0	3	1	0	0
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	14	1	5	4	2	2
No	118	26	42	30	17	3
Provide periodic ophthalmologic examination						
Yes, all employees	1	0	1	0	0	0
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	7	1	3	2	0	1
No	126	26	45	32	19	4
Unknown	2	0	1	1	0	0
Provide periodic audiometric tests						
Yes, all employees	0	0	0	0	0	0
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	7	1	2	1	2	1
No	129	26	48	34	17	4
Provide periodic blood tests						
Yes, all employees	1	0	1	0	0	0
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	8	1	3	2	1	1
No	126	26	45	33	18	4
Unknown	1	0	1	0	0	0

Table 3 (con't.).

Health Services in Establishments	Employees in Production Area					
	Total	≥ 7	8-19	20-49	50-99	≤ 100
Provide periodic urine tests						
Yes, all employees	1	0	1	0	0	0
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	8	1	2	4	0	1
No	126	26	46	31	19	4
Unknown	1	0	1	0	0	0
Provide periodic pulmonary function tests						
Yes, all employees	0	0	0	0	0	0
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	2	1	1	0	0	0
No	133	26	48	35	19	5
Unknown	1	0	1	0	0	0
Provide periodic chest x-rays						
Yes, all employees	1	0	1	0	0	0
Yes, executive and/or managerial only	0	0	0	0	0	0
Yes, other employees	4	1	1	1	0	1
No	130	26	47	34	19	4
Unknown	1	0	1	0	0	0
Regularly scheduled immunizations						
Yes	11	0	3	5	3	0
No	124	27	46	30	16	5
Unknown	1	0	1	0	0	0
Employee absenteeism records						
Yes, showing specific nature of sickness when present	6	1	1	1	3	0
Yes, showing only the type of absence	25	3	4	8	6	4
Yes, without showing type of absence	64	8	30	18	8	0
No	33	10	14	7	1	1
Unknown	8	5	1	1	1	0

Table 3 (con't.)

Health Services in Establishments	Employees in Production Area					
	Total	≥ 7	8-19	20-49	50-99	≥ 100
Areas where personal protective devices recommended						
Yes, required	57	13	17	18	6	3
Yes, recommended	23	4	14	4	1	0
Yes, both	34	2	8	10	12	2
No	22	8	11	3	0	0
How do you carry Workmen's Compensation Insurance						
Private insurance company	0	0	0	0	0	0
Self-insured	0	0	0	0	0	0
State insurance fund	25	5	9	9	1	1
Other	1	0	0	1	0	0
Unknown	110	22	41	25	18	4
Are any unions operating in this facility						
Yes	73	8	26	24	14	1
No	58	18	21	11	4	4
Unknown	5	1	3	0	1	0
Regularly monitor fumes, gases, mists, vapors, etc.						
Yes	7	0	0	3	4	0
No	129	27	50	32	15	5
Summary of Occupational Injuries and Illness						
Yes	85	4	33	30	14	4
No	34	18	11	2	3	0
Unknown	17	5	6	3	2	1

Table 4

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

AVERAGE NUMBER OF HAZARDS PER EMPLOYEE BY LEVEL OF CONTROL FOR ESTABLISHMENTS IN MEDICAL SURVEY AND NOT IN MEDICAL SURVEY FOR EACH AREA

Area and Medical Survey Status	Workers	Total		Adequate		Inadequate		Marginal		Unknown	
		Hazards	Per Worker	Hazards	Per Worker	Hazards	Per Worker	Hazards	Per Worker	Hazards	Per Worker
TOTALS	3,693	11,873	3.2	8,594	2.3	624	0.2	2,275	0.6	380	0.1
In Medical Survey	1,850	6,576	3.6	4,606	2.5	349	0.2	1,384	0.8	237	0.1
Not In Medical Survey	1,843	5,297	2.9	3,988	2.2	275	0.2	891	0.5	143	0.1
Tacoma	508	1,246	2.4	774	1.5	115	0.2	283	0.6	74	0.1
In Medical Survey	225	712	3.2	458	2.0	52	0.2	143	0.6	59	0.3
Not In Medical Survey	283	534	1.9	316	1.1	63	0.2	140	0.5	15	0.1
Seattle	1,044	4,173	4.0	3,286	3.2	135	0.1	594	0.6	158	0.2
In Medical Survey	588	2,717	4.6	2,088	3.6	108	0.2	456	0.8	65	0.1
Not In Medical Survey	456	1,456	3.2	1,198	2.6	27	0.1	138	0.3	93	0.2
Portland	1,800	5,552	3.1	3,774	2.1	348	0.2	1,365	0.8	65	a
In Medical Survey	732	2,332	3.2	1,380	1.9	163	0.2	757	1.0	32	a
Not In Medical Survey	1,068	3,220	3.0	2,394	2.2	185	0.2	608	0.6	33	a
Yakima	341	902	2.6	760	2.2	26	0.1	33	0.1	83	0.2
In Medical Survey	305	815	2.7	680	2.2	26	0.1	28	0.1	81	0.3
Not In Medical Survey	36	87	2.4	80	2.2	0	---	5	0.1	2	0.1

Note: There is a discrepancy in the totals for level of control (adequate, inadequate and unknown) between this Table and Table 6a caused by corrections made in the data after Table 5 was compiled. Because of the expense involved in getting another computer run, and the insignificance of the error, the discrepancy was allowed to remain.

Table 5a

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

HAZARD GROUP AND TYPE OF CONTROL BY LEVEL OF CONTROL

Hazard Group and Type of Control	Total	Level of Control			
		Adequate	Inadequate	Marginal	Unknown
TOTALS	11,873	8,596	621	2,275	381
Dusts					
Abrasive Dust	382	358	1	23	0
No Control	3	1	1	1	0
Limited Time - Happenstance	191	185	0	6	0
Limited Time - Design	6	6	0	0	0
Protective Clothing	42	42	0	0	0
Respirators	12	12	0	0	0
Forced Ventilation	32	26	0	6	0
Natural Ventilation	89	79	0	10	0
Other and Unknown	7	7	0	0	0
Free Silica Dust	117	103	0	14	0
No Control	3	1	0	2	0
Limited Time - Happenstance	45	34	0	11	0
Limited Time - Design	1	1	0	0	0
Protective Clothing	3	3	0	0	0
Respirators	28	28	0	0	0
Forced Ventilation	9	9	0	0	0
Natural Ventilation	15	14	0	1	0
Other and Unknown	13	13	0	0	0
Other and Unspecified Inorganic Dust	395	293	0	77	25
No Control	47	43	0	4	0
Limited Time Happenstance	127	78	0	26	23
Protective Clothing	59	37	0	22	0
Respirators	37	37	0	0	0
Forced Ventilation	49	26	0	23	0
Natural Ventilation	61	57	0	2	2
Other and Unknown	15	15	0	0	0
Wood and Paper Dust	144	141	0	0	3
No Control	5	2	0	0	3
Limited Time - Happenstance	111	111	0	0	0
Protective Clothing	14	14	0	0	0
Respirators	8	8	0	0	0
Natural Ventilation	2	2	0	0	0
Other and Unknown	4	4	0	0	0

Table 5a (con't.)

Hazard Group and Type of Control	Total	Level of Control			
		Adequate	Inadequate	Marginal	Unknown
Other and Unspecified Organic Dust	148	148	0	0	0
No Control	4	4	0	0	0
Limited Time - Happenstance	52	52	0	0	0
Protective Clothing	87	87	0	0	0
Other and Unknown	5	5	0	0	0
Dust Not Elsewhere Classified	69	69	0	0	0
No Control	1	1	0	0	0
Limited Time - Happenstance	11	11	0	0	0
Respirators	9	9	0	0	0
Forced Ventilation	32	32	0	0	0
Natural Ventilation	2	2	0	0	0
Other and Unknown	14	14	0	0	0
Gases	368	319	0	43	6
Limited Time - Happenstance	134	134	0	0	0
Limited Time - Design	9	9	0	0	0
Forced Ventilation	80	64	0	15	1
Natural Ventilation	140	112	0	28	0
Other and Unknown	5	0	0	0	5
Agricultural Chemicals	218	161	0	14	43
No Control	8	0	0	0	8
Limited Time - Happenstance	28	4	0	0	24
Protective Clothing	65	51	0	14	0
Natural Ventilation	108	106	0	0	2
Other and Unknown	9	0	0	0	9
Elements, Mainly Metals and Their Compounds					
Aluminum	160	156	0	4	0
No Control	8	4	0	4	0
Limited Time - Happenstance	36	36	0	0	0
Limited Time - Design	15	15	0	0	0
Protective Clothing	43	43	0	0	0
Forced Ventilation	45	45	0	0	0
Natural Ventilation	13	13	0	0	0
Iron (Steel, Ferric or Ferric Compounds)	291	254	1	35	1
No Control	43	9	1	33	0
Limited Time - Happenstance	146	146	0	0	0
Protective Clothing	33	31	0	2	0
Respirators	8	8	0	0	0
Forced Ventilation	12	12	0	0	0
Natural Ventilation	48	48	0	0	0
Other and Unknown	1	0	0	0	1

Table 5a (con't.)

Hazard Group and Type of Control	Total	Level of Control			
		Adequate	Inadequate	Marginal	Unknown
Lead	394	300	9	85	0
No Control	9	7	0	2	0
Limited Time - Happenstance	109	92	1	16	0
Protective Clothing	6	6	0	0	0
Respirators	2	1	0	1	0
Forced Ventilation	47	30	8	9	0
Natural Ventilation	208	151	0	57	0
Other and Unknown	13	13	0	0	0
Welding Fumes and Metal Fumes	203	202	0	1	0
Limited Time - Happenstance	33	33	0	0	0
Limited Time - Design	4	4	0	0	0
Forced Ventilation	64	64	0	0	0
Natural Ventilation	102	101	0	1	0
Sulfur	127	127	0	0	0
No Control	125	125	0	0	0
Limited Time - Happenstance	2	2	0	0	0
Elements and Their Compounds, Other and Unspecified	510	465	14	24	7
No Control	9	7	1	1	0
Limited Time - Happenstance	197	195	0	2	0
Limited Time - Design	7	7	0	0	0
Protective Clothing	120	107	0	13	0
Respirators	2	2	0	0	0
Forced Ventilation	98	82	7	5	4
Natural Ventilation	47	35	6	3	3
Other and Unknown	30	30	0	0	0
Liquid Hydrocarbons					
Benzine (Gasoline, Petroleum Ether, Stoddard Solvent and Aliphatic Solvents)	688	565	0	122	1
No Control	35	6	0	29	0
Limited Time - Happenstance	611	521	0	90	0
Protective Clothing	10	10	0	0	0
Forced Ventilation	8	8	0	0	0
Natural Ventilation	23	20	0	3	0
Other and Unknown	1	0	0	0	1
Benzene, Toluene and Xylene	216	189	12	14	1
No Control	10	1	2	7	0
Limited Time - Happenstance	158	157	0	1	0
Respirators	5	3	0	2	0
Forced Ventilation	6	5	0	1	0
Natural Ventilation	28	23	2	3	0
Other and Unknown	9	0	8	0	1

Table 5a (con't.)

