Public Health Briefs

Nonoccupational Exposures to Indoor Air Pollutants: A Survey of State Programs and Practices

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Abstract: A national survey of health department activities in 1982 revealed that 32 states (63 per cent) had a program or person(s) responsible for evaluating exposures to one or more nonoccupational indoor air pollutants (NIAPs). Only four states (8 per cent) had existing or proposed NIAP exposure standards. Twenty-nine (57 per cent) of the states had a program to evaluate nonoccupational exposures to formaldehyde, but these varied widely. There is a need for coordinated, consistent approaches to defining and controlling emerging environmental public health problems such as indoor air pollution. (*Am J Public Health* 1984; 74:1020–1023.)

Introduction

Congress, the public, and the scientific community have become increasingly aware of and concerned about the potential hazard caused by air pollutants in indoor environments.[1–7] The magnitude and severity of this emerging public health problem appear to have been exacerbated by energy-conserving practices and increased use of certain building materials and consumer products.[8,9] Since 1971, the National Institute for Occupational Safety and Health (NIOSH) at the Centers for Disease Control (CDC) has conducted over 200 indoor air quality investigations in occupational settings, 90 per cent of which have been requested in the last five years.[10]*

Federal agencies with statutory responsibility and authority for characterizing and controlling hazardous exposures to nonoccupational indoor air pollutants (NIAPs) include the Environmental Protection Agency (EPA), the Food and Drug Administration, and the Consumer Product Safety Commission (CPSC). With the exception of requirements for nonsmoking areas in certain environments, there are no mandatory federal exposure standards or regulations for commonly occurring NIAPs.[11]

The spectrum of NIAPs includes biological, chemical, and physical agents such as pathogenic microorganisms, aeroallergens, carbon monoxide, nitrogen oxides, pesticides, detergent (alkaline) dusts, respirable particulates, and potential human carcinogens such as radon decay products, asbestos fibers, formaldehyde, and tobacco smoke.[2–9]

The air quality of nonoccupational indoor environments, the nature of exposed populations, and the epidemiology of NIAP-related health effects among high-risk groups are poorly characterized.[2–12] The most prevalent complaints in what has come to be called the "stuffy building" syndrome are the acute effects referable to irritant properties of certain NIAPs (e.g., formaldehyde, oxides of nitrogen, and airborne particulates such as fibrous glass, alkaline dust, and tobacco smoke). It is biologically plausible that NIAPs may also exacerbate or cause subacute, recurrent, or chronic respiratory diseases such as obstructive airways diseases, hyperreactive airways diseases, hypersensitivity lung diseases, mucus hypersecretion, fibrosis, and cancer.[2–7] However, disagreements and confusion exist over the clinical, environmental, and epidemiologic methods used for identifying and confirming the environmental relatedness of such respiratory diseases.[12,13]

In the latter half of 1982, the Center for Environmental Health and NIOSH, CDC, conducted a national survey of state health departments to identify the program components in states responsible for evaluating NIAP health hazards; characterize the range of NIAPs subject to state evaluation; and determine the state practices for handling exposures to a specific NIAP, formaldehyde. This report summarizes our findings and recommendations.

Methods

Regional NIOSH consultants and industrial hygienists assisted state health officers in obtaining and validating the following responses from the appropriate component or individual within each of the 50 states and the District of Columbia. Validation and reliability of the sampling and analytical methods used in state NIAP programs are reviewed elsewhere.[14,15] The following summary data reliably reflect programs and practices in state health departments as of early 1983.

Results

State NIAP Programs and Exposure Standards

Only one state did not have an NIAP program or other formal means of consultation and technical assistance (Table 1), but only 11 NIAP programs offered to conduct compre-

*In many of these instances, the occupational setting was also the site of nonoccupational exposures to indoor air pollutants (e.g., children in schools, patients in medical care facilities, and passengers in commercial conveyances).

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TABLE 1—State Programs for Hazard Evaluations of Exposures to Nonoccupational Indoor Air Pollutants (NIAPs)

Nature of State NIAP Program	Number of States (% of 51)
No consultant or NIAP field services	1 (2)
Consultant available; no program *per se*	8 (16)
NIAP program in effect	32 (63)
No NIAP program; Occupational Health Division may offer NIAP assessment	7 (14)
Used to have formaldehyde program only, but no longer available	3 (6)
NIAPs Subject to Evaluation	
No nonoccupational air-sampling available	19 (37)
Formaldehyde and/or asbestos only	17 (33)
CO_2, CO, and/or NO_x only	1 (2)
Formaldehyde; asbestos; CO, CO_2, and/or NO_x; and tobacco smoke or pesticides	11 (22)
Radon decay products and any of above NIAPs	3 (6)
NIAP Field Services and Research	
No field services or research available	11 (22)
Advice and consultation only	4 (8)
Exposure evaluations only	15 (29)
Health effects evaluations only	2 (4)
Exposures and health effects evaluated	11 (22)
Exposures evaluated and research on health effects conducted	8 (16)

