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EPIDEMIOLOGIC NOTES AND REPORTS

PULMONARY FUNCTION OF ASBESTOS WORKERS - Massachusetts

On December 11, 1974, pulmonary function tests were performed on 30 workers at the Asbestos Textile Company plant in North Brookfield, Massachusetts. Forced vital capacity (FVC) and 1-second forced expiratory volume (FEV₁) were calculated for each worker from the best 3 of 5 attempts using a Stead-Wells spirometer. Other data obtained included smoking history and length of employment at the plant. FVC for each worker was compared to the value predicted on the basis of age, sex, and height (Veterans' Administration/Army Prediction Equation). The ratios of observed FVC to predicted FVC compared to length of employment are shown in Table 1, as are the FEV₁ to FVC ratios.

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The loss of FVC related to length of employment ($p = 0.006$ using a one-way analysis of variance) is substantial. The low values of FVC among persons working with asbestos for more than 20 years cannot be accounted for by smoking.

TABLE 1. CASES OF SPECIFIED NOTIFIABLE DISEASES: UNITED STATES
(Cumulative totals include revised and delayed reports through previous weeks)

DISEASE	5th WEEK ENDING		MEDIAN 1970-1974	CUMULATIVE, FIRST 5 WEEKS		
	February 1, 1975	February 2, 1974		February 1, 1975	February 2, 1974	MEDIAN 1970-1974
Aseptic meningitis	29	43	37	193	178	178
Brucellosis	1	4	2	8	9	9
Chickenpox	3,838	3,813	—	15,988	15,238	—
Diphtheria	9	2	2	43	5	10
Encephalitis	11	16	19	58	66	74
Primary	2	3	6	14	15	21
Post-Infectious	176	209	166	941	799	799
Hepatitis, Viral	718	929	1,011	3,228	4,058	—
Type A	147	140	16	683	662	5,327
Type unspecified	4	3	16	16	13	207
Malaria	275	334	790	1,121	1,927	3,189
Measles (rubeola)	25	23	34	148	119	166
Meningococcal infections, total	25	23	34	144	119	159
Civilian	—	—	—	4	—	8
Military	1,411	1,559	2,364	6,284	7,408	10,398
Mumps	32	8	—	135	113	—
Pertussis	204	180	550	757	858	2,274
Rubella (German measles)	1	1	1	7	5	5
Tetanus	581	665	—	2,400	2,334	—
Tuberculosis	—	2	1	6	8	8
Tularemia	5	5	5	17	28	27
Typhoid fever	—	2	1	9	12	2
Typhus, tick-borne (Rky. Mt. spotted fever)	—	—	—	—	—	—
Venereal Diseases:						
Gonorrhea	19,010	16,058	—	88,611	80,287	—
Civilian	536	520	—	2,502	2,600	—
Military	564	466	—	2,416	2,327	—
Syphilis, primary and secondary	11	9	—	36	44	—
Civilian	31	53	66	183	238	260
Military	—	—	—	—	—	—

TABLE II. NOTIFIABLE DISEASES OF LOW FREQUENCY

	Cum.		Cum.
Anthrax:	—	Poliomyelitis, total: Tenn. 1	1
Botulism:	3	Paralytic: Tenn. 1	1
Congenital rubella syndrome:	4	Psittacosis:	2
Leprosy: Calif. 1, Hawaii 2, Tex. 1	18	Rabies in man:	1
Leptospirosis: Ore. 1	6	Trichinosis:	7
Plague:	—	Typhus, murine:	—

*Delayed reports. Trichinosis: (1974) N.J. 3, W. Va. 1

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ASBESTOSIS - Continued

6 of the 8 in the group with lowest FVC value had never smoked cigarettes (Table 2). In addition, because the prediction formula controls for age, as well as height and sex, the variation of FVC with length of employment is not a function of age. The FEV₁/FVC ratio was not observed to fall with increased length of employment (Table 1). The data indicate, therefore, that these workers have restrictive lung impairment of the sort typically seen in pulmonary asbestosis.