Hazard Group and Type of Control	Total	Level of Control			
		Adequate	Inadequate	Marginal	Unknown
Lubricating Oils and Greases	377	303	4	67	3
No Control	38	22	4	11	1
Limited Time - Happenstance	284	230	0	54	0
Limited Time - Design	8	6	0	2	0
Protective Clothing	34	34	0	0	0
Forced Ventilation	5	5	0	0	0
Other and Unknown	8	6	0	0	2
Other and Unspecified Liquid Hydrocarbons	183	182	0	0	1
Limited Time - Happenstance	134	134	0	0	0
Protective Clothing	34	34	0	0	0
Respirators	1	1	0	0	0
Natural Ventilation	13	13	0	0	0
Other and Unknown	1	0	0	0	1
Alcohol and Ethers	304	302	0	1	1
No Control	2	0	0	1	1
Limited Time - Happenstance	269	269	0	0	0
Protective Clothing	3	3	0	0	0
Respirators	3	3	0	0	0
Forced Ventilation	22	22	0	0	0
Natural Ventilation	5	5	0	0	0
Esters	8	8	0	0	0
Limited Time - Happenstance	8	8	0	0	0
Halogenated Hydrocarbons	286	176	3	107	0
No Control	7	0	0	7	0
Limited Time - Happenstance	195	141	0	54	0
Protective Clothing	2	2	0	0	0
Respirators	2	2	0	0	0
Forced Ventilation	62	17	1	44	0
Natural Ventilation	4	2	2	0	0
Other and Unknown	14	12	0	2	0
Ketones					
Acetones	168	161	7	0	0
No Control	6	0	6	0	0
Limited Time - Happenstance	141	141	0	0	0
Respirators	7	6	1	0	0
Natural Ventilation	14	14	0	0	0
Methyl Ethyl Ketones	129	124	0	5	0
No Control	5	0	0	5	0
Limited Time - Happenstance	116	116	0	0	0
Forced Ventilation	8	8	0	0	0

Table 5a (con't)

Hazard Group and Type of Control	Total	Level of Control			
		Adequate	Inadequate	Marginal	Unknown
Other and Unspecified Ketones	31	25	0	5	1
No Control	6	1	0	5	0
Limited Time - Happenstance	20	20	0	0	0
Protective Clothing	2	2	0	0	0
Forced Ventilation	2	2	0	0	0
Other and Unknown	1	0	0	0	1
Solvents					
Paint, Varnish, Shellac, and Lacquer Thinners	186	180	2	4	0
No Control	1	0	1	0	0
Limited Time - Happenstance	90	89	1	0	0
Protective Clothing	3	3	0	0	0
Respirators	46	42	0	4	0
Forced Ventilation	44	44	0	0	0
Natural Ventilation	2	2	0	0	0
Other Solvents	45	35	6	4	0
No Control	8	0	6	2	0
Limited Time - Happenstance	35	35	0	0	0
Limited Time - Design	2	0	0	2	0
Acids	260	221	0	35	4
Limited Time - Happenstance	55	43	0	12	0
Limited Time - Design	2	2	0	0	0
Protective Clothing	111	111	0	0	0
Respirators	4	1	0	3	0
Forced Ventilation	43	32	0	11	0
Natural Ventilation	38	32	0	2	4
Other and Unknown	7	0	0	7	0
Alkalis	156	151	1	2	2
No Control	1	0	1	0	0
Limited Time - Happenstance	104	102	0	2	0
Protective Clothing	42	40	0	0	2
Forced Ventilation	9	9	0	0	0
Aldehydes	37	20	0	15	2
Limited Time-Happenstance	8	7	0	1	0
Protective Clothing	10	10	0	0	0
Forced Ventilation	3	1	0	0	2
Natural Ventilation	16	2	0	14	0
Inorganic Anions	98	78	14	5	1
Limited Time - Happenstance	31	30	0	0	1
Protective Clothing	38	33	0	5	0
Respirators	1	1	0	0	0
Forced Ventilation	21	7	14	0	0
Natural Ventilation	7	7	0	0	0

Hazard Group and Type of Control	Total	Level of Control			
		Adequate	Inadequate	Marginal	Unknown
Phenols and Related Compounds	349	125	8	216	0
Limited Time - Happenstance	76	21	0	55	0
Protective Clothing	158	84	8	66	0
Respirators	8	8	0	0	0
Forced Ventilation	59	6	0	53	0
Natural Ventilation	42	0	0	42	0
Other and Unknown	6	6	0	0	0
Miscellaneous Chemicals					
Dyes and Inks	148	117	0	31	0
No Control	34	4	0	30	0
Limited Time - Happenstance	112	111	0	1	0
Protective Clothing	2	2	0	0	0
Natural Glues	129	128	0	1	0
No Control	1	0	0	1	0
Limited Time - Happenstance	121	121	0	0	0
Protective Clothing	4	4	0	0	0
Forced Ventilation	3	3	0	0	0
Other Miscellaneous Chemicals	162	127	5	26	4
No Control	15	0	5	6	4
Limited Time - Happenstance	110	90	0	20	0
Limited Time - Design	1	1	0	0	0
Protective Clothing	27	27	0	0	0
Respirators	1	1	0	0	0
Other and Unknown	8	8	0	0	0
Plastics and Plastic Materials	431	337	15	54	25
No Control	4	1	2	1	0
Limited Time - Happenstance	250	225	0	1	24
Protective Clothing	75	39	0	36	0
Respirators	21	3	8	9	1
Forced Ventilation	25	20	5	0	0
Natural Ventilation	56	49	0	7	0
Plant and Animal Products	163	135	0	20	8
No Control	13	10	0	1	2
Limited Time - Happenstance	111	104	0	1	6
Natural Ventilation	38	21	0	17	0
Other and Unknown	1	0	0	1	0
Environmental Conditions					
Ambient Heat	355	326	0	28	1
No Control	22	21	0	1	0
Limited Time - Happenstance	62	51	0	11	0
Protective Clothing	120	120	0	0	0
Respirators	4	4	0	0	0
Forced Ventilation	50	43	0	7	0
Natural Ventilation	69	60	0	9	0
Other and Unknown	28	27	0	0	1

Table 5a (con't.)

Hazard Group and Type of Control	Total	Level of Control			
		Adequate	Inadequate	Marginal	Unknown
Ultra Violet	274	206	9	59	0
No Control	50	0	9	41	0
Limited Time - Happenstance	1	0	0	1	0
Protective Clothing	158	155	0	3	0
Other and Unknown	65	51	0	14	0
Vibration, Repeated Motion, Sudden Impact Blows	191	3	0	44	144
No Control	179	0	0	44	135
Limited Time - Happenstance	10	3	0	0	7
Other and Unknown	2	0	0	0	2
Noise	2,332	758	503	1,053	18
No Control	740	3	462	270	5
Limited Time - Happenstance	1,347	701	36	610	0
Limited Time - Design	22	17	0	5	0
Ear Protection	203	28	2	168	5
Other and Unknown	20	9	3	0	8
Other Environmental Conditions	135	59	1	12	63
No Control	53	1	1	6	45
Limited Time - Happenstance	43	40	0	3	0
Protective Clothing	12	12	0	0	0
Forced Ventilation	2	1	0	1	0
Other and Unknown	25	5	0	2	18
Other, Unspecified and Unknown	506	459	6	25	16
No Control	28	19	1	0	8
Limited Time - Happenstance	260	246	0	14	0
Limited Time - Design	4	4	0	0	0
Protective Clothing	113	108	0	5	0
Respirators	7	2	5	0	0
Forced Ventilation	57	56	0	0	1
Natural Ventilation	20	10	0	6	4
Other and Unknown	17	14	0	0	3

Table 5b

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

DURATION OF EMPLOYEE EXPOSURE BY HAZARD GROUP AND FORM

Hazard Group and Form	Total	Hours of Exposure					Per Week			Unknown
		<1	1-4	5-9	10-19	20-40	>40			
TOTAL	11,873	1,131	3,048	2,604	2,560	2,481	38	11		
Dusts										
Abrasive Dust	382	0	33	75	188	86	0	0		
Dust, respiratory/systemic	31	0	2	0	28	1	0	0		
Particles, skin (to include liquid skin)	351	0	31	75	160	85	0	0		
Free Silica Dust	117	7	20	35	28	27	0	0		
Dust, respiratory/systemic (to include vapor respiratory/systemic)	102	7	20	33	28	14	0	0		
Particles, skin	15	0	0	2	0	13	0	0		
Other and Unspecified Inorganic Dust	395	33	54	71	191	46	0	0		
Dust, respiratory/systemic	131	28	1	23	35	44	0	0		
Particles, skin (to include fumes, skin)	264	5	53	48	156	2	0	0		
Wood and Paper Dust	144	0	24	25	85	10	0	0		
Dust, respiratory/systemic	7	0	0	3	4	0	0	0		
Particles, skin	137	0	24	22	81	10	0	0		
Other and Unspecified Organic Dust	148	0	0	70	5	60	13	0		
Dusts, respiratory systemic	4	0	0	0	0	0	4	0		
Particles, skin (to include liquid skin)	144	0	0	70	5	60	9	0		

Table 5b (con't.)

Hazard Group and Form	Total	Hours of Exposure Per Week						Unknown
		<1	1-4	5-9	10-19	20-40	>40	
Dusts, Not Elsewhere Classified Particles, skin (to include liquid)	69 69	0 0	7 7	1 1	5 5	56 56	0 0	0 0
Gases	368	86	152	77	39	10	0	4
Gas, respiratory/systemic	350	85	152	60	39	10	0	4
Smoke, respiratory/systemic	17	0	0	17	0	0	0	0
Liquid, skin	1	1	0	0	0	0	0	0
Agricultural Chemicals	218	1	23	169	25	0	0	0
Dust, respiratory/systemic	7	0	0	7	0	0	0	0
Mists, respiratory/systemic	2	0	0	0	2	0	0	0
Liquids, skin	113	1	4	85	23	0	0	0
Particles, skin	93	0	19	74	0	0	0	0
Gas, respiratory/systemic	1	0	0	1	0	0	0	0
Unknown	2	0	0	2	0	0	0	0
Elements, Mainly Metals, and Their Compounds								
Aluminum	160	0	9	42	91	18	0	0
Dusts, respiratory/systemic	3	0	0	0	0	3	0	0
Fumes, skin	20	0	2	6	12	0	0	0
Fumes, respiratory/systemic	34	0	3	20	9	2	0	0
Particles, skin	103	0	4	16	70	13	0	0
Iron (Steel, Ferric or Ferric Compounds)	291	0	15	46	158	72	0	0
Dusts, respiratory/systemic	30	0	0	0	30	0	0	0
Fumes, skin	34	0	2	6	3	23	0	0
Fumes, respiratory/systemic (to include smoke)	37	0	2	0	9	26	0	0
Particles, skin	190	0	11	40	116	23	0	0

Table 5b (con't.)

Hazard Group and Form	Total	Hours of Exposure Per Week						Unknown
		<1	1-4	5-9	10-19	20-40	>40	
Lead	394	12	135	121	92	30	4	0
Dusts, respiratory/systemic	92	8	17	13	42	12	0	0
Fumes, respiratory/systemic	289	4	118	108	41	14	4	0
Particles, skin	13	0	0	0	9	4	0	0
Welding Fumes and Metal Fumes	203	29	69	41	35	29	0	0
Fumes, skin	1	0	0	1	0	0	0	0
Fumes, respiratory/systemic	22	7	1	5	1	8	0	0
Gas, respiratory/systemic	180	22	68	35	34	21	0	0
Sulfur	127	0	2	125	0	0	0	0
Liquid, skin	2	0	2	0	0	0	0	0
Particles, skin	125	0	0	125	0	0	0	0
Elements and Their Compounds, Other and Unspecified	510	93	184	70	69	94	0	0
Dusts, respiratory/systemic	40	0	15	3	3	19	0	0
Fumes, respiratory/systemic	128	20	72	14	18	4	0	0
Liquid, skin	101	54	28	18	1	0	0	0
Mist, respiratory/systemic	17	0	11	6	0	0	0	0
Particles, skin	156	9	30	1	46	70	0	0
Vapor, respiratory/systemic	16	2	0	14	0	0	0	0
Fumes, skin (to include vapor)	39	2	22	13	1	1	0	0
Gas, respiratory/systemic	11	4	6	1	0	0	0	0
Unknown	2	2	0	0	0	0	0	0
Liquid Hydrocarbons								
Benzene (Gasoline, Petroleum Ether, Stoddard Solvent and Aliphatic Solvents)	688	80	394	206	7	0	0	1
Liquid, skin	606	61	341	197	6	0	0	1
Vapor, respiratory/systemic	82	19	53	9	1	0	0	0

Table 5b (con't.)

Hazard Group and Form	Total	Hours of Exposure Per Week							Unknown
		<1	1-4	5-9	10-19	20-40	>40		
Benzene, Toluene and Xylene Liquid, skin	216	33	154	26	3	0	0	0	
Vapor, respiratory/systemic	50	1	36	13	0	0	0	0	
	166	32	118	13	3	0	0	0	
Lubricating Oils and Greases Liquid, skin	377	14	25	23	212	102	0	1	
	377	14	25	23	212	102	0	1	
Other and Unspecified Liquid Hydrocarbons	183	42	43	54	25	19	0	0	
Liquid, skin	124	25	29	38	15	17	0	0	
Fumes, skin	3	3	0	0	0	0	0	0	
Mists, respiratory/systemic	20	0	5	15	0	0	0	0	
Vapor, respiratory/systemic	8	0	4	0	2	2	0	0	
Particles, skin	23	13	5	0	5	0	0	0	
Smoke, respiratory/systemic	4	0	0	1	3	0	0	0	
Unknown	1	1	0	0	0	0	0	0	
Alcohols and Ethers Liquid, skin	304	33	209	43	19	0	0	0	
Vapors, respiratory/systemic	236	12	170	37	17	0	0	0	
	68	21	39	6	2	0	0	0	
Esters Liquid, skin	8	5	3	0	0	0	0	0	
Vapor, respiratory/systemic	5	4	1	0	0	0	0	0	
	3	1	2	0	0	0	0	0	
Halogenated Hydrocarbons Liquid, skin	286	44	204	36	0	2	0	0	
Vapor, respiratory/systemic	153	13	131	9	0	0	0	0	
	133	31	73	27	0	2	0	0	
Ketones Acetone Liquid, skin	168	44	122	0	2	0	0	0	
Vapor, respiratory/systemic	23	11	12	0	0	0	0	0	
	145	33	110	0	2	0	0	0	

Table 5b (con't.)

