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## Occupational Health Services in South Carolina Manufacturing Plants: Results of a Survey

ALAN C. CHOVIL, MD, MPH  
GREG R. ALEXANDER, MPH  
JAMES J. GIBSON, MD, MPH  
JOAN M. ALTEKRUSE, MD, DrPH

The authors are with the department of preventive medicine and community health, University of South Carolina School of Medicine, Columbia. Dr. Chovil is an associate professor, Mr. Alexander is a biostatistician, Dr. Gibson is an assistant professor, and Dr. Altekruise is professor and chairman of the department. Major assistance in carrying out this project was provided by Blue Cross/Blue Shield of South Carolina, Inc., and by a grant from E. I. du Pont de Nemours & Company.

Tearsheet requests to Alan C. Chovil, MD, MPH, Department of Preventive Medicine and Community Health, University of South Carolina School of Medicine, Columbia, S.C. 29208.

### SYNOPSIS .....

*A mailed survey of occupational health and safety practices in industrial manufacturing plants with*

*more than 50 employees was carried out in South Carolina, with a response rate of 60 percent. The responding plants represented 73 percent of the total workforce in the industries. Data were analyzed in relation to the types of industry as delineated by the Standard Industrial Code.*

*Eighty-three percent of the responding plants (a percentage that represented more than 92 percent of the total workforce in the industries) had some arrangements for the medical or nursing care of employees. For the study, occupational health services were defined at three levels: basic (mandatory), secondary (beneficial to management), and tertiary (health promotion-preventive medicine). The basic services provided by most of the industries surveyed appeared to be adequate. Secondary services were well developed except in the apparel and lumber industries. Tertiary services, in terms of five selected preventive programs, were moderately developed only in the paper, petroleum, and chemical industries. Only alcohol abuse control programs were commonly offered in the other types of industry. The size of the workforce in a plant partly dictated the level of occupational health services it offered but did not always account for all inter-industry variation.*

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**O**UR NATIONAL PERCEPTIONS OF THE OBJECTIVES and need for occupational health services have been subjected to the changing social trends over recent decades. A laissez-faire governmental approach, under which services were established at the option of management in a few—often service-type—industries, was superseded by an intensive regulatory period following passage of the Occupational Safety and Health Act (OSHA) in 1972. More recently, deemphasis of the regulatory approach in occupational health has coincided with a new, totally independent general surge in interest in promoting individual physical and mental health in the workplace and elsewhere. Although the use of sophisticated health promotion programs by large corporations has been widely reported in business journals, the extent to which occupational health services of various types, including health promotion programs, are actually available to the workforce has not been well documented.

OSHA regulations mandate certain standards in the workplace to prevent injury or illness, and these

standards include requirements for programs for medical surveillance and recordkeeping in specific hazardous industries. These programs, together with the requirement for care of injured employees under workers' compensation laws, might be considered as the basic level for an occupational health service. A secondary level of service can expand beyond such basic activities to include preemployment examinations, absentee surveillance, and so forth, which have been found to be cost-efficient to management in some circumstances. Health promotion-preventive medicine programs, which are currently fashionable but for which the benefits to management (or to workers) are more obscure, could be considered as the tertiary level of care. The subject of the costs and benefits to management of occupational health programs, as well as the rather limited background literature, have been discussed in detail previously (1).

A literature review revealed few data on the extent of occupational health services at the national level. In the course of the 1972 National Occupa-

*'The number of plants reporting that they had no arrangements for medical or nursing services, 107 of 717, is disquieting. Thirty-nine indicated an absence even of employees trained in first aid (30 of these were in the apparel and lumber industries).'*

tional Hazard Survey (2), the National Institute for Occupational Safety and Health assembled data on the personnel of occupational health units and on the provision of certain examinations. To collect the data, NIOSH surveyed, by site visits, a statistically designed sample, representative for the nation, of 5,000 establishments with 8 or more employees in 67 metropolitan areas. It is difficult to translate such sample data into the actual services available in specific regions and industries; moreover, they are outdated. NIOSH is currently repeating this survey. Another NIOSH survey in 1978, which was essentially directed at forecasting the needs for and supply of manpower (3), provided little new information on the actual level of occupational health personnel. (We cite this 1978 NIOSH survey, however, because as in the survey described in this paper, a mailed questionnaire was used under similar circumstances, and it is of interest to compare the response rates in the two surveys.)