TABLE 2—State Practices for Sampling and Analyzing Nonoccupational Exposures to Formaldehyde Gas in 29 States

Criteria for Offering Air-Sampling	Number of States
Upon receipt of a (biologically plausible) complaint without an MDs diagnosis, and without documentation of exposure	16
Upon request, regardless of symptoms, if a potential source of formaldehyde is present	2
Physician or local health department makes the request	9
Part of state NIAP research project	2
Sampling Strategy and Collecting Device	
Active collection, area samples only, NIOSH Method #125	20
Active collection, area and personal samples, NIOSH #125 plus #318 or #354	1
Active collection, area samples, with use of detector tubes	5
Passive collection, area samples, with use of dosimeter badge	2
Other method (direct-reading instrument)	1
Documentation of Environmental Conditions	
None specified	15
At least temperature and humidity	3
Temperature, humidity, and source data	6
Temperature, humidity, source data, and ventilation characteristics	4
Temperature, humidity, source data, ventilation characteristics, and occupancy/use characteristics	1

hensive medical-epidemiological evaluations of nonoccupational, building-related health complaints. The scope of NIAPs subject to evaluation also varied widely, but most programs were quite limited.

Two of the 29 states which provided air-sampling services to evaluate nonoccupational exposure to formaldehyde charged nominal fees per visit or per sample. Forty-seven states had no existing or proposed NIAP exposure standards. In three states which had proposed standards for formaldehyde exposures in houses or mobile homes, the standards were under legal challenge. Only one state had an NIAP exposure standard in effect (for tobacco smoke).

State Practices for Handling Nonoccupational Exposure to Formaldehyde

Among the 29 states which offered air-sampling to evaluate nonoccupational exposure to formaldehyde, the sampling and analytical methods varied widely, as did the criteria for providing on-site air-sampling (Table 2). Comparison air-sampling in unaffected parts of the building or outdoor environment was rarely done. In most instances, the operation of the heating, ventilation, and air conditioning system was not evaluated. Less than half of the 29 consultants routinely collected a full range of environmental data at the time of air-sampling for formaldehyde.

The types of advice given to requestors who thought that they had been exposed to formaldehyde varied widely by state (Table 3). Ten of the 29 states which offered formaldehyde air sampling did not have a specific exposure level (evaluation criteria) upon which they based recommendations for controlling exposures. Among the 18 states which used the current OSHA occupational health standard (3 ppm) as their evaluation criterion, the sampling and analytical methods being used were not sufficiently sensitive or specific to evaluate low-level exposures.[14,15] Although results were reported to requestors with a letter of explanation by 26 states, only three of them provided information on the limitations of their methods.

On the basis of the air sampling results and specific evaluation criteria, the advisability of abatement and alternative control methods were provided to requestors by 19 states. Suggested control strategies included those recommended by the National Academy of Sciences (dilution and exhaust ventilation, source removal or modification, air cleaning, and education),[3] legal remedies, and evacuation of the affected premises.

Discussion

Among the 32 states with NIAP programs in effect, formaldehyde and asbestos exposure assessments were the primary concerns. A wide range of other potentially hazardous exposures were not investigated.

The great diversity of approaches to evaluating a commonly occurring NIAP exposure hazard such as formaldehyde may reflect the complexity of assessing formaldehyde's toxicology and health risks[16–20] and the limited human and technical resources devoted to environmental epidemiology in state health departments.[21] There is a real need for training, education, and consultation in measuring environmental exposures and in evaluating the relatedness of adverse health effects.[12,22]

State health departments can help meet the need for more epidemiologic data on the health effects of indoor air pollution by coordinating their approaches to this problem through a recently organized Interagency Committee on

TABLE 3—State Practices for Evaluating Air-Sampling Results and Advising Requestors Exposed to Formaldehyde Gas

Advice for Asymptomatic Exposed	Number of states (% of 51)
(a) No advice given (or none specified)	5 (10)
(b) Don't worry, don't measure exposures, increase ventilation if concerned	7 (14)
(c) See MD if (biologically plausible) symptoms occur	3 (6)
(d) Exposure monitoring and subsequent advice on abatement are available	5 (10)
(e) Responses (c) plus (d)	9 (18)
(f) Use a passive dosimeter or consult with a commercial laboratory, private contractor, or OSHA	13 (25)
(g) Responses (c) plus (f)	7 (14)
(h) Provide state-prepared fact sheet on formaldehyde hazards	2 (4)
Advice for Symptomatic Exposed	
(a) No advice given (or none specified)	6 (12)
(b) See MD if (biologically plausible) symptoms occur	3 (6)
(c) Exposure monitoring and subsequent advice on abatement are available	4 (8)
(d) Responses (b) plus (c)	15 (29)
(e) Take legal action to reduce exposure	1 (2)
(f) Use a passive dosimeter or consult with a commercial laboratory, private contractor, or OSHA	1 (2)
(g) Responses (b) plus (f)	16 (31)
(h) Vacate premises if (b) and (c) or (f) are not helpful	5 (10)
Evaluation Criteria (Exposure Level) for Adverse Effects	**Number of States (% of 29)**
None specified	10 (34)
OSHA* (3 ppm), acute effects only	1 (3)
CPSC* (0.03 ppm), acute effects only	2 (7)
NAS* (no threshold), acute effects only	1 (3)
IARC* and Federal Panel* (lowest feasible level), acute and chronic effects	8 (28)
State or unspecified sources of criteria (0.05–0.5 ppm), acute effects only)	7 (24)