Table 1
Forced Vital Capacity (liters) in Asbestos Workers
Related to Length of Employment

Year First Employed	Number	Mean FVC Observed/ Predicted	FEV ₁ /FVC
1970-74	15	0.96	0.80
1954-69	7	0.93	0.79
Before 1954	8	0.76	0.82

Table 2
Forced Vital Capacity (liters) in Asbestos Workers
Related to Cigarette Smoking History

Number of Years Smoking	Number	Mean FVC Observed/ Predicted	FEV ₁ /FVC
0	14	0.87	0.82
<15	6	0.93	0.82
>15	10	0.92	0.75

For many years, levels of asbestos dust in textile-producing areas of this plant, as measured by the State Division of Occupational Hygiene, have been well above the present federal standard of 5 fibers per cubic centimeter of air. Following action by the Occupational Safety and Health Administration (O.S.H.A.), the company recently shut down its dustiest textile-producing operations.

(Reported by Alan H Shapiro, research assistant, Department of Physiology, Harvard School of Public Health; David H Wegman, MD, Division of Occupational Hygiene, Massachusetts Department of Labor and Industries; National Institute for Occupational Safety and Health, CDC.)

Editorial Note

The relationship between inhalation of asbestos dust and the fibrotic lung lesion of asbestosis has been well known since early in this century. Pulmonary function tests have proved to be useful in screening for asbestosis in workers exposed to asbestos dust (1,2). FVC and FEV₁ both decrease as a result of the restrictive lung disease caused by asbestos, while the ratio of FEV₁ to FVC does not. As noted in this report, significant loss of lung function may not be observed until years after a worker's initial exposure to asbestos (2).

In 1972 the National Institute for Occupational Safety and Health (N.I.O.S.H.) proposed a standard of 2.0 asbestos fibers per cubic centimeter of air as a maximum average exposure in the workplace (3). Data showed that asbestosis does occur at average exposure levels of as low as 2 fibers/cc (4). The proposed standard was based primarily on knowledge of the dose-response relationship in asbestosis; but it is also of considerable concern that asbestos is a known carcinogen. The increased risk of lung cancer and mesothelioma in asbestos workers has been well documented, while an increased incidence of gastrointestinal cancer has also been suggested (3). In June, 1972, the Secretary of Labor promulgated the present official standard of 5.0 fibers/cc with a level of 2 fibers/cc to be achieved by 1976 (5).

However, the situation described above illustrates, as do other cases of asbestos exposure (6), the need for continual evaluation of the potential risks in the asbestos industry.

References

1. Wegman DH, Theriault GP, Peters JM: Worker-sponsored survey for asbestosis. *Arch Environ Health* 27:105-109, 1973
2. Murphy RLH, Jr, Gaensler EA, Redding RA, Belleau R, Keelan PJ, Smith AA, Gott AM, Ferris BG, Jr: Low exposure to asbestos. Gas exchange in ship pipe coverers and controls. *Arch Environ Health* 25:253-264, 1972
3. National Institute for Occupational Safety and Health: Criteria for a Recommended Standard: Occupational Exposure to Asbestos (HSM 72-10267). Rockville, CDC, 1972
4. Committee on Hygiene Standards of the British Occupational Hygiene Society: Hygiene standard for chrysotile asbestos dust. *Ann Occup Hyg* 11:47-49, 1968
5. General Services Administration: Standard for Exposure to Asbestos Dust. *Federal Register* 37:11318-11322, 1972
6. Schoenberg JB, Mitchell CA: Implementation of the federal asbestos standard in Connecticut. *J of Occup Med* 16:781-784, 1974

TRANSFUSION-INDUCED MALARIA - Tennessee

On May 15, 1974, a 15-year-old girl was admitted to a hospital in Tennessee with a history of intermittent, spiking fever of unknown origin. A paroxysmal fever characterized by 72-hour cycles of temperature elevation had begun on May 11, 1974, and was associated with chills and sweating. Additional symptoms included malaise, myalgia, anorexia, headache, nausea, vomiting, and abdominal pain. A peripheral blood smear revealed the presence of rings, trophozoites, and schizonts of *Plasmodium malariae*. The patient was treated with chloroquine and primaquine and recovered uneventfully.