The recently completed survey reported here reveals the extent of actual occupational health services in one State—South Carolina. Conducted in 1982, it was directed at all manufacturing industries in the State with more than 50 employees. Its results provide a cross-sectional view of occupational health services in a sunbelt State with a high rate of industrial growth and a mix of traditional and new industries.

## Methods

A concise mailed questionnaire, designed to determine the use and availability of occupational health services, was sent in 1982, with a personalized letter of explanation, to the chief executive of each manufacturing plant in South Carolina having more than 50 employees. A second mailing, with another personalized request for cooperation, was sent to those who failed to respond within 4 to 6 weeks to the first mailing. The questionnaire was primarily intended

to provide background data that the department of preventive medicine and community health at the University of South Carolina School of Medicine could use in determining priorities in teaching and research activities. It contained queries about health and safety personnel, practices, and programs. The plants were categorized by type of product as designated by the Standard Industrial Code—SIC (4) and by size of workforce. To encourage appropriate responses, questions were framed so as to avoid potentially contentious issues. Confidentiality was also assured.

Usable responses were received from 717 (60 percent) of 1,202 plants; these 717 represented 73 percent of the workforce of the manufacturing plants in South Carolina with more than 50 employees. (In the 1978 NIOSH survey cited previously (3), the researchers expressed satisfaction with a 50 percent response rate.) Eight of the larger corporations, which had 91 separate plants, chose either to send a single response to include all their statewide operations or else indicated that several of their plants had integrated programs for health care. In our analysis, these corporate responses were extrapolated to indicate the services available at the individual plants.

The chief executives of three major corporations, two of whom indicated concerns about confidentiality, declined to participate in the survey. These three corporations represented 34 plants. Cotton dust standards have caused great concern in the textile industry, and two of the three corporations declining to participate are engaged in textile manufacture. However, replies were subsequently received from four subsidiary plants of these corporations, and these replies have been treated as individual responses in the analysis.

Data from the South Carolina Industrial Directory (5) on the product, size of workforce, and location of plants permitted some comparison between those plants that responded to the questionnaire and those that did not. Standard Industrial Code groupings were used to classify the plants surveyed. The SIC codes were consolidated whenever activities or hazards seemed related.

## Results

Table 1 shows the SIC groups used to classify the plants surveyed, provides a definition of each group, and gives actual figures for the numbers surveyed and responding, the mean and median size of the workforce, and the percentage of plants with 300 or

more employees, by SIC group. Also in this table, the responding plants are characterized by the number of workers and the percentage of the total workforce that these workers represent.

Plant size (number of employees) was directly related to many of the variables studied, including the response rate. Review of the data from the questionnaires showed major differences in both the mean and the median plant size among different industries, as classified under the SIC groupings. The distributions of plant sizes varied greatly among different industries, being skewed, bimodal, or multimodal. To permit some review of differences in levels of service that might be truly related to the type of industry, SIC groups were ordered so as to reflect the increasing proportion of plants with more than 300 employees. By this maneuver, we avoided the alternative of stratifying the plants into three or more plant-size subsets, a procedure that would have resulted in small numbers in each subset. The response rate was appreciably lower for smaller companies. It was also below average for plants in SIC categories 20 and 23 (46 percent for category 20 plants—food and kindred products—and 39 percent for category 23 plants—apparel). However, the

proportion of the workforce within each SIC category that was represented in the responses exceeded 50 percent for all groups except apparel.

It has been suggested elsewhere that nonresponders may be less likely than responders to have well-developed occupational health services (6), a suggestion implying that the survey results will overestimate the true levels of service. It should be noted, however, that the three nonparticipating corporations had well-developed occupational health programs and full-time corporate medical directors.

**Personnel.** A breakdown of the type of health service personnel available by size of the plants' workforce is provided in table 2. Health personnel categories are mutually exclusive in the order shown in this table. For example, onsite nurses may be present in the "Full-time physician" category, but no onsite physicians are present in the "Nurse onsite" category.