Hazard Group and Form	Total	Hours of Exposure						Unknown
		<1	1-4	5-9	10-19	20-40	>40	
Methyl Ethyl Ketones	129	21	93	3	12	0	0	0
Liquid, skin	79	8	66	0	5	0	0	0
Vapor, respiratory/systemic	48	13	25	3	7	0	0	0
Unknown	2	0	2	0	0	0	0	0
Other and Unspecified Ketones	31	0	18	13	0	0	0	0
Liquid, skin	22	0	17	5	0	0	0	0
Vapor, respiratory/systemic	9	0	1	8	0	0	0	0
Solvents								
Paint, Varnish, Shellac and Lacquer Thinners	186	56	92	28	7	3	0	0
Liquid, skin	87	41	24	18	3	1	0	0
Mist, respiratory/systemic	3	0	0	0	2	1	0	0
Vapor, respiratory/systemic	96	15	68	10	2	1	0	0
Other Solvents	45	6	32	5	2	0	0	0
Liquid, skin	42	6	32	2	2	0	0	0
Vapor, respiratory/systemic	3	0	0	3	0	0	0	0
Acids	260	67	94	53	21	25	0	0
Liquid, skin	169	63	71	31	0	4	0	0
Mist, skin	12	1	2	5	0	4	0	0
Mist, respiratory/systemic	68	0	14	16	21	17	0	0
Vapor, skin	2	2	0	0	0	0	0	0
Vapor, respiratory/systemic	9	1	7	1	0	0	0	0
Alkalis	156	78	32	42	0	4	0	0
Dusts, respiratory/systemic	2	2	0	0	0	0	0	0
Liquid, skin	140	75	24	41	0	0	0	0
Mist, respiratory/systemic	9	1	7	1	0	0	0	0
Unknown	5	0	1	0	0	4	0	0

Table 5b (con't.)

Hazard Group and Form	Total	Hours of Exposure						Unknown
		<1	1-4	5-9	10-19	20-40	>40	
Aldehydes								
Gas, respiratory/systemic	37	10	12	11	4	0	0	0
Liquid, skin	17	0	5	10	2	0	0	0
Smoke, respiratory/systemic	11	10	0	1	0	0	0	0
Vapor, respiratory/systemic	6	0	1	0	2	0	0	0
		0	6	0	0	0	0	0
Inorganic Anions								
Dust, respiratory/systemic	98	19	19	44	10	6	0	0
Fumes, respiratory/systemic	9	0	1	0	8	0	0	0
Gas, respiratory/systemic	8	0	2	6	0	0	0	0
Liquid, skin	8	0	2	6	0	0	0	0
Particles, skin	40	9	10	21	0	0	0	0
Smoke, respiratory/systemic	12	5	0	0	2	5	0	0
Vapor, respiratory/systemic	20	5	3	11	0	1	0	0
	1	0	1	0	0	0	0	0
Phenols and Related Compounds								
Liquid, skin	349	19	143	91	96	0	0	0
Vapor, respiratory/systemic	291	15	135	87	54	0	0	0
	58	4	8	4	42	0	0	0
Miscellaneous Chemicals								
Dyes and Inks	148	7	12	42	63	24	0	0
Liquid, skin	147	7	12	42	62	24	0	0
Particles, skin	1	0	0	0	1	0	0	0
Natural Glues								
Fumes, skin	129	9	51	60	9	0	0	0
Liquid, skin	3	0	0	3	0	0	0	0
	126	9	51	57	9	0	0	0
Other Miscellaneous Chemicals								
Liquid, skin	162	18	53	10	70	11	0	0
Mists, respiratory/systemic	159	18	51	10	69	11	0	0
Particles, skin	1	0	1	0	0	0	0	0
	2	0	1	0	1	0	0	0

Table 5b (con't.)

Hazard Group and Form	Hours of Exposure							
	Total	<1	1-4	5-9	10-19	20-40	>40	Unknown
Plastics and Plastic Materials	431	64	161	139	40	27	0	0
Dusts, respiratory/systemic	27	16	0	5	6	0	0	0
Fumes, respiratory/systemic	11	11	0	0	0	0	0	0
Particles, skin	61	0	30	10	2	19	0	0
Smoke, respiratory/systemic	9	9	0	0	0	0	0	0
Liquid, skin	212	15	89	86	19	3	0	0
Mists, respiratory/systemic	26	12	13	1	0	0	0	0
Vapor, respiratory/systemic	85	1	29	37	13	5	0	0
Plant and Animal Products	163	23	17	54	26	43	0	0
Particles, skin	84	16	16	29	23	0	0	0
Dust, respiratory/systemic	44	0	0	0	1	43	0	0
Liquid, skin	32	6	0	25	1	0	0	0
Unknown	3	1	1	0	1	0	0	0
Environmental Conditions								
Ambient Heat	355	0	2	32	260	61	0	0
Physical agent	355	0	2	32	260	61	0	0
Ultra Violet	274	21	60	42	60	91	0	0
Physical agent	273	20	60	42	60	91	0	0
Unknown	1	1	0	0	0	0	0	0
Vibration, Repeated Motion, Sudden Impact Blows	191	0	3	42	16	130	0	0
Physical Agent	191	0	3	42	16	130	0	0
Noise	2,332	15	115	397	541	1,250	10	4
Physical agent	2,332	15	115	397	541	1,250	10	4
Other Environmental Conditions	135	2	21	20	52	40	0	0
Physical agent	90	2	21	20	10	37	0	0
Non application	45	0	0	0	42	3	0	0

Table 5b (con't.)

Hazard Group and Form	Total	Hours of Exposure						Unknown
		<1	1-4	5-9	10-19	20-40	>40	
Other, Unspecified and Unknown	506	140	137	120	77	30	1	1
Dust, respiratory/systemic	9	0	2	1	4	2	0	0
Fumes, respiratory/systemic	10	0	0	4	1	5	0	0
Liquid, skin	299	83	112	69	29	6	0	0
Particles, skin	71	44	6	21	0	0	0	0
Smoke, respiratory/systemic	23	0	3	12	7	0	1	0
Vapor, respiratory/systemic	82	13	14	8	36	11	0	0
Mist, skin	4	0	0	4	0	0	0	0
Mist, respiratory/systemic	1	0	0	1	0	0	0	0
Other and Unknown	7	0	0	0	0	6	0	1

Table 6a
 Occupational Disease Surveillance Study
 University of Washington - Department of Environmental Health

EMPLOYEES BY AGE, RACE AND SEX

Sex and Race	Total	<20	20-29	30-39	40-49	≥50	Unknown
TOTAL	908	57	305	189	140	199	18
White	835	42	289	171	132	189	12
Other	73	15	16	18	8	10	6
Men	767	45	261	159	113	173	16
White	713	35	249	145	109	165	10
Other	54	10	12	14	4	8	6
Women	141	12	44	30	27	26	2
White	122	7	40	26	23	24	2
Other	19	5	4	4	4	2	0

Table 6b
 Occupational Disease Surveillance Study
 University of Washington - Department of Environmental Health

LENGTH OF EMPLOYMENT AT CURRENT PLACE OF WORK BY AGE AND SEX

Length of Employment	MEN										WOMEN				
	Total	<20	20-29	30-39	40-49	≥50	Unknown	Total	<20	20-29	30-39	40-49	≥50	Unknown	
	TOTAL	767	45	261	159	113	173	16	141	12	44	30	27	26	2
<1 year	307	41	163	54	21	26	2	67	10	29	13	13	2	0	
1 - 4 years	135	2	57	33	20	20	3	26	0	8	5	3	9	1	
5 - 10 years	115	0	29	38	25	22	1	29	0	3	9	8	9	0	
>10 years	173	0	2	30	43	96	2	10	0	0	2	2	6	0	
Unknown	37	2	10	4	4	9	8	9	2	4	1	1	0	1	

Table 7

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

COMPLETION OF MEDICAL EXAMINATION, QUESTIONNAIRES,
AUTHORIZATION AND CONSENT FORMS BY AREA

Area	Medical Examination	Consent Forms	Questionnaires Completed	Authorization Forms
TOTAL	908	874	1,081	1,027
Tacoma	165	155	190	174
Seattle	348	335	397	388
Portland	355	345	454	430
Yakima	40	39	40	35

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

EMPLOYEES WHO COMPLETED
QUESTIONNAIRE BY YEARS OF EXPOSURE
TO SELECTED OCCUPATIONAL RISKS

Occupational Exposure	Total	Years of Exposure						Yes, Years Unknown	Unknown
		None	<1	1-5	6-9	>10			
Coal Mine	1,081	595	6	9	2	4	10	455	
Other Mine	1,081	798	10	10	1	0	10	252	
Quarry	1,081	803	3	4	1	0	4	266	
Foundry	1,081	724	32	35	6	15	28	241	
Pottery	1,081	811	0	4	0	1	0	265	
Fiber Mill	1,081	799	5	4	0	4	4	265	
Other Dust	1,081	523	66	125	31	40	108	188	
Welding Fumes	1,081	473	56	108	38	61	194	151	
Exhaust	1,081	502	38	125	31	41	160	184	
Noise	1,081	238	57	165	59	120	319	123	
Heat	1,081	473	35	94	18	37	216	208	
Arsenic	1,081	829	4	8	4	2	18	216	
Asbestos	1,081	803	8	8	3	3	52	204	
Benzene	1,081	823	2	2	3	3	32	216	
Beryllium	1,081	838	1	4	1	1	10	226	
Cadmium	1,081	805	3	14	4	4	32	219	
Carbon Tetrachloride	1,081	746	12	24	5	13	69	212	
Chromic Acid Mist	1,081	790	7	19	6	7	36	216	

Table 8 (con't.)

Occupational Exposure	Total	Years of Exposure						Yes, Years Unknown	Unknown
		None	≤ 1	1-5	6-9	≥ 10			
Epoxy Resin	1,081	716	23	46	4	10	86	196	
Fiber Glass	1,081	710	32	43	6	5	92	193	
Lead	1,081	691	25	35	9	44	96	181	
Mercury	1,081	824	2	3	1	5	26	220	
Microwaves, Lasers	1,081	828	5	7	1	0	15	225	
Pesticides	1,081	788	11	23	2	3	34	220	
Radioactive Materials	1,081	819	8	6	2	1	15	230	
Solvents	1,081	661	22	56	14	9	108	211	
Others	1,081	574	27	65	22	17	154	222	

Table 9

Occupational Disease Surveillance Study
 University of Washington - Department of Environmental Health

a. MEDICAL HISTORY QUESTIONNAIRE - PROPORTION OF WORKERS
 WITH ONE OR MORE POSITIVE AND WORK RELATED
 ANSWERS BY AREA

Area and Stratum	Workers Completing Questionnaire	Workers with One or More			
		Positive Answers		Work Related Answers	
		Workers	Percent	Workers	Percent
TOTAL	1,081	970	89.7	798	73.8
Tacoma	190	168	88.4	136	71.6
Seattle	397	353	88.9	293	73.8
Portland	454	415	91.4	339	74.7
Yakima	40	34	a	30	a

a - Percent not computed if denominator (workers completing questionnaire) is less than 100.

b. MEDICAL HISTORY QUESTIONNAIRE - AVERAGE NUMBER OF
 POSITIVE AND WORK RELATED ANSWERS PER EMPLOYEE BY AREA

Area and Stratum	Workers Completing Questionnaire	Positive Answers		Work Related Answers	
		Number	Per Worker	Number	Per Worker
TOTAL	1,081	6,696	6.2	3,254	3.0
Tacoma	190	942	5.0	472	2.5
Seattle	397	2,570	6.5	1,255	3.2
Portland	454	2,936	6.5	1,407	3.1
Yakima	40	248	6.2	120	3.0

Table 9c

Occupational Disease Surveillance Study
 University of Washington - Department of Environmental Health

POSITIVE RESPONSES TO MEDICAL HISTORY QUESTIONNAIRE (Percent¹)