The patient had resided in Tennessee for the preceding 12 years and had never traveled outside the United States. She had no previous history of malaria. However, she had a history of chronic renal failure and had been receiving con-

tinuous hemodialysis for the previous 7 months. She also had a history of uterine bleeding and anemia which was diagnosed as endometriosis. In February 1974, after developing acute abdominal pain, she had an exploratory laparotomy. During her illnesses she received 14 units of frozen blood from 14 donors. None of the 14 donors had a history of malaria, and all but 1 donor had never lived or traveled in any areas designated as malarious. Peripheral blood smears examined from all 14 donors were negative for malaria parasites. Serologic examinations of all donors by indirect immunofluorescent antibody tests were negative, except for the 1 individual who revealed high antibody titers against *P. malariae* and *P. falciparum* and a low titer against *P. vivax*. This donor was a 28-year-old African man who had entered the United States in

and dust will contaminate the asbestos cargo.

(f) If the airborne concentrations of asbestos fibers to which employees are exposed during asbestos cargo loading, unloading and storage are unknown select any respirator from Table 1 of the asbestos for employee use. During clean-up operations in carrier or storage areas where airborne concentrations of asbestos fibers are unknown have employees wear respirators selected from Table 1 of the Asbestos standard which protect for up to 50 times or more of the limits in paragraph (b) of the asbestos standard. Where the concentrations are known have employees wear appropriate respirators as specified in Table 1 of the asbestos standard.

(g) Special clothing is to be worn by all employees engaged in loading, unloading, and storage of asbestos cargo when the wearing of such clothing is required by paragraph (d)(3) of the asbestos standard.

ENCLOSURE II

INTRODUCTION OF ASBESTOS FIBER INTO MANUFACTURING PROCESSES

(a) Conduct production operations involving introduction of asbestos fiber into a process under dust controlled conditions such that employees are not exposed to concentrations of asbestos fiber above the exposure limits prescribed in paragraph (b) of the asbestos standard.

(b) In those operations where bagged asbestos fiber is being used, ensure that the fiber bags arrive at the work station in clean condition, free of loose fiber on the bag surface. If the bags are stacked on pallets, the pallets must be clean and free of loose fiber.

(c) Place empty bags or other containers which have contained asbestos fibers in

closed or sealed containers impermeable to asbestos fibers until disposed of by methods that do not create airborne concentrations in excess of the exposure limits prescribed in paragraph (b) of the asbestos standard.

APPENDIX C—MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

A. Exposure to asbestos dust may result in asbestosis if the dust concentration is high or the duration of exposure is long. In general, there is a considerable time lapse between inhalation of the dust and the appearance of changes as determined by X-ray. Asbestosis is characterized by:

1. A pattern of roentgenographic changes consistent with diffuse interstitial fibrosis of variable degree and, at times, pleural changes of fibrosis and calcification.

2. Clinical changes including fine rales and finger clubbing. These may be present or absent in any individual case.

3. Physiological changes consistent with a lung disorder.

B. Neoplasms

Neoplasms, such as mesothelioma, may occur without radiological evidence of asbestosis at exposure levels lower than those required for prevention of radiologically evident asbestosis.

III. SPECIAL TESTS

A. Chest roentgenographs.

B. Lung function tests.

1. Forced vital capacity.

2. Forced respiratory volume at 1 second.

3. Sputum cytology.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. Preplacement

A routine medical examination and a complete medical and work history are required to be made available. The examination includes a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) forced expiratory volume at 1 second (FEV₁), and, for employees with 10 or more years of exposure to airborne concentrations of asbestos fibers or who are 45 years of age or older, a sputum cytology examination. Those employees with respiratory disorders generally should not be placed where there is increased risk to inhalation of asbestos fibers.

C. Annual and termination examination

Annual and termination examinations are required to be made available. They are to include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV₁), and, for employees with 10 or more years of exposure to airborne concentrations of asbestos fibers or who are 45 years of age or older, a sputum cytology examination.

(Secs. 4, 6, 8, 84 Stat. 1592, 1593, 1599 (29 U.S.C. 653, 655, 657) and 29 CFR Part 1911)

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[40 FR 47652]



Journal

MEETINGS SCHEDULED

November 20-21 — Longshoremen's and Harbor Workers' Act Seminar, Burlingame Hyatt House, San Francisco, Calif. (Industrial Claims Association, 215 Market St., Suite 650, San Francisco, Calif. 94105).

November 21 — Introductory Seminar on Occupational Safety and Health, 1231 25th St., N.W., Washington, D.C. (Harriett G. Berlin, The Bureau of National Affairs, Inc., Room 473, 1231 25th St., N.W., Washington, D.C. 20037, tel. (202) 452-4400).