The majority of the plants with a nurse onsite also indicated that they had some arrangement, formal or informal, for providing physician services. Twenty-four plants, however, indicated nursing service only without mention of a physician. Overall, 495 plants (79 percent) reported that they had a

Table 1. Distribution of the plants surveyed, the plants responding, and the responding plants' employees, by SIC group

SIC (Standard Industrial Code) group	Plants surveyed		Plants responding					
	Number of plants	Number of employees	Number	Percent	Percent of SIC group workforce <sup>1</sup>	Number of employees per plant		Percent of plants with 300 or more employees
						Median	Mean	
24 LUMBER (lumber and wood products except furniture) . . . . .	68	9,200	46	67.6	56.8	87	114	4.3
20 FOOD (food and kindred products) . . . . .	77	12,990	35	45.5	52.2	118	194	17.1
32 CONCRETE (stone, clay, glass, and concrete products) . . . . .	47	9,612	26	55.3	72.2	83	260	19.2
30 RUBBER (rubber and miscellaneous plastic products) . . . . .	47	13,935	37	78.7	57.8	155	218	21.6
33-34 METAL (primary metal industries—33; fabricated metal products except machinery and transportation equipment) . . . . .	113	25,952	63	55.8	58.4	139	241	23.8
23 APPAREL (apparel and other finished products made from fabric and similar materials) . . . . .	185	40,758	72	38.9	44.5	188	252	34.7
35-36 MECHAN (machinery except electrical—35; electrical and electronic machinery equipment and supplies—36) . . . . .	156	70,506	109	69.9	84.0	225	543	34.9
26 PAPER (paper and allied products—not including printing and publishing) . . . . .	37	13,910	27	73.0	92.3	<sup>2</sup> 138	<sup>2</sup> 476	<sup>2</sup> 34.8
28-29 PETRO (chemicals and allied products—28; petroleum refining and related industries—29) . . . . .	63	35,668	51	81.0	95.5	222	668	43.1
22 TEXTILE (textile mill products) . . . . .	304	135,039	187	61.5	73.8	<sup>2</sup> 313	<sup>2</sup> 533	<sup>2</sup> 54.0
MISC (other industry) . . . . .	105	24,186	64	61.0	76.0	200	287	35.9
Total . . . . .	1,202	391,756	717	(59.7)	72.6	...	...	32.9

<sup>1</sup> Percent of the SIC group's workforce that was composed of employees of the responding plants.

<sup>2</sup> Data from plants that supplied corporate responses are excluded (see text).

designated physician or clinic. Of these 495, 14 (2.8 percent) had full-time physicians. However, only 35 (7 percent) indicated that their part-time physicians visited the plants regularly, and a further 32 (6 percent) indicated that these physicians visited occasionally or irregularly.

The number of plants reporting that they had no arrangements for medical or nursing services, 108 of the 717 responding plants, is disquieting. Thirty-nine plants indicated an absence even of employees trained in first aid. Of the 39, more than half were

in SIC category 23—apparel (12 plants) and in SIC category 24—lumber (8 plants).

The chart shows the percentages of plants with professional staff available onsite or offsite and the percentages with employees who have had first aid training in relation to the number of workers employed in each SIC category. (The health personnel categories are, again, exclusive.) When the data are displayed in this way, it is apparent that some medical or nursing services are actually available to nearly 93 percent of the workforce at the plants re-

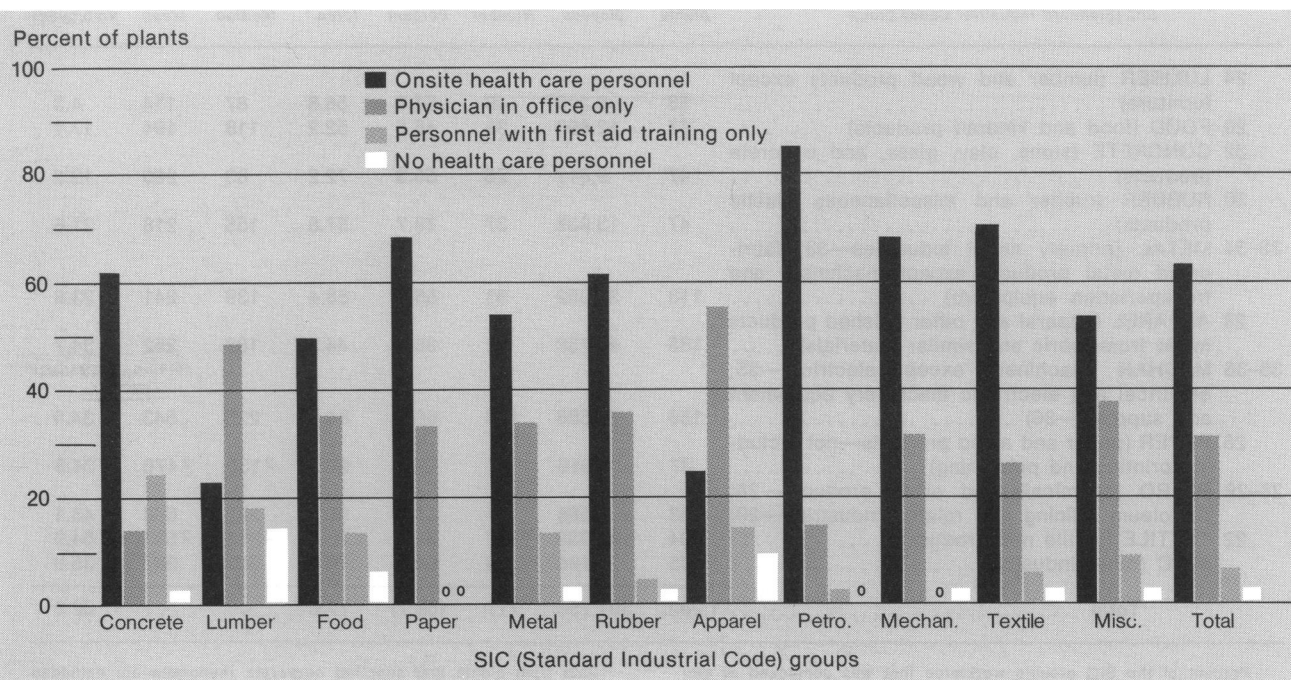
Table 2. Distribution of responding plants with one or more types of occupational health care personnel, by level of that personnel and size of workforce