Question Number	Medical History Questionnaire	Percent ¹	
		Positive	Job Related
1.	Has your eyesight blacked out completely any time in the past year?	3.8	1.4
2.	Do your eyes often blink or water?	21.9	14.3
3.	Do you often have bad pains in your eyes?	9.0	5.5
4.	Are your eyes often red or inflamed?	20.0	13.5
5.	Are you often troubled with bad spells of sneezing?	15.6	9.6
6.	Is your nose continually stuffed up?	23.2	14.2
7.	Do you suffer from a constantly running nose?	10.0	6.2
8.	At any time in the past year, have you had bad nose bleeds?	6.4	2.0
9.	Do you frequently suffer from heavy chest colds?	7.4	3.3
10.	When you catch a cold, do you usually have to go to bed?	8.5	2.7
11.	Are you troubled by constant coughing?	8.7	4.5
12.	Do you often have difficulty in breathing?	9.8	4.6
13.	Do you get out of breath long before anyone else?	11.1	3.2
14.	Do you have pains in the heart or chest?	16.7	3.5
15.	Does your heart often race like mad?	8.8	2.2

Question Number	Medical History Questionnaire	Percent ¹	
		Positive	Job Related
16.	Are your ankles often badly swollen?	4.5	2.4
17.	Did a doctor ever say you had varicose veins (swollen veins) in your legs?	6.9	3.0
18.	Do cold hands or feet trouble you even in hot weather?	4.9	0.9
19.	Do you have a chronic chest condition?	4.7	1.6
20.	Has a doctor ever said your blood pressure was too high?	14.3	1.4
21.	Has a doctor ever said you had heart trouble?	5.9	0.4
22.	As an adult, have you suffered from asthma?	3.4	1.1
23.	Have you ever had T.B. (tuberculosis)?	0.9	--
24.	Are you troubled by sore gums?	6.1	0.2
25.	Is your tongue usually badly coated?	4.1	0.7
26.	Have you lost your appetite in the past year?	9.4	2.3
27.	Do severe pains in the stomach often double you up?	5.1	1.6
28.	Has a doctor ever said you had stomach ulcers?	10.4	2.7
29.	Do you suffer from frequent loose bowel movements?	7.2	0.7
30.	At any time in the past year, have you had severe bloody diarrhea?	1.6	0.5
31.	Do you constantly suffer from bad constipation?	3.0	0.5
32.	As an adult, have you ever had jaundice (yellow eyes and skin)?	3.3	--
33.	Have you ever had serious liver or gall bladder trouble?	4.1	0.1
34.	Are your joints often painfully swollen?	6.0	3.0
35.	Are your muscles and joints stiff when getting out of bed in the morning for at least 15 minutes?	17.2	7.9

Question Number	Medical History Questionnaire	Percent ¹	
		Positive	Job Related
36.	Do you usually have severe pains in the arms or legs?	10.2	5.2
37.	Are you crippled with severe rheumatism (arthritis)?	1.5	0.6
38.	Do weak or painful feet make your life miserable?	7.4	5.3
39.	Do back pains make it hard for you to keep on with your work?	11.9	8.7
40.	Are you troubled with a serious bodily disability or deformity?	3.5	1.8
41.	Is your skin very sensitive or tender?	13.1	4.9
42.	Do cuts in your skin usually stay open a long time?	6.5	3.6
43.	Are you often bothered by severe itching?	12.3	7.1
44.	At any time in the last five years, have you had skin conditions such as red inflamed skin, tiny blisters, dry scaling skin, cracked skin?	30.4	16.6
45.	At any time in the last five years have you had hives or any other allergic skin conditions?	13.3	4.7
46.	At any time in the last five years, have you had skin conditions such as acne, pimples, warts or patchy loss of hair?	25.2	4.4
47.	Do you suffer badly from frequent severe headaches?	12.9	7.1
48.	Do you often have spells of severe dizziness?	4.4	1.4
49.	Do you frequently feel faint?	3.7	1.2
50.	At any time in the past year, have you had any periods of tingling or numbness in your arms or legs?	21.3	6.8
51.	At any time in the past year, was any part of your body paralyzed?	1.0	0.6
52.	At any time in the past year, have you been unconscious?	3.1	0.3

Table 9c (con't.)

Question Number	Medical History Questionnaire	Percent ¹	
		Positive	Job Related
53.	Has a doctor ever said you had kidney or bladder disease?	5.7	0.6
54.	Do you often get spells of complete exhaustion or fatigue?	11.5	6.7
55.	Do you usually get up tired and exhausted in the morning?	19.0	7.5
56.	At any time in the past five years, have you had any periods of frequent illness?	9.1	3.6
57.	At any time in the past five years were you treated for severe anemia (thin blood)?	2.7	0.5
58.	Did a doctor ever treat you for tumor or cancer?	5.2	0.2
59.	Did you have a serious accident or injury on the job in the past 12 months? for example, broken bone, brain concussion, deep cut requiring stitches, back injury, particle in eye, smashed finger?	16.1	16.1
60.	Did you have a minor accident or injury on the job in the past 12 months? for example, sprain, bruise, minor cut?	45.0	45.0
61.	Have you ever been unable to work on a job because of sensitivity to chemicals, dust, sunlight, etc.?	5.6	5.6
62.	Have you ever been unable to work on a job because of inability to perform certain motions?	2.8	2.8
63.	Have you ever been unable to work on a job because of inability to assume certain positions?	3.1	3.1
64.	Have you ever been unable to work on a job because of other medical reasons _____? Specify	7.3	7.3

¹ Each percent relates to the total number of questionnaires completed, 1,081.

Table 10a

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

REQUIRED MEDICAL EXAMINATION PROCEDURES BY AREA

Area	Medication Use		Height		Weight		Blood Pressure		Visual Acuity	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Total	177	731	3	905	3	905	53	855	10	898
Tacoma	138	27	3	162	3	162	45	120	8	157
Seattle	1	347	0	348	0	348	0	348	0	348
Portland	20	335	0	355	0	355	1	354	2	353
Yakima	18	22	0	40	0	40	7	33	0	40

Note: The answers indicate whether or not the procedure was performed or the questions asked of the patient.

Table 10b, Part 1

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

COMPLETED MEDICAL PROCEDURES BY INDICATION

Completed Medical Procedures by Indication by Area	Audiometry	Spirometry	Respiratory Questionnaire	Neurological Questionnaire	Chest X-ray	Other X-ray	Laboratory Test (Clinical)	Laboratory Test (Assay)	Lead Questionnaire	Pesticide Questionnaire
Total	908	908	908	908	908	908	908	908	908	908
No, not indicated	421	45	58	822	537	902	517	476	714	865
No, indicated	45	22	43	13	46	1	27	43	14	3
Yes	442	841	807	73	325	2	364	389	179	37
Unknown	0	0	0	0	0	3	0	0	1	3
Tacoma	165	165	165	165	165	165	165	165	165	165
No, not indicated	96	29	33	152	109	163	144	134	158	165
No, indicated	5	16	23	11	14	0	3	20	7	0
Yes	64	120	109	2	42	2	18	11	0	0
Unknown	0	0	0	0	0	0	0	0	0	0
Seattle	348	348	348	348	348	348	348	348	348	348
No, not indicated	117	1	4	324	146	345	217	217	265	344
No, indicated	19	0	0	1	2	1	17	14	7	0
Yes	212	347	344	23	200	0	114	117	75	1
Unknown	0	0	0	0	0	2	0	0	1	3
Portland	355	355	355	355	355	355	355	355	355	355
No, not indicated	168	15	19	307	282	354	156	103	251	355
No, indicated	21	6	6	1	29	0	7	6	0	0
Yes	166	334	330	47	44	0	192	246	104	0
Unknown	0	0	0	0	0	1	0	0	0	0
Yakima	40	40	40	40	40	40	40	40	40	40
No, not indicated	40	0	2	39	0	40	0	22	40	1
No, indicated	0	0	14	0	1	0	0	3	0	3
Yes	0	40	24	1	39	0	40	15	0	36
Unknown	0	0	0	0	0	0	0	0	0	0

Note: Indication refers to whether or not the procedure was performed as indicated by the workers' exposures at the time of the medical examination. It does not refer to the usefulness of the outcome in helping to make a diagnosis.

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

INDICATED MEDICAL PROCEDURES BY AREA (Percent)

Indication by Area	Audiometry	Spirometry	Respiratory Questionnaire	Neurological Questionnaire	Chest X-ray	Other X-ray	Laboratory Test (Clinical)	Laboratory Test (Assay)	Lead Questionnaire	Pesticide Questionnaire
Total, Indicated	(487) 100.0	(863) 100.0	(850) 100.0	(86)	(371) 100.0	(3)	(391) 100.0	(432) 100.0	(193) 100.0	(40)
Not Completed	9.2	2.5	5.1	(13)	12.4	(1)	6.9	10.0	7.2	(3)
Completed	90.8	97.4	94.9	(73)	87.6	(2)	93.1	90.0	92.7	(37)
Tacoma, Indicated	(69)	(136) 100.0	(132) 100.0	(13)	(56)	(2)	(21)	(31)	(7)	(0)
Not Completed	(5)	11.8	17.4	(11)	(14)	(0)	(3)	(20)	(7)	(0)
Completed	(64)	88.2	82.6	(2)	(42)	(2)	(18)	(11)	(0)	(0)
Seattle, Indicated	(231) 100.0	(347) 100.0	(344) 100.0	(24)	202 100.0	(1)	(131) 100.0	(131) 100.0	(82)	(1)
Not Completed	8.2	0	0	(1)	1.0	(1)	13.0	10.7	(7)	(0)
Completed	91.7	100.0	100.0	(23)	99.0	(0)	87.0	89.3	(75)	(1)
Portland, Indicated	(187) 100.0	(340) 100.0	(336) 100.0	48	(73)	(0)	(199) 100.0	(252) 100.0	(104) 100.0	(0)
Not Completed	11.2	1.8	1.8	(1)	(29)	(0)	3.5	2.4	0	(0)
Completed	88.8	98.2	98.2	(47)	(44)	(0)	96.5	97.6	100.0	(0)
Yakima, Indicated	(0)	(40)	(38)	(1)	(40)	(0)	(40)	(18)	(0)	(39)
Not Completed	(0)	(0)	(14)	(0)	(1)	(0)	(0)	(3)	(0)	(3)
Completed	(0)	(40)	(24)	(1)	(39)	(0)	(40)	(15)	(0)	(36)

Note: See Table 11b, Part 1 for distribution of indicated tests among all persons completing medical examination.

() number of cases; percents not computed if denominator is less than 100.

Table 11a

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

MEDICAL CONDITION¹ BY OCCUPATIONAL RELATIONSHIP

Medical Condition ¹	Total	Probable Occupational Disease	Can't Evaluate and Doubtful	Suggestive History	Probable Non-Occupational Disease
TOTAL	1,116	346	151	113	506
Anemia and other diseases of blood	49	7	21	1	20
Conjunctivitis and Other Conditions of the Eye	74	31	1	24	18
Refractive Errors	84	0	1	0	83
Hearing Loss, mild	86	68	12	0	6
Hearing Loss, moderate	32	26	4	0	2
Hearing Loss, advanced	4	2	2	0	0
Hearing Loss, possible threshold	16	0	16	0	0
Hypertension	138	1	0	0	137
Heart Disease	14	0	1	0	13
Other Diseases of Circulatory System	3	0	0	0	3
Respiratory Conditions, Excluding Upper	289	49	76	11	153
Upper Respiratory Conditions	73	38	2	21	12
Skin Conditions	128	64	4	35	25
Diseases of Musko-Skeletal and Connective Tissues	28	9	2	7	10
Symptoms and Ill Defined Conditions	17	1	6	1	9
Non Symptomatic Conditions	27	27	0	0	0
Toxic and Other Adverse Effects	23	9	1	13	0
Low Grade Toxic Effects	14	13	1	0	0
Other Conditions	17	1	1	0	15

Note: Probable occupational disease - Manifestations of disease are consistent with those known to result from excessive exposure to a given injurious agent; this injurious agent is present in the patient's working environment and significant contact in course of usual duties is likely.

Doubtful occupational disease - 1) Manifestations of disease are not entirely consistent with those known to result from excessive exposure to an injurious agent or 2) manifestations of illness are consistent with those known but no significant contact with alleged injurious agent can be established.

Suggestive History - Manifestations of disease as given in history are consistent with those known to result from excessive exposure to a given injurious agent; this exposure is or has taken place; there is no objective evidence of disease at the time of the medical examination.

Cannot be evaluated - an association between disease and occupational factors has never been clearly established; e.g. cardiovascular disease, respiratory infections, mental and psychoneurotic episodes.

Non-occupational - Manifestations of disease but no relationship to occupational exposures.

¹Does not include employees who took hearing tests only.