December 1-5 — Fundamentals of Occupational Safety Course, Sheraton-Chicago Hotel, Chicago, Ill., \$50 registration fee (National Safety Council, Registrar, Safety Training Institute, 425 N. Michigan Ave., Chicago, Ill. 60611).

December 1-5 — Inspector Training Course, Macon, Ga. (International Safety Academy, 1021 Georgia Ave., Macon, Ga. 31201, tel. (912) 746-7677).

December 3-5 — Environmental Health Management Course, Macon, Ga. (International Safety Academy, 1021 Georgia Ave., Macon, Ga. 31201, tel. (912) 746-7677).

December 3-5 — Audiometric Technician certification Course, Cleveland, Ohio (Environmental Technology Corporation, 3439 W. Brainard Rd., Cleveland, Ohio 44122, tel. (216) 464-3888).

December 8-9 — Symposium on Workplace Hazard Monitoring, Netherland Hilton Hotel, Cincinnati, Ohio (William D. Kelley, Secretary-Treasurer, American Conference of Governmental Industrial Hygienists, 2205 South Rd., Cincinnati, Ohio 45238).

December 8-12 — Total Loss Control Management Course, Innisbrook Resort and Golf Club, Tarpon Springs, Fla. (International Safety Academy, 1021 Georgia Ave., Macon, Ga. 31201, tel. (912) 746-7677).

December 8-12 — Safety Training Methods Course, \$50 registration fee (National Safety Council, Registrar, Safety Training Institute, 425 N. Michigan Ave., Chicago, Ill. 60611).

December 10 — OSHA Implementation Seminar for First-Line Supervisory Personnel, Rutgers University Extension Division, New Brunswick, N.J. (Helmut E. Horr, Program Coordinator, Rutgers University, Management Education Department, Clifton Ave., New Brunswick, N.J. 08903).

December 12 — Introductory Seminar on Water Pollution Control Regulation, 1231 25th St., N.W., Washington, D.C. (Harriett G. Berlin, The Bureau of National Affairs, Inc., Room 473, 1231 25th St., N.W., Washington, D.C. 20037, tel. (202) 452-4400).

Asbestos**FIRM OBJECTS TO OSHA'S FAILURE TO EXCLUDE NONFIBROUS MINERALS**

The failure of the Occupational Safety and Health Administration to exclude nonfibrous forms of certain minerals from coverage under its proposed revisions to the current asbestos rule could make many industrial grades of talc unnecessarily subject to coverage, E.I. du Pont de Nemours & Company told OSHA.

The firm's comments were forwarded in response to revisions to the current asbestos rule proposed by OSHA last October calling for a maximum eight-hour time-weighted average concentration of 0.5 fibers per cubic centimeter of air with a maximum ceiling concentration of five fibers/cc (Current Report, October 16, p. 638).

Specifically, DuPont objected to the failure of OSHA to exclude from the proposed revisions nonfibrous forms of tremolite, anthophyllite, and actinolite. The failure to exclude these nonfibrous forms "would require unnecessary training, medical surveillance, and labeling . . . many tones of talc which may in truth be completely free of harmful material," the firm said. DuPont called upon OSHA to revise its definition of "asbestos" to eliminate tremolite and to clarify analytical procedures in the proposal.

In support of its views, DuPont quoted from several letters written by former Assistant Labor Secretary John H. Stender to the R.J. Vanderbilt Company in 1974. Stender noted in the letters that nonfibrous or non-asbestiform minerals "are not within the scope of the existing standard."

DuPont also stated that asbestos insulation maintenance work presents special problems "that are not considered in the proposed standard which obviously is written for manufacturing or shop activities." The firm called the monitoring requirements in the proposal "inconsistent" and objected to the inclusion of sputum cytology exams under the medical surveillance provisions.

Asbestos Industry Response

Noting that the proposed revisions relate only to general industry, the Asbestos Information Association/North America (AIA) recommended that OSHA defer action on a final rule until the separate standard pertaining to the construction industry has been proposed and its potential impact measured. The AIA comments were based on reports prepared by two consultants: Roy F. Weston, Inc., for technological and economic feasibility and Hans Weill, professor of medicine, Tulane School of Medicine, on health effects.