Level of occupational health care personnel	50-99 employees <sup>1</sup>		100-259 employees		250-499 employees		500-999 employees		1,000 or more employees		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Full-time physician .....	0	0.0	1	0.5	1	0.8	1	1.2	11	33.3	14	2.2
Part-time physician:												
Regular site visits .....	0	.0	6	2.9	4	3.2	16	19.8	9	27.3	35	5.6
On call .....	2	1.1	7	3.3	15	12.1	4	4.9	4	12.1	32	5.1
In office with nurse on site ...	6	3.4	25	12.0	36	29.0	33	40.7	4	12.1	104	16.6
In office .....	111	62.0	134	64.1	49	39.5	15	18.5	1	3.0	310	49.5
Nurse only on site .....	4	2.2	1	.5	7	5.6	8	9.9	4	12.1	24	3.8
First-aid trained employees only .	30	16.8	25	12.0	9	7.3	4	4.9	0	.0	68	10.9
No health care personnel .....	26	14.5	10	4.8	3	2.4	0	.0	0	.0	39	6.2
Total .....	179	100.0	209	100.1	124	99.9	81	99.9	33	99.9	626	99.9

<sup>1</sup>The study was based on plants with 50 or more employees.

NOTE: Data from plants that supplied corporate responses are excluded. Percentages may not add to 100.0 because of rounding.

Availability of health care personnel and services in plants with 50 or more employees, by SIC group and type of health care personnel



sponding, but that deficiencies still appear in both the lumber and apparel categories and also in the concrete category (SIC 32).

**Services.** Less than 5 percent of the respondents indicated they had difficulties in complying with OSHA health and safety standards or in arranging for treatment of injuries under Workers' Compensation. This result may provide support to the claim that adequate basic occupational health care is available. The frequency of use of audiometry, chest X-rays, and pulmonary testing appeared to be appropriate in terms of the known hazards peculiar to the various industries surveyed and the requirements mandated under OSHA regulations.

We reviewed the availability of what we defined as the secondary level of occupational health service on the basis of responses to questions about the use of preemployment physical examinations, examinations upon return to work after disability, and health-screening programs (such as for hypertension). The levels of response are shown in table 3 by SIC group in terms of the percentage of workers in the responding plants where these services were offered.

Preemployment physical examinations (considered desirable to help ensure correct job placement) and return-to-work examinations (often used by management to monitor absenteeism) primarily benefit management, whereas health screening may have a more direct value to the individual worker. All of these services, however, if used intelligently, have a reasonable probability of being cost-beneficial to industry (1). Although there is a graded difference in the availability of these three services across all

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industry, the infrequent provision of any of these services by the apparel groups and the relatively frequent provision of all three by the paper, petro, and textile groups stands out. Overall, continuing health screening services, albeit of an unspecified type, were provided to 50 percent of the workforce in the responding plants.