Table 11b

Occupational Disease Surveillance Study
 University of Washington - Department of Environmental Health

LOSS OF HEARING¹ BY OCCUPATIONAL RELATIONSHIP

Condition	Total	Probable Occupational	Can't Evaluate and Doubtful	Suggestive History	Non Occupational
TOTAL	257	162	71	0	24
Hearing Loss, Mild	162	119	26	0	17
Hearing Loss, Moderate	56	39	10	0	7
Hearing Loss, Advanced	8	4	4	0	0
Hearing Loss, Possible Threshold	31	0	31	0	0

¹Includes workers with hearing loss who completed the medical and workers who participated in the hearing test only.

Table 11c

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

PROBABLE OCCUPATIONALLY INCURRED CONDITIONS
(ALL PARTICIPANTS IN MEDICAL EXAMINATION)
BY LEVEL OF EXPOSURE CONTROLS
RATES PER 100 WORKERS

Conditions	All Levels of Control			One or More Inadequate/Marginal Exposure		
	Workers	Workers with Condition	Rate	Workers	Workers with Condition	Rate
All	908	258 ^a	28.4	480	187 ^a	39.0
Respiratory	908	73	8.0	480	47	9.8
Skin	908	64	7.0	480	43	9.0
Eye	908	31	3.4	480	24	5.0
Hearing Loss	908	96	10.6	480	78	16.2

^a Conditions do not total because a worker could have one or more probable occupationally incurred conditions.

Table 11d

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

PROBABLE OCCUPATIONALLY INCURRED CONDITIONS
BY WORKERS EXPOSED TO SELECTED EXPOSURES BY LEVEL OF
EXPOSURE CONTROL
RATES PER 100 WORKERS

Selected Exposure and Condition	All Levels of Control			One or More Inadequate/Marginal Exposure		
	Workers	Workers with Condition	Rate	Workers	Workers with Condition	Rate
Respiratory/Systemic Irritants Respiratory/Systemic Conditions	517	63	12.2	141	23	16.3
Skin Irritants Skin Conditions	600	50	8.3	179	24	13.4
Noise ¹						
Mild Hearing Loss	724	101	14.0	511	89	17.4
Moderate Hearing Loss	724	32	4.4	511	28	5.5
Advanced Hearing Loss	724	3	0.4	511	2	0.4
Halogenated Hydrocarbon Solvents						
All Conditions	52	12	(23.1) ^a	8	1	a
Respiratory Conditions	52	3	(5.8) ^a	8	1	a
Skin Conditions	52	8	(15.4) ^a	8	0	-
Lead						
All Effects of Lead	105	18	17.1	34	8	a
Blood Conditions	105	5	4.8	34	3	a
Non-symptomatic Conditions ²	105	10	9.5	34	4	a
Toxic Effects	105	6	5.7	34	2	a

¹Includes workers exposed to noise who completed medical and workers exposed to noise who took hearing test only.

²Elevated blood leads, no other signs or symptoms.

^aRate not computed if denominator under 50; in () if denominator between 50-100.

Table 12a

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

COMPARISON OF PROBABLE OCCUPATIONAL DISEASE AND INJURY FOUND ON MEDICAL SURVEY
WITH THE EMPLOYERS' LOG AND WORKMEN'S COMPENSATION CLAIMS

Area and Condition	Total	Survey Only	Employers' Log Only	Workmen's Compensation Only	More Than One Source
TOTAL	1,456	818	83	135	420
Occupational Disease	451	399	11	13	28
Occupational Injuries	1,005	419	72	122	392
Tacoma	198	119	12	5	62
Occupational Disease	55	46	2	2	5
Occupational Injuries	143	73	10	3	57
Seattle	584	364	16	59	145
Occupational Disease	199	193	0	1	5
Occupational Injuries	385	171	16	58	140
Portland	674	335	55	71 ^a	213
Occupational Disease	197	160	9	10	18
Occupational Injuries	477	175	46	61	195

^a Information on Workmen's Compensation claims (lost time and non lost time) could not be obtained from the insurance carriers of 4 establishments; instead lost time only claims were reviewed in the Department of Labor and Industries, Salem, Oregon.

Table 12b

Occupational Disease Surveillance Study
University of Washington - Department of Environmental Health

COMPARISON OF PROBABLE OCCUPATIONAL DISEASE CONDITIONS FOUND ON MEDICAL
SURVEY WITH THE EMPLOYER'S LOG AND WORKMEN'S COMPENSATION CLAIMS

Probable Occupational Disease Condition	Total	Survey Only	Log Only	Compensation Claims Only	Survey and Log	Survey and Claims	Log and Claims	All Three
TOTAL	451	399	11	13	2		20	6
Anemia and Other Diseases of Blood	7	7						
Conjunctivitis and other Conditions of Eye Refractive Errors	40	30		2	1		7	
Hearing Loss, Mild	113	113						
Hearing Loss, Moderate	39	39						
Hearing Loss, Advanced	4	4						
Unknown Hearing Loss	1			1				
Hypertension	1	1						
Respiratory Conditions excluding upper Upper Respiratory Conditions	51 39	49 39	1				1	
Skin Conditions	76	58	6	3	1		3	5
Diseases of Musko-Skeletal and Connective Tissues	13	8		2			2	1
Symptoms and Ill-Defined Conditions	1	1						
Non-Symptomatic Conditions	27	27						
Chemical Burns	6		1	3			2	
Toxic and Other adverse effects	17	9	3	2			3	
Low Grade Toxic Effects	13	13						
Other Conditions ¹	3	1					2	

¹ Includes conditions such as diseases of digestive system and epididymitis.

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APPENDICES

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STANDARD INDUSTRIAL CLASSIFICATIONS INCLUDED IN THE SURVEY

- I. Agriculture
 - 011 Field Crops
 - 012 Fruits, Tree Nuts, and Vegetables
- II. Lead Using Industries
 - A. 2711 Newspapers: Publishing, Publishing and Printing
2751 Commercial Printing, Except Lithographic
 - B. 2791 Typesetting
 - 3362 Brass, Bronze, Copper, Copper Base Alloy Castings
 - 3369 Nonferrous Castings, not elsewhere classified
 - 3691 Iron and Steel Forgings
 - 7539 Automobile Repair Shops, not elsewhere classified
- III. Chlorinated Hydrocarbon Solvent Using Industries
 - A. 3079 Miscellaneous Plastic Products
 - 3471 Electroplating, Plating, Polishing, Anodizing and Coloring
 - 3479 Coating, Engraving, and Allied Services, not elsewhere classified
 - 3494 Valves and Pipe Fittings, Except Plumbers' Brass Goods
 - 3564 Blowers and Exhaust and Ventilation Fans
 - 3811 Engineering, Laboratory, and Scientific and Research Instruments and Associated Equipment
 - 3841 Surgical and Medical Instruments and Apparatus
 - 3842 Orthopedic, Prosthetic, and Surgical Appliances and Supplies
 - 3843 Dental Equipment and Supplies
 - 3851 Ophthalmic Goods
 - B. 7216 Dry Cleaning and Dyeing Plants, Except Rug Cleaning
- IV. Other Industries
 - 085 Forestry Services
 - 261 Pulp Mills
 - 262 Paper mills, Except Building Paper Mills
 - 263 Paperboard Mills
 - 270 Printing, Publishing, and Allied Industries
 - 280 Chemicals and Allied Products
 - 290 Petroleum Refining and Allied Industries
 - 300 Rubber and Miscellaneous Plastic Products
 - 330 Primary Metal Industries
 - 340 Fabricated Metal Products, Except Ordinance, Machinery, and Transportation Equipment
 - 350 Machinery Except Electrical
 - 360 Electrical Machinery, Equipment, and Supplies
 - 373 Ship and Boat Building and Repairing
 - 379 Miscellaneous Transportation Equipment
 - 421 Trucking, Local and Long Distances
 - 458 Fixed Facilities and Services Related to Air Transportation
 - 723 Beauty Shops
 - 753 Automobile Repair Shops
 - 1752 Floor Laying and Other Floorwork, not elsewhere classified
 - 2042 Prepared Feeds for Animals and Fowls
 - 2432 Veneer and Plywood
 - 2491 Wood Preserving
 - 2499 Wood Products, not elsewhere classified
 - 3791 Trailer Coaches
 - 5591 Boat Dealers
 - 5599 Aircraft and Automobile Dealers, not elsewhere classified

Source: (6)

Appendix IIa

Excerpts From Lead Protocol

Industrial Hygiene Inspection and Analytical Criteria

A. Walk-Through Survey

Employee exposure to lead and lead compounds will be identified and exposure control methods rated as: adequate, inadequate, or marginal. Assessment will be in terms of types of exposure, i.e. fume or particulate, duration of exposure, and likelihood of significant airborne concentrations. Key considerations in arriving at conclusions regarding the adequacy of control measures include:

1. type of exposure;
2. presence or absence of local exhaust or dilution ventilation;
3. manner of use;
4. use of personal protective clothing and equipment;
5. appearance of employee (skin, clothing);
6. appearance of work area (accumulation of dust, poor housekeeping);
7. assessment of comments made by employees and/or members of management.

- B. Follow-up Surveys (Ancillary Project II). Some of the establishments visited will be of sufficient interest, by reason of either inadequate exposure control or significant medical findings, (or both) to warrant a re-visit. During the follow-up survey, employee exposure duration in particular areas or operation will be more closely determined and measurements of airborne contaminants will be performed. Lead fumes will be collected by an electrostatic precipitator. Lead dust will be collected by standard impingers or filter paper. Analysis will be by spectrophotometer on a dithizone extraction.

Questionnaire, Medical Diagnostic and Other Statistical Criteria

A. Questionnaire (Appendix VI)

The pertinent questions are:

1. Digestive system: 24, 26, 27, 31
2. Musculoskeletal system and connective tissue: 35, 36, 38, 39

3. Central nervous system: 47, 48
 4. General fatigue: 54, 55
- B. Routine Examination Procedures
1. Height
 2. Weight
 3. Visual acuity
 4. Blood pressure
- C. Special Examinations
1. History (See Lead Questionnaire, attached)
 2. Physical examination
 - a. general appearance (dull facial expression, grey pallor)
 - b. oral cavity (spongy gums, lead line, dental hygiene)
 - c. abdomen (for tenderness, listen for diminished peristaltic activity)
 - d. musculoskeletal system and connective tissue (wrist drop)
 - e. rule out any conditions relating to the feet in connection with pain in back and extremities.
 3. Laboratory tests (refer: Lead, Medical Procedure Manual)
 - a. CBC and smear (note: look particularly for stippling)
 - b. Urinalysis - routine urine lead (>150mm/liter) plus Delta - Amino - Levulinic Acid (>20mm/liter)
 - c. Blood lead (.08mg/100 cc blood)
 - d. If blood lead is borderline (.04 - .08 mg %) with low grade symptoms, then do urine excretion test. (See Medical Procedure Manual, Lead).

1. Are you troubled by bleeding gums? NO YES
2. During the past year have you had periods of several weeks where you lost your appetite or were unenthusiastic about eating even though you were hungry? NO YES
3. During the past year have you had periods of several weeks when you were troubled with dull stomach pains? NO YES
4. During the past year have you had periods of sluggish bowel movements? NO YES
5. During the past year:
- (a) Have you had vague aches and pains in your arms and legs or in your back? NO YES * If YES, answer (b) below.
- (b) Did these aches and pains occur even when you were at rest at night? NO YES *
- * NOTE TO PHYSICIAN: If YES, be sure to rule out any conditions of the feet that may be the cause of these symptoms.
6. During the past year have you had periods of several weeks in which you had dull headaches in the course of the day? NO YES
7. During the past year:
- (a) Have you suffered from spells of unhappiness or exhaustion; have you felt disinterested in life? NO YES If YES, answer (b) below.
- (b) Are these feeling of unhappiness, exhaustion, or disinterest unresolved after a night of sleep? NO YES
8. Do you get up tired after a full night sleep? NO YES
9. Have you noticed a change in the frequency of your sexual relations? NO YES

Appendix IIb

Excerpts from Chlorinated Hydrocarbon Solvents Protocol

Industrial Hygiene Inspection and Analytical Criteria

A. Walk-Through Survey

Employee exposure to chlorinated hydrocarbon solvents will be identified and exposure control methods rated as: adequate, inadequate, or marginal. Assessment will be in terms of types of exposures, and likelihood of significant vapor concentrations. Key considerations in arriving at conclusions regarding the adequacy of control measures include:

1. toxicity of hazardous nature of the solvent;
2. presence or absence of local exhaust or dilution ventilation;
3. manner of use;
4. use of personal protective clothing and equipment;
5. appearance of employees (skin, clothing);
6. solvent temperature and exposed surface area;
7. intensity of solvent odor;
8. assessment of comments made by employees and/or members of management.