If deferral of the final standard is not possible, AIA recommended an exposure level of two fibers/cc with a ceiling limit of 10 fibers/cc, using the membrane filter test method. The two-fiber level will automatically become effective on July 1, 1976, under the current asbestos standard.

In requesting the deferral of a final asbestos rule, AIA noted that 70 to 80 percent of all asbestos manufactured in the U.S. is utilized by the construction industry. "It would be a pyrrhic victory to achieve a viable manufacturing regulation, only to discover that the construction regulation thereafter so threatened or damaged the manufacturers' markets that they could not continue to operate profitably," the comments said.

Feasibility Analysis

According to the AIA comments, the limit of two fibers/cc "is feasible technically and economically." The proposed

level can be achieved in three to five years, although some portions of the secondary segment of the industry may require a somewhat longer period, AIA said.

The two-fiber limit can be attained through what AIA termed "best available technology" (BAT), which is an optimum combination of human engineering techniques and carefully enforced work practices. AIA stated that the costs of installing BAT will not be cheap "but indications are that, for the larger part of the industry, the annual cost of achieving the two-fiber limit can be added to the cost of products sold without significant adverse impact upon market position."

Segments of industry which may have more difficulty economically in meeting the standard may be asbestos textile and friction products industries and certain portions of the secondary industry segment, AIA said.

Health Effects

According to the study by Weill, the weight of scientific evidence tends to support the two-fiber limit proposed by AIA, but neither that level nor the 0.5 fiber/cc limit proposed by OSHA can provide complete assurance that the workplace will be totally free of health hazards.

Weill noted that there is "little debate concerning the causal association between occupational exposure to asbestos dust and certain adverse health effects, including but perhaps not limited to asbestosis, bronchogenic carcinoma of the lung, mesothelioma of the pleural and peritoneal surfaces, and gastrointestinal neoplasms."

Weill cited two major alternatives for setting a standard for exposure to asbestos:

- The first alternative depends upon the premise that the adverse health effects demonstrated in workers have resulted from high but poorly quantitated levels of asbestos dust. Where information is available, dose-response relations indicate that for mortality from malignant disease and for asbestosis, the risks were associated with levels of exposure considerably higher than the current or proposed levels of asbestos.

- The second alternative depends on the premise that occupational exposure to asbestos at some level has been shown to be associated with a carcinogenic risk. Since a safe threshold level cannot be scientifically proven at this time, the standard must require that all exposures be at or below the lowest technologically feasible level.

United Paperworkers' View

The United Paperworkers International Union offered the following comments on the OSHA proposal:

- The exposure limit should be fixed at "no detectable level" because OSHA has acknowledged that asbestos is a carcinogen.

- A "regulated area" should be defined as any work area where workers may be exposed to detectable airborne concentrations of asbestos.

- Monitoring requirements in the proposal should be planned and conducted in such a way as to obtain measurements representative of the exposure of each worker exposed to asbestos.

- Worker training and education should be provided to all employees who may be exposed to airborne asbestos fibers. The training and education should include information as to the hazards of exposure to asbestos. All materials used should be available for inspection and copying by worker representatives.

- OSHA should specify in the proposal the number of lavatories deemed necessary in the workplace.

► The medical surveillance provisions should be clarified to leave no doubt that medical exams will be provided to workers exposed to any airborne concentrations of asbestos.

► OSHA should make it clear that compliance with section (f)(7) of the proposal in no way mitigates the employer's responsibility to reduce worker exposure through engineering controls and work practices.

► Protective clothing should be required for all workers exposed to airborne asbestos, regardless of the quantitative levels.

► The records required under section (n) of the proposal should be available for inspection and copying by worker representatives.

► The monitoring provisions should be reworded to require that observers will receive a copy of the monitoring results.

► Section (m)(1) should be changed to require that all exposed surfaces in the workplace will be maintained free of accumulations of asbestos fibers, without regard to any specific potential airborne concentration.

NPCA Comment

The National Paint and Coatings Association, Inc. (NPCA) offered the following general comments on the OSHA proposal:

► The proposed rule is inappropriately broad and includes materials in its definition of "asbestos" which do not belong in that category.

► Section (b)(1) of the proposal fails to acknowledge the existence of ambient or background presence of asbestos noted by the Environmental Protection Agency. NPCA recommended that a minimum trigger or action level be established in the proposal to acknowledge the background level.