*OSHA: Occupational Safety and Health Administration
CPSC: Consumer Product Safety Commission
NAS: National Academy of Sciences
IARC: International Agency for Research on Cancer
Federal Panel: a panel of experts[18] designated by OSHA, NIOSH, CPSC, the Environmental Protection Agency, the National Cancer Institute, the Food and Drug Administration, the National Institute of Environmental Health Sciences, and the Department of Energy.

Indoor Air Quality.** Objectives of collaborative efforts might include: identification of environmentally related, sentinel respiratory diseases of public health importance (e.g., nasopharyngeal carcinoma, pleuroperitoneal mesothelioma, extrinsic asthma, hypersensitivity pneumonitides, noncardiogenic respiratory distress syndrome, and diffuse pulmonary fibrosis); characterization of all existing state-based systems for obtaining morbidity and mortality data on the epidemiology of environmentally related respiratory diseases; evaluation of the reliability and validity of these data bases; characterization and monitoring of exposures to indoor air pollutants of particular concern (e.g., tobacco smoke, asbestos and other fibrous minerals, combustion products and volatile chemicals such as formaldehyde, allergens, pesticides and household cleaning agents, and ionizing and nonionizing radiation), identification of uniquely exposed or hypersusceptible cohorts for surveillance or more detailed studies; and adoption of standardized epidemiologic methods for interviews and medical testing[23] and for environmental monitoring.[14,15,24] A national clearinghouse to coordinate and disseminate data collected from case studies, environmental monitoring, and surveillance of sentinel health events is desirable.[25–28]

**The Interagency Committee on Indoor Air Quality is co-chaired by representatives of EPA, CPSC, and the US Departments of Energy and Health and Human Services. Correspondence should be directed to Mr. David Berg, EPA/RD-681, 401 M Street, SW, Washington, DC 20460 (phone 202/382-2621). Collaborative efforts may be facilitated and information on specific state NIAP components may be obtained by writing to the Director, Center for Environmental Health, Centers for Disease Control, Atlanta, GA 30333.

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Survey of Health Department-Based Environmental Epidemiology Programs

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Abstract: A survey of state epidemiologists in all 50 states and New York City was conducted between October 1982 and January 1983 to determine which states had existing programs in environmental epidemiology. We identified 29 environmental epidemiology programs with at least one full-time state-funded staff member. The most common areas of responsibility included investigations of indoor air pollution (96 per cent), exposures to toxic or hazardous substances (93 per cent), and pesticide exposures (93 per cent). (*Am J Public Health* 1984; 74:1023–1025.)

Introduction

The industrialization of our society over the past 200 years has led to significant increases in the human lifespan within developed countries. However, industrialization has also generated potential hazards in the form of chemical and radiological wastes and pesticide residues. The first victims of the industrial revolution were populations exposed occupationally to these hazards; however, toxic substances have gradually begun to seep into our water supplies and to contaminate our food and air. These habitat changes raise important questions regarding their various impacts on human health.

In response to the growing need for investigations into the health effects of environmental pollutants, epidemiology programs focusing on environmental problems are being developed in many state health departments. This paper reports the results of a national survey of health department-based environmental epidemiology programs. The study was designed to determine which states currently have established programs in environmental epidemiology and to ascertain their size and areas of responsibility.

Materials and Methods

Between October 1982 and January 1983, state epidemiologists in all 50 states and New York City were sent a questionnaire and asked to provide information about their state's activities in environmental epidemiology. Telephone interviews were conducted where questionnaires were incomplete or not returned. States were ranked separately according to population and number of US Environmental Protection Agency Superfund sites.[1] States with and without environmental epidemiology programs were compared.[2]

An environmental epidemiology program was defined as a program separate from communicable disease epidemiology, having a staff of at least one state-funded, full-time equivalent, and addressing problems in one or more of the following areas: health effects of air pollution, illnesses from indoor pollution, hazardous consumer products, foodborne illnesses, non-communicable diseases or cancer clusters, occupational hazards or diseases, pesticide exposures, radiation exposures, adverse pregnancy outcomes, exposures to toxic substances, and waterborne diseases.

Results

All of the states surveyed had programs in communicable disease control, and 28 states plus New York City had established environmental epidemiology programs. These programs were most prevalent in the northeastern and

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