- B. Follow-up Surveys (Ancillary Project II). Some of the establishments visited will be of sufficient interest, by reason of either inadequate exposure control or significant medical findings, (or both) to warrant a re-visit. During the follow-up survey employee exposure duration in particular areas or operation will be more closely determined and measurements of airborne contaminants will be performed. In the case of the chlorinated solvents, airborne concentrations will be determined by the use of a calibrated Davis Halide meter and/or by collection in evacuated flasks and subsequent analysis by gas chromatography.

Questionnaire, Medical Diagnostic and Other Statistical Criteria

A. Questionnaire (Appendix VI)

The pertinent questions are:

1. Skin: 41, 42, 43, 44
2. Eyes: 2, 3, 4
3. Upper respiratory system: 6, 7
4. Chronic effects on liver and CNS: 26, 32, 33, 47, 48, 49, 50, 52, 54

B. Routine Examination Procedures

1. Height
2. Weight
3. Visual acuity
4. Blood pressure

C. Special Examination

1. History
2. Skin (see criteria- Manual of Medical Procedures)
3. Eyes (see criteria- Manual of Medical Procedures)
4. Chronic Effects
 - a. bio-assay of metabolites of chlorinated hydrocarbon in urine (to be determined whether grab sample or collection at time of known exposure i.e., by industrial hygienist).
 - b. liver function profile

QUESTIONNAIRE ON NEUROLOGICAL CONDITIONS
(chlorinated hydrocarbon solvent exposure)

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OHS 68S 72178

1. In the past two years have you fainted or lost consciousness (passed out)?
No
Yes If yes, complete answersheet I.
2. In the past two years have you fallen down?
No
Yes If yes, complete answersheet I and answer the following question:
Did you feel dizzy or faint before you fell? Yes No
3. In the past two years have you ever suddenly lost your eyesight or been unable to see for a short period of time (in either or both eyes)?
No
Yes If yes, complete answersheet I.
4. In the past two years have you ever suddenly seen double (or had double vision)?
No
Yes If yes, complete answersheet I.
5. In the past two years have there been times when you were suddenly unable to talk (or speak) normally?
No
Yes If yes, complete answersheet I.
6. In the past two years have you been suddenly unable to swallow normally?
No
Yes If yes, complete answersheet I.
7. In the past two years have you had a sudden feeling of numbness or pins and needles, (tingling), (loss of feeling), (dead feeling) in any part of your body?
No
Yes If yes, complete answersheet I and answer the following question:
Was this the: 1. right side of your face 4. left arm
2. left side of your face 5. right leg
3. right arm 6. left leg

8. In the past two years have you ever lost the power or been paralyzed in your arms or legs or been unable to move them?

No

Yes

If yes, complete answersheet I and the following question:

Was it the: 1. right arm 5. left arm
 2. right leg 6. left leg
 3. right arm and leg 7. other
 4. left arm and leg

9. In the past two years have you had any dizzy spells?

No

Yes

If yes, complete answersheet II.

10. How is your memory? Is it:

1. good

2. poor

3. fair

4. very bad

11. Is your memory:

1. as good as it used to be

2. not as good as it used to be

3. much worse than it used to be

12. Do you remember things that happened many years ago?

1. Yes

2. No

13. Do you remember things that happened last week?

1. Yes

2. No

14. Do you have or have you ever had diabetes?

Yes

No

15. Did a doctor tell you that you had diabetes?

Yes

No

16. Do you have or have you ever had epilepsy (seizures, spells)?

Yes

No

17. Did a doctor tell you that you have epilepsy?

Yes

No

18. Have you ever had a stroke?

Yes

No

19. If yes, did a doctor tell you that you had a stroke?

Yes

No

OBTAIN NAME OF PHYSICIAN, HOSPITAL AND DATE

name _____

address _____

date _____

QUESTION _____

ANSWER SHEET I

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1. DID THIS HAPPEN FOR ANY REASON YOU KNOW OF? no yes explain _____

RECORD THE ANSWERS FOR THE FOLLOWING QUESTIONS IN THE BOXES BELOW. IF THERE WERE MORE THAN 5 EPISODES, INCLUDE ONLY THE MOST RECENT EVENTS.

2. HOW MANY TIMES DID THIS HAPPEN?

3. CAN YOU GIVE US THE APPROXIMATE DATE (S)?

4. WHAT WERE YOU DOING AT THE TIME? (If occupational, what tools were you using, what job were you doing, and what was the time sequence of events?)

5. WHERE WERE YOU AT THE TIME?

6. HOW LONG DID THIS CONDITION LAST?

7. DID YOU GO TO YOUR DOCTOR OR HOSPITAL?

8. CAN YOU GIVE ME THE NAME AND ADDRESS OF HOSPITAL AND DOCTOR?

9. DID THIS HAPPEN TOGETHER WITH ANY OTHER SYMPTOMS? no yes

DATE	ACTIVITY AND PLACE AT ONSET	LENGTH OF TIME	PHYSICIAN OR HOSPITAL	OTHER SYMPTOMS
1.				
2.				
3.				
4.				
5.				

ANSWER SHEET II

1. DID THIS HAPPEN FOR ANY REASON YOU KNOW OF? no yes explain _____

RECORD THE ANSWERS FOR THE FOLLOWING QUESTIONS IN THE BOXES BELOW. IF THERE WERE MORE THAN 5 EPISODES, INCLUDE ONLY THE MOST RECENT EVENTS.

2. HOW MANY TIMES DID THIS HAPPEN?

3. CAN YOU GIVE US THE APPROXIMATE TIME?

4. WHAT WERE YOU DOING AT THE TIME? (If occupational, what tools were you using, what job were you doing, and what was the time sequence of events?)

5. WHERE WERE YOU AT THE TIME?

6. HOW LONG WERE YOU DIZZY?

7. DID YOU GO TO YOUR DOCTOR OR HOSPITAL?

8. CAN YOU GIVE ME THE NAME AND ADDRESS OF HOSPITAL AND DOCTOR?

9. DURING THIS DIZZY SPELL DID YOU FEEL THAT YOU WERE MOVING OR THE ROOM WAS MOVING?

10. DID THIS DIZZY SPELL HAPPEN IMMEDIATELY UPON GETTING UP IN THE MORNING OR OUT OF A CHAIR?

11. DID YOU HAVE ANY TROUBLE SEEING DURING THIS (THESE) DIZZY SPELL (S)?

12. WHILE YOU WERE DIZZY DID YOU SEE THINGS DOUBLE?

13. WHILE YOU WERE DIZZY WERE YOU TEMPORARILY BLIND AND UNABLE TO SEE?

14. WERE YOU UNABLE TO SEE OUR OF 1) right eye or right side, or 2) left eye or left side

15. DID THIS HAPPEN TOGETHER WITH ANY OTHER SYMPTOMS? no yes

DATE	ACTIVITY AND PLACE AT ONSET	LENGTH OF TIME	PHYSICIAN OR HOSPITAL	ROOM OR YOU MOVING		OUT OF CHAIR		TROUBLE SEEING		DOUBLE VISION		TEMPORARILY BLIND		EYES		OTHER SYMPTOMS
				YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	RE	LE	
1.																
2.																
3.																
4.																

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Appendix IIc

Excerpts from Agriculture Protocol

Industrial Hygiene Inspection and Analytical Criteria

A. Walk-through survey

The primary difference between the technique utilized for manufacturing industries and that for agriculture will probably be the necessity to rely more on discussions with growers regarding the sequence of operations conducted before and after the walk-through survey. Persistent herbicides, pesticides or other chemical agents may have been applied several days before the walk-through but still posing a risk at the time of the walk-through. Similarly, knowledge of a forthcoming operation may be helpful in assessing occupational exposures to physical and chemical agents. The conduct of the survey will differ little, in other respects, from that of the industrial walk-through. Key considerations in arriving at conclusions regarding the adequacy of control measures include:

1. type of exposure (chemical, physical, particulate etc.)
2. duration of exposure.
3. manner of use.
4. presence or absence of wind currents, magnitude and direction.
5. ambient temperature.
6. use of personal protective clothing and devices.
7. assessment of comments made by workers and/or growers.

B. Follow-up surveys (Ancillary Project II).

Some follow-up surveys will be performed. Field collection airborne physical or chemical agents will be accomplished using battery operated midget impingers, membrane or paper filter, length of stain tubes, or evacuated flasks, as appropriate for the agent in question. Analysis of collected samples will also be as appropriate for the agent in question. In the case of parathion, collection and analysis will be performed utilizing midget impingers with subsequent chemical treatment for analysis by a spectrophotometer.

Questionnaire, Medical Diagnostic and Other Statistical Criteria

Agriculture has been selected as a target stratum in the study in order for us to ascertain whether the methods devised for identifying occupational disease in non agricultural industry can be applied in agriculture.

Basic procedures will be used.

Appendix IIc (cond.)

- A. The Occupational Health Questionnaire will be completed by all workers selected for the medical survey. Since some of these agricultural workers do not understand English, a translator will be available to help them.
- B. Routine Examination Procedures
 - 1. Height
 - 2. Weight
 - 3. Visual acuity
 - 4. Blood pressure
- C. Special Examinations and laboratory tests
 - 1. History
 - 2. Special examinations and laboratory tests will be based upon current exposures as determined by the industrial hygienist, past exposures as determined by answers in the questionnaire, and interview with the physician.
 - 3. Workers known to have been exposed to pesticides will complete a special questionnaire at the time of the medical examination.
(See attached.)

Past Episodes of Illness Due to Agricultural Chemicals

Note to interviewer: This questionnaire is to help the physician evaluate possible past episodes of illness due to agricultural chemicals. With every "yes" answer, ask the following question: (What do you think caused this?) Then probe:

1. Does worker relate this to use of pesticides and other agricultural chemicals.
2. What were the circumstances at work when these symptoms occurred? (Such as spillage, equipment malfunction, drift, poor work practices, early re-entry).
3. Was the worker using any protection at the time? (Such as rubber gloves, mask or respirator, coveralls, rubber boots, long sleeves.)
4. How many occurrences of these symptoms has worker had.

In the past two years have you:

1. been aware of periods of bodily discomfort as though you were about to get sick?

No Yes Probe: _____

2. had periods of feeling tired not explained by your usual work?

No Yes Probe: _____

3. had periods of confusion, i.e. feeling mixed up?

No Yes Probe: _____

4. suffered from headaches?

No Yes Probe: _____

5. had periods of nervousness?

No Yes Probe: _____

6. had periods of feeling extra restless and under strain?

No Yes Probe: _____

7. had periods of light headedness?

No Yes Probe: _____

- 8. had fainting spells?
No Yes Probe: _____

- 9. had periods of dizziness?
No Yes Probe: _____

- 10. had skin rash?
No Yes Probe: _____

- 11. ever been unconscious?
No Yes Probe: _____

- 12. ever had periods of flushing of the skin?
No Yes Probe: _____

- 13. had periods of increased sweating not explained by your usual work?
No Yes Probe: _____

- 14. had periods of blurry vision?
No Yes Probe: _____

- 15. had periods of increased tearing of the eyes?
No Yes Probe: _____

- 16. had trouble with soreness and inflammation inside your nose?
No Yes Probe: _____

- 17. had trouble with stuffed nose?
No Yes Probe: _____

- 18. had periods of increased saliva in the mouth?
No Yes Probe: _____

19. had periods of tightness in chest?

No Yes

Probe: _____

20. had periods when it was difficult to breathe?

No Yes

Probe: _____

21. had periods when you felt your heart beating?

No Yes

Probe: _____

22. had periods of being sick to the stomach?

No Yes

Probe: _____

23. had periods of vomiting?

No Yes

Probe: _____

24. had periods of belly pain or cramps?

No Yes

Probe: _____

25. had runny stools? (diarrhea)

No Yes

Probe: _____

26. had periods of muscular weakness?

No Yes

Probe: _____

27. had periods of feeling shaky?

No Yes

Probe: _____

28. had convulsions?

No Yes

Probe: _____

29. had periods of tingling and numbness of toes and fingers?

No Yes

Probe: _____

30. had any periods of fever?

No Yes

Probe: _____

Pasados Epidodios de Enfermedades Causadas por Productos Quimicos Agrícolas

Nota al entrevistador: Este cuestionario es para ayudar al doctor a evaluar posibles episodios pasados concerniente enfermedades causadas por productos quimicos agrícolas. En cada respuesta de "SI" pregunte la siguiente pregunta: (Que piensa usted que causo esto?) Entonces pregunte:

1. Relaciona esto el trabajador al uso de pestilizantes y otros productos quimicos agrícolas.
2. Cuales fueron las circunstancias en el trabajo cuando estas sintomas ocurrieron? (Tal como derrames malfuncionamiento de equipo, apilamiento, practicas de trabajo no deseadas, etc.).
3. En tal ocasión usaba al trabajador alguna clase de protección? (Tal como guantes de hule, máscara or respirador, sobretodo, botas de hule, manga large).
4. Cuantas veces ha tenido el trabajador estas sintomas?