► The manufacturing process in paint and coating plants and the short, intermittent periods of potential worker exposure to asbestos warrant a second look at the adequacy of proposed respirator protection.

► Imposition of requirements for information, training, labeling, and placarding in every standard for each potentially hazardous material "is irresponsible rulemaking, unwieldy . . . and ignores other OSHA efforts to develop the overall systems approach."

► Inclusion of detailed conditions of job reassignment encroaches into the field of labor-management relations, exceeds OSHA's statutory power to regulate, and poses a conflict with other established federal authority.

Johns-Manville Corporation

"In certain process steps in various industry segments, best available technology will not reduce TWA airborne concentrations of asbestos to below 0.5 fibers/cc," Johns-Manville Corporation wrote OSHA. Furthermore, the firm added, it is also likely that a number of employers would abandon various operations and products in view of the uncertainties as to whether any effort would be sufficient to meet the proposed rule.

The firm called OSHA's actions in proposing the new revisions "contrary to . . . evidence as to be arbitrary, negligent, and untenable."

According to Johns-Manville, the OSHA proposal should not be adopted for the following reasons:

► The standard of two fibers/cc, which will become effective automatically on July 1, 1976, "will not have any adverse impact on the morbidity or mortality of individuals occupationally exposed to asbestos."

► The OSHA/NIOSH recommended monitoring method "is unable to distinguish between 0.5 fibers/cc and two fibers/cc in workplace monitoring, thereby rendering the 0.5 fibers/cc proposed permissible exposure limit moot and a fiction."

► There is not existing technology to uniformly reduce TWA exposures to below 0.5 fibers/cc, regardless of the efforts exerted."

Johns-Manville stated that the currently mandated standard of two fibers/cc which will become effective on July 1 "must remain unchanged." In the unlikely event that ongoing studies of the Turner Brothers Asbestos Company workers yield data that question this standard, a scientifically sound reappraisal will be in order, the firm said. In the meantime, the firm said, "there is clearly no evidence to indicate that any excess incidence of asbestos-related disease will result from such an interim decision."

Johns-Manville requested that OSHA scheduled a public hearing on the proposed revisions.

General Policy

NSC OFFICIAL SCORES OSHA

FOR RECORD IN PROTECTING PUBLIC EMPLOYEES

SACRAMENTO — (By an OSHR staff correspondent) — The Occupational Safety and Health Act has done little to protect public employees, Ray Lascoe, public employee section, National Safety Council, told the Golden West Safety Congress in Sacramento on April 6.

Lascoe could point to only three exceptions to what he called the "dismal record" of OSHA in protecting public employees. Those exceptions were the state programs covering public employees in California, Colorado, and Minnesota.

Despite an apparent reluctance to protect public workers, Lascoe believes these employees may be more in need of OSHA's protection than employees in the private sector. NSC statistics indicate that public employees may be suffering injuries at three times the rate of private industry, he said. The extent of the problem may not be known, he added, because public recordkeeping of injuries and illnesses is a "shambles."

Even though some evidence indicates they may need it more than others, public employees are barred from some training programs funded by the Occupational Safety and Health Administration, according to Lascoe. Specifically, public employees are barred from participating in OSHA-funded training provided through the American Association of Community and Junior Colleges, he said.

In the absence of OSHA and most state interest in covering public employees, Lascoe called on public agencies and public employees to develop their own safety programs.

Public Agency "Lethargy"

Safety consultant Alfred B. Barnes, of Oakland, provided some confirmation of Lascoe's public employee injury data and blamed the high rate on "lethargy" and other factors in public agencies on job safety and health. Barnes cited injury incidence rates compiled in California to show that state and local employees in the state suffered almost 50 percent more injuries than workers in the private sector.

The causes for the higher rate are numerous. Heading the list is lethargy in public agencies, Barnes said. Entrenched bureaucratic procedures and lack of information on OSHA and job safety and health also constrain agency effectiveness, he said. Responsibility within agencies for safety and health generally is vaguely defined, Barnes has found. Finally, competing special interests within and without the agency are vying for the agency's resources and attention.

Even with these constraints, public agencies are becoming more aware of safety because of OSHA, Barnes believes. In upgrading their safety programs, he urged public agencies to