En los pasados 2 años usted:

1. ha tenido momentos de malestares de cuerpo como si se fuera ha enfermar?
No ___ Si ___ Explique: _____
2. ha tenido momentos en que se siente cansado, lo cual no coincide con su trabajo usual?
No ___ Si ___ Explique: _____
3. ha tenido períodos de confusión, como sintiendose confundido?
No ___ Si ___ Explique: _____
4. ha sufrido dolores de cabeza?
No ___ Si ___ Explique: _____
5. ha tenido períodos de nerviosismo?
No ___ Si ___ Explique: _____
6. ha tenido períodos en que se siente muy inquieto y bajo tensión?
No ___ Si ___ Explique: _____
7. ha tenido momentos en que se siente mariado?
No ___ Si ___ Explique: _____

8. ha tenido desmayos?
No ___ Si ___ Explique: _____
9. ha tenido períodos de marcos?
No ___ Si ___ Explique: _____
10. ha tenido erupción del cutis?
No ___ Si ___ Explique: _____
11. ha estado sin sentido?
No ___ Si ___ Explique: _____
12. ha tenido momentos en que su piel se pone roja?
No ___ Si ___ Explique: _____
13. ha tenido períodos en que suda demasiado lo cual no coincide con su trabajo usual?
No ___ Si ___ Explique: _____
14. ha tenido períodos que la **vista** se la nubla?
No ___ Si ___ Explique: _____
15. ha tenido períodos en que sus ojos lagrimean demasiado?
No ___ Si ___ Explique: _____
16. ha tenido problemas de dolencias o inflamación adentro de la nariz?
No ___ Si ___ Explique: _____
17. ha tenido problemas de respirar por la nariz debido a catarros?
No ___ Si ___ Explique: _____
18. ha tenido períodos en que la boca se le pone salivada?
No ___ Si ___ Explique: _____
19. ha tenido períodos en que sienta el pecho apretado?
No ___ Si ___ Explique: _____
20. ha tenido períodos en que le era difícil respirar?
No ___ Si ___ Explique: _____

21. ha tenido períodos en que siente los latidos de su corazón?

No ___ Si ___ Explique: _____

22. ha tenido períodos de sentirse enfermo del estomago?

No ___ Si ___ Explique: _____

23. ha tenido períodos de vomitar?

No ___ Si ___ Explique: _____

24. ha tenido períodos de calambres o dolores del vientre?

No ___ Si ___ Explique: _____

25. ha tenido diarrea?

No ___ Si ___ Explique: _____

26. ha tenido períodos de debilidad muscular?

No ___ Si ___ Explique: _____

27. ha tenido períodos de sentirse tembloroso?

No ___ Si ___ Explique: _____

28. ha tenido convulsiones o ataques?

No ___ Si ___ Explique: _____

29. ha tenido períodos en que los dedos de las manos y de los pies le hormigean o se le adormecen?

No ___ Si ___ Explique: _____

30. ha tenido períodos de fiebre?

No ___ Si ___ Explique: _____

Appendix III

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

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*School of Public Health and Community Medicine
Department of Environmental Health sc34*

Seattle Employer

Dear Sir:

The School of Public Health and Community Medicine of the University of Washington in Seattle will be conducting a special survey of occupational health in your establishment within the next 2 weeks. The purpose of this study is to develop a method of occupational health surveillance. Some background and a brief description of the study follow.

The Occupational Safety and Health Act of 1970 gives NIOSH (National Institute for Occupational Safety and Health) the responsibility for determining the incidence of occupational disease by such medical examinations and tests as are needed and through contracts and grants with outside agencies, if advisable. The School of Public Health and Community Medicine at the University of Washington has a contract with NIOSH to develop and test a method for identifying the extent and kinds of occupational disease. Results from this study also will be used to help set appropriate OSHA standards for the workplace. An advisory committee of representatives from management, labor and government in the State of Washington is helping to coordinate this study.

The study consists of two phases. First there will be an environmental survey of some 140 places of work, 48 in the Seattle area of which yours is one. This will be conducted by an industrial hygienist, Mr. F. J. Foster, of our staff. He will note any occupational health hazards, evaluate the adequacy with which they are controlled, and identify the workers exposed to these hazards. Typically, an industrial hygiene survey provides information to management on the hazardous properties of chemical and physical agents, the work situations involving employee exposure, and methods to eliminate or control the hazard.

When this part of the survey has been completed, a majority of establishments in the study will be chosen for the second phase, the medical appraisal. Assuming your place of work is chosen for the medical, we would like to meet with you at the conclusion of the environmental phase to discuss details and scheduling.

In general, production workers in the second phase will complete an occupational and medical history questionnaire and then have a medical examination tailored to their occupational exposures. The results of the medical survey will indicate whether the workers have developed any condition which can be ascribed to these occupational exposures. The medical findings will be related to past and current exposures using criteria developed for diagnosing occupational disease. Individual results of the medical examination will be made available only to the worker and his private physician in accordance with the ethics of medical practice.

At the end of the survey, you will be provided with a summary of environmental and medical findings and recommendations for your plant which may help you to evaluate any changes that you may wish to undertake in anticipation of what may be necessary under the Occupational Safety and Health Act of 1970. These findings will also be useful for your contacts with the Washington Industrial Safety and Health Administration.

Sincerely yours,

David P. Discher, M.D.
Director, Occupational Health
Surveillance Methods

Appendix IV

YOU AND THE OCCUPATIONAL HEALTH EXAMINATION

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WHAT'S GOING ON?

Two years ago Congress passed a major bill affecting every working man and woman in the United States -- the Occupational Safety and Health Act of 1970. This law requires every employer to furnish his employees "safe and healthful working conditions." The Occupational Safety and Health Administration (OSHA) is required by that law to determine what constitutes a safe and healthful workplace and set standards for all employers.

To determine what these standards should be requires study and research. You and your employer are a part of the program of research. The information gained in our study of this establishment and the people who work here will help the government determine the best ways to implement the new safety and health law. We need to know what kinds of diseases are caused by the materials and processes used by working men and women. Our research here, and in other places of work, will help us find out.

A lot of information about job accidents exists. But there is little known about the extent of occupational disease. We, at the School of Public Health and Community Medicine in the University of Washington, are conducting this study for the federal government to learn how often and what types of occupational disease exist in the United States. Your cooperation will help us develop the type of information that will lead to safer workplaces for all working Americans.

WHAT THE STUDY IS ALL ABOUT:

The study consists of two parts:

First, an industrial hygienist made a survey of your place of work. In his survey, he carefully noted what kinds of occupational hazards existed, how they were controlled and which workers were exposed to the hazards.

Second, and this is where you come in, we will be conducting a medical survey of workers. The medical survey will relate present and past job exposures to see if occupational disease may be determined in this manner.

WHAT YOU ARE ASKED TO DO:

You will be asked to complete a health questionnaire. We cannot learn all we need to know by just asking questions, so we also need to make some medical tests. After you have completed the questionnaire, an appointment will be made for you to have a medical examination.

The medical examination will be thorough in many respects, BUT IT WILL NOT BE A COMPLETE EXAMINATION. The examination will be specifically related to the hazards to which you are exposed. In some cases, a hearing test will be necessary, sometimes a blood study or an x-ray. THE EXAMINATION IS FREE.

The results of the examination will be made available only to you and your personal physician, if you wish. The results of your examination will not be made available to your employer. If you have no physician, and the findings suggest you should see one, you will be so advised,

YOUR RIGHT TO PARTICIPATE:

You cannot be discharged or discriminated against on the job in any way for participating in this study. The Occupational Safety and Health Act, 1970, forbids an employer from discharging or discriminating against a worker because the worker has participated in any activity under the provision of the law. This study is being conducted with the cooperation of your employer.

YOUR COOPERATION IS VITAL

You have been chosen because you are representative of workers doing certain jobs and exposed to certain working conditions. If you fail to keep your medical examination, we will have that much less information about workers such as yourself. We urge you to keep your appointment. If you cannot, call _____ and we'll make another appointment for you.

Thank you for your cooperation.

University of Washington School of Public Health and Community Medicine
OCCUPATIONAL HEALTH QUESTIONNAIRE

PLACE OF WORK

Name of Business 1) _____

Business Address 2) _____
(Zip)

WORKER IDENTIFICATION

3) Name _____
(Last) (First) (Middle)

4) Address _____
(Zip)

5) Home Phone Number _____ 6) Date of Birth _____
month / day / year

7) Sex: Male Female

8) Color or race: White Black Indian (American)
Oriental Other _____
(specify)

OCCUPATIONAL HISTORY

In order to relate the possible effects of working conditions on your health, we need to know your occupational background and especially some detail about what you do on your current job.

9) What is your current occupation or job title? _____

10) Describe what you do on your current job, the way you do it and the materials you use:

11) When did you start working at this place of work? _____
month / year

Now, starting with the job you had just before the one you have now, and going backward to your first job, please list as best you can all the jobs you have ever held:

Years worked	Name of firm and type of business (e.g. Weyerhaeuser - lumber manufacturer, Sears - department store)	Occupation or job title
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

DIRECTIONS:

We are interested in knowing if you have had any of the listed symptoms or conditions. If you have, check YES and answer the question below before going on to the next numbered question. If you have not had this symptom or condition, check NO and proceed to the next numbered question.

EXAMPLE: READ THIS BEFORE STARTING

1. Do your eyes often blink or water?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 2

2. Do you often have bad pains in your eyes?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 3

NOW START. PLEASE ANSWER ALL QUESTIONS.

1. Has your eyesight blacked out completely any time in the past year?

YES answer question below

Do you think this was caused
or made worse by your work?

caused made worse no

NO proceed to question 2

2. Do your eyes often blink or water?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 3

3. Do you often have bad pains in your eyes?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 4

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4. Are your eyes often red or inflamed?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 5

5. Are you often troubled with bad spells of sneezing?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 6

6. Is your nose continually stuffed up?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 7

7. Do you suffer from a constantly running nose?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 8

8. At any time in the past year, have you had bad nose bleeds?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 9

9. Do you frequently suffer from heavy chest colds?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 10

10. When you catch a cold, do you usually have to go to bed?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 11

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11. Are you troubled by constant coughing?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 12

12. Do you often have difficulty in breathing?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 13

13. Do you get out of breath long before anyone else?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 14

14. Do you have pains in the heart or chest?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 15

15. Does your heart often race like mad?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 16

16. Are your ankles often badly swollen?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 17

17. Did a doctor ever say you had varicose veins (swollen veins) in your legs?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 18

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18. Do cold hands or feet trouble you even in hot weather?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 19

19. Do you have a chronic chest condition?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 20

20. Has a doctor ever said your blood pressure was too high?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 21

21. Has a doctor ever said you had heart trouble?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 22

22. As an adult, have you suffered from asthma?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 23

23. Have you ever had T.B. (tuberculosis)?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 24

24. Are you troubled by sore gums?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 25

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25. Is your tongue usually badly coated?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 26

26. Have you lost your appetite in the past year?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 27

27. Do severe pains in the stomach often double you up?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 28

28. Has a doctor ever said you had stomach ulcers?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 29

29. Do you suffer from frequent loose bowel movements?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 30

30. At any time in the past year, have you had severe bloody diarrhea?

YES answer question below

Do you think this was caused or made worse by your work?

caused made worse no

NO proceed to question 31

31. Do you constantly suffer from bad constipation?

YES answer question below

Do you think this is caused or made worse by your work?

caused made worse no

NO proceed to question 32

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32. As an adult, have you ever had jaundice (yellow eyes and skin)?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 33

33. Have you ever had serious liver or gall bladder trouble?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 34

34. Are your joints often painfully swollen?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 35

35. Are your muscles and joints stiff when getting out of bed in the morning for at least 15 minutes?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 36

36. Do you usually have severe pains in the arms or legs?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 37

37. Are you crippled with severe rheumatism (arthritis)?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 38

38. Do weak or painful feet make your life miserable?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 39

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39. Do back pains make it hard for you to keep on with your work?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 40

40. Are you troubled with a serious bodily disability or deformity?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 41

41. Is your skin very sensitive or tender?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 42

42. Do cuts in your skin usually stay open a long time?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 43

43. Are you often bothered by severe itching?

YES answer question below

Do you think this is caused
or made worse by your work?

caused made worse no

NO proceed to question 44

44. At any time in the last five years, have you had skin conditions such as red inflamed skin, tiny blisters, dry scaling skin, cracked skin?

YES answer question below

Do you think this was caused
or made worse by your work?

caused made worse no

NO proceed to question 45

45. At any time in the last five years have you had hives or any other allergic skin conditions?

YES answer question below

Do you think this was caused
or made worse by your work?

caused made worse no

NO proceed to question 46

46. At any time in the last five years, have you had skin conditions such as acne, pimples, warts or patchy loss of hair?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 47

47. Do you suffer badly from frequent severe headaches?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 48

48. Do you often have spells of severe dizziness?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 49

49. Do you frequently feel faint?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 50

50. At anytime in the past year, have you had any periods of tingling or numbness in your arms or legs?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 51

51. At any time in the past year, was any part of your body paralyzed?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 52

52. At any time in the past year, have you been unconscious?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 53

53. Has a doctor ever said you had kidney or bladder disease?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 54

54. Do you often get spells of complete exhaustion or fatigue?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 55

55. Do you usually get up tired and exhausted in the morning?

YES answer question below

Do you think this is caused or made worse by your work? caused made worse no

NO proceed to question 56

56. At any time in the past five years, have you had any periods of frequent illness?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 57

57. At anytime in the past five years were you treated for severe anemia (thin blood)?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 58

58. Did a doctor ever treat you for tumor or cancer?

YES answer question below

Do you think this was caused or made worse by your work? caused made worse no

NO proceed to question 59

NOW FOR SOME FINAL QUESTIONS:

59. Did you have a serious accident or injury on the job in the past 12 months? for example, broken bone, brain concussion, deep cut requiring stitches, back injury, particle in eye, smashed finger?

YES

NO

60. Did you have a minor accident or injury on the job in the past 12 months? for example, sprain, bruise, minor cut?

YES

NO

61. Have you ever been unable to work on a job because of: YES NO

a. sensitivity to chemicals, dust, sunlight, etc. _____

b. inability to perform certain motions _____

c. inability to assume certain positions _____

d. other medical reasons _____
if yes, explain

THANK YOU.

Occupational Disease Surveillance Project
University of Washington, Department of Environmental Health

I have read the statement "Your and the Occupational Health Examination" and have been informed of the medical questionnaire which I consent to complete in privacy. I have had the opportunity to discuss the study and my part in it with _____.

I understand the purpose of the study and the general nature of the examination and tests that may be involved. I consent to participate with the understanding that I can withdraw at any time without penalty.

I understand that all medical information will be kept confidential except upon my authorization.

I authorize the School of Public Health and Community Medicine of the University of Washington to release to my private physician information contained in the questionnaire and any medical findings concerning myself and to request medical information about myself from my private physician if necessary.

PLEASE PRINT



(Name of Physician)

(Street Address)

(City) (State) (Zip)

I do not wish to have the information released to my private physician at this time.

I have no private physician.

MY NAME _____
(Last) (First) (Middle)

ADDRESS _____
(Number) (Street) (City) (State) (Zip)

HOME TELEPHONE NUMBER _____

BIRTHDATE _____

Please sign your name here

(Date)

PATIENT CONSENT FORM

TESTS AND PROCEDURES

A. Routine Procedures

Put X in Box if patient is to receive a given procedure

- 1. Weight
- 2. Height
- 3. Blood pressure
- 4. Visual Acuity

B. Special Procedures

- 1. Audiometry (Hearing Test)
- 2. Spirometry (Breathing Test)
- 3. Chest X-ray (P.A.)
- 4. Other X-ray, specify _____
- 5. Blood study, specify _____
- 6. Other tests, specify _____
- _____
- _____



I have read the statement "You and the Occupational Health Examination" and have been informed of all medical procedures, and tests with which I will be involved. I understand the purpose of the study and the general nature of the examination and tests involved. I consent to participate with the understanding that I can withdraw at any time without penalty. I have had the opportunity to discuss the study and my part in it with:

PRINT _____ (Staff Associate of _____)

SIGNATURE OF STAFF ASSOCIATE

SIGNATURE OF PATIENT

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PLACE OF WORK: _____

NAME: _____

ADDRESS: _____

MEDICAL APPOINTMENT: _____ DATE: _____ TIME: _____

OCCUPATION: _____

EXPOSURES: _____

QUESTIONNAIRE: Positive responses on questions: _____

ARE YOU CURRENTLY USING ANY MEDICATIONS: NO YES SPECIFY _____

HEIGHT _____ WEIGHT _____ BLOOD PRESSURE _____

VISUAL ACUITY TEST: without glasses: Right eye _____ Left eye _____

with glasses: Right eye _____ Left eye _____

SYMPTOMS AND SIGNS: _____

LABORATORY TEST (type and results): _____

X-RAY: _____

PHYSICIAN'S SUMMARY: NEGATIVE

CONDITION (S): (note occupational relationship of each condition listed,
See reverse side for occupational relationship code.)

Physician's Signature: _____

OCCUPATIONAL RELATIONSHIP:

- (1). Not occupational disease
- (2). Can't evaluate
- (3). Suggestive history
- (4). Doubtful occupational disease
- (5). Probable occupational disease - current job exposure
- (6). Probable occupational disease - past job exposure
- (7). Probable occupational disease - current and past job exposure

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COUGH

1. Do you usually cough first thing in the morning [on getting up*] in the winter? ...
Count a cough with first smoke or on first going out of doors. Exclude clearing throat or a single cough.
2. Do you usually cough during the day—or at night—in the winter? ...
Ignore an occasional cough.
If 'No' to both questions 1 and 2, go to question 6.
If 'Yes' to either question 1 or 2:
3. Do you cough like this on most days [or nights*] for as much as three months each year? ...

1 2

 Yes No

1 2

 Yes No

1 2 3

 Yes No N.A.

PHLEGM

4. Do you usually bring up any phlegm from your chest first thing in the morning [on getting up*] in the winter? ...
Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.
5. Do you usually bring up any phlegm from your chest during the day—or at night—in the winter? ...
Accept twice or more.
If 'No' to both questions 4 and 5, go to question 12a.
If 'Yes' to either question 4 or 5:
6. Do you bring up phlegm like this on most days [or nights*] for as much as three months each year? ...
* For subjects who work by night.
7. In the past three years have you had a period of [increased*] cough and phlegm lasting for three weeks or more? ...
If 'No' to question 12a, go to question 13.
If 'Yes' to question 12a:
- 12b/c. Have you had more than one such period? ...
* For subjects who usually have phlegm.

1 2

 Yes No

1 2

 Yes No

1 2 3

 Yes No N.A.

7
 No

Yes—1 period

Yes—2 or more periods

BREATHLESSNESS

- 14a. Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill? ...
If 'No' to question 14a, go to question 15a.
If 'Yes' to question 14a:
- 14b. Do you get short of breath walking with other people of your own age on level ground? ...
If 'No' to question 14b, go to question 15a.
If 'Yes' to question 14b:
- 14c. Do you have to stop for breath when walking at your own pace on level ground?
† Disabled from walking by any conditions other than heart or lung disease.

9
 Disabled †

No—b.

No—c.

Yes—c.

WHEEZING

- 15a. Does your chest ever sound wheezing or whirling? ...
If 'No' to question 15a, go to question 16a.
If 'Yes' to question 15a:
- 15b. Do you get this most days—or nights? ...
- 16a. Have you ever had attacks of shortness of breath with wheezing? ...
If 'No' to question 16a, go to question 17.
If 'Yes' to question 16a:
- 16b. Is/was your breathing absolutely normal between attacks? ...

10
 No

Yes, but not most days [or nights]

Yes, most days [or nights]

11
 No attacks

No

Yes

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WEATHER

17. Does the weather affect your chest? ...
Only record 'Yes' if adverse weather definitely and regularly causes chest symptoms.
If 'No' to question 17, go to question 18.
If 'Yes' to question 17:
- 17a. Does the weather make you short of breath? ...
- 17b. Specify type of weather, e.g. fog, damp, cold, heat, other

12
 No

Yes

No

13

NASAL CATARRH

18. Do you usually have a stuffy nose or catarrh at the back of your nose in the winter? ... 1 Yes 2 No 14
19. Do you have this in the summer? ... 1 Yes 2 No 15
- If 'No' to both questions 18 and 19, go to question 21.
- If 'Yes' to either question 18 or 19:
20. Do you have this on most days for as much as three months each year? ... 1 Yes 2 No 3 N.A. 16

CHEST ILLNESSES

21. During the past three years have you had any chest illness which has kept you from your usual activities for as much as a week? ... 17 No 1
- If 'No' to question 21, go to question 22.
- If 'Yes' to question 21:
- 21a. Did you bring up more phlegm than usual in any of these illnesses? ... 2 No 2
- If 'No' to question 21a, go to question 22.
- If 'Yes' to question 21a:
- 21b. How many illnesses like this have you had in the past three years? ... 3 1 illness 4 2 or more illnesses

HAVE YOU EVER HAD :

- | | |
|--|---|
| 22. An injury or operation affecting your chest? ... <input type="checkbox"/> 18 † | 27. Pulmonary tuberculosis? ... <input type="checkbox"/> 23 † |
| 23. Heart trouble? ... <input type="checkbox"/> 19 † | 28. Bronchial asthma? ... <input type="checkbox"/> 24 † |
| 24. Bronchitis? ... <input type="checkbox"/> 20 * | 29. Emphysema? ... <input type="checkbox"/> 25 † |
| 25. Pneumonitis? ... <input type="checkbox"/> 21 * | 30. Bronchiectasis? ... <input type="checkbox"/> 26 † |
| 26. Pleurisy? ... <input type="checkbox"/> 22 * | 31. Other chest trouble? ... <input type="checkbox"/> 27 * |

* Code: 0=no; 1=once; 2=twice...9=nine or more times.
 † Code 0=no; 1=yes.
 Give relevant details after each positive answer.



ADDITIONAL CLINICAL QUESTIONS

These must be asked before the questions on smoking and occupation.

Do symptoms appear to get worse upon exertion YES NO
 or after work YES NO or when doing certain tasks YES NO

TOBACCO SMOKING

35a. Do you smoke? ... Yes No

Record 'Yes' if regular smoker (as defined in question 35b) up to one month ago.

If 'No' to question 35a, ask question 35b.

If 'Yes' to question 35a:

Do you inhale the smoke? ... Yes No

Would you say you inhale the smoke slightly (S), moderately (M), deeply (D)? ... S M D

How old were you when you started smoking regularly? years old

How many manufactured cigarettes do you usually smoke per day? per working day

..... at weekends

How much tobacco (oz/g) do you usually smoke per week in hand-rolled cigarettes?

How much pipe tobacco (oz/g) do you usually smoke per week?

How many cigars do you usually smoke per week?

Specify large (L) or small (S).

35b. Have you ever smoked as much as one cigarette a day [or one ounce of tobacco a month] for as long as a year? Yes No

If 'No' to question 35b, go to question 38.

If 'Yes' to question 35b:

How old were you when you started smoking regularly? years old

How old were you when you last gave up smoking? years old

How many manufactured cigarettes per day were you smoking before you gave up? per working day

..... at weekends

How much tobacco (oz/g) per week were you smoking in hand-rolled cigarettes before you gave up?

How much pipe tobacco (oz/g) per week were you smoking before you gave up?

How many cigars per week were you smoking before you gave up?

Specify large (L) or small (S).

CODING FOR SMOKING HISTORY

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Before coding refer to instructions.

Smoking history **28**

Never smoked ... 1

Ex-smoker ... 2

Present smoker — does not inhale ... 3

Present smoker — inhales slightly ... 4

Present smoker — inhales moderately ... 5

Present smoker — inhales deeply ... 6

Type of smoker **29**

Cigarettes only ... 1

Pipe only ... 2

Cigars only ... 3

Cigarettes and pipe/cigars ... 4

Cigars and pipe ... 5

Non-smoker ... 6

Amount smoked per day* (average including weekends)

Cigarette tobacco: **30**

Nil ... 1

1-4 g ... 2

5-14 g ... 3

15-24 g ... 4

25 g or more ... 5

Pipe/cigar tobacco: **31**

Nil ... 1

1-4 g ... 2

5-14 g ... 3

15-24 g ... 4

25 g or more ... 5

* 1 oz of pipe tobacco = 28 cigarettes = 28 g
 1 small cigar = 2 cigarettes
 1 large cigar = 5 cigarettes

Age started (years) **Code XX if a non-smoker** **32** **33**

Age stopped (years) **Code YY if a present smoker** **34** **35**