We considered the provision of health promotion-preventive medicine programs to be the third level of occupational health services. Although such programs are currently receiving much publicity, their benefits for management remain largely unproved. In the survey, questions were asked about five programs that fall under this rubric—alcohol and drug abuse, smoking cessation, diet counseling, stress counseling, and physical fitness. It is apparent from table 4 that such programs have as yet found little acceptance in South Carolina, even in the larger industries. Alcohol control programs are the most widely available type of health-promotion programs,

Table 3. Percentage of employees in responding plants who had specified occupational health services available and percentage of the responding plants providing them, by SIC group

SIC (Standard Industrial Code) group	Preemployment examinations		Return-to-work examinations		Health screening programs	
	Employees	Plants	Employees	Plants	Employees	Plants
24 LUMBER .....	44	53	37	32	15	7
20 FOOD .....	56	62	51	34	20	9
32 CONCRETE .....	90	73	49	31	23	8
30 RUBBER .....	83	70	63	57	30	19
33-34 METAL .....	80	79	45	43	30	16
23 APPAREL .....	11	11	23	21	8	7
35-36 MECHAN .....	87	82	45	36	24	26
26 PAPER .....	95	93	79	64	65	33
28-29 PETRO .....	99	90	50	51	85	43
22 TEXTILE .....	92	86	74	65	75	57
MISC .....	51	59	31	28	25	17
Total .....	81	71	55	44	50	29

For further explanation of these groups, see table 1.

*'Within the limitations of a cross-sectional survey, we were able to observe that medical services, at least up to mandated minimums, are probably available to most of the workforce in South Carolina.'*

being available to 38 percent of State workers overall, and have proved cost-beneficial (1). Other health-promotion type programs are seldom available to employees except those in the paper and petro groups.

## Discussion and Conclusion

To draw strong conclusions from the data derived from this sort of survey would be dangerous. Comments that respondents added to the questionnaires indicated that local conditions, such as geographic location in relation to hospitals, clinics, and physicians and the socioeconomic structure of the workforce, played a part in determining what services company management would decide to institute and how they would be organized. The data seem to indicate that in South Carolina, occupational medical services are adequate for basic compliance with the Occupational Safety and Health Act and for the treatment of injured workers. The finding that only a small proportion of plant physicians ever visited

the worksite is a matter of concern, however, as it suggests that plant physicians may be unfamiliar with local occupational hazards. Occupational health services were somewhat more modestly developed at what we consider the secondary level—the provision of extra services that might be of cost-benefit to management as well as of value to the worker. The use of health promotion programs (the tertiary level of services), with the exception of alcohol control programs, was extremely limited.

We found variations both in the level and the type of occupational health services that were provided by industry that were apparently not solely dependent on the plant-size categorization chosen for our analysis. However, as mentioned before, the SIC groups that we used had skewed or bimodal distributions of size (number of employees per plant) within industries. Such distributions made the ordering that we used to compensate for size variation only an approximation, and this approximation would be even less valid if only a small proportion of the plants in a group were involved.

Other factors related to variations in the services provided also must be considered. One might suspect that larger corporations with many plants located across the nation would tend to set national standards for all their plants. The plants of a corporation in one State may have been influenced to provide services by union pressures on the corporation's plants in other States. The size of individual plants and the factor of economies of scale may also be involved. The paper, petro, and mechan groups have relatively larger workforces than the lumber, food, or apparel groups. This greater size may have been

Table 4. Percentage of employees in responding plants who had specified health promotion programs available and percentage of the responding plants providing them, by SIC group

SIC (Standard Industrial Code) group <sup>1</sup>	Alcohol		Fitness		Smoking		Diet		Stress	
	Employees	Plants	Employees	Plants	Employees	Plants	Employees	Plants	Employees	Plants
24 LUMBER .....	11	11	4	2	0	0	4	2	4	4
20 FOOD .....	19	6	5	6	19	6	19	6	17	3
32 CONCRETE .....	44	16	1	4	1	4	3	8	0	0
30 RUBBER .....	25	16	16	8	3	3	6	5	13	11
33-34 METAL .....	26	10	11	8	8	3	9	5	13	6
23 APPAREL .....	6	4	0	0	0	0	3	3	5	3
35-36 MECHAN .....	13	16	12	16	2	3	11	10	10	10
26 PAPER .....	58	41	34	22	25	11	25	7	34	22
28-29 PETRO .....	74	35	51	16	43	16	46	14	49	14
22 TEXTILE .....	53	37	3	2	10	11	8	9	14	19
MISC .....	15	11	12	11	17	13	10	6	15	8
Total .....	38	21	13	8	12	7	14	7	17	11

For further explanation of these groups, see table 1.

at least partly responsible for the higher levels of health promotion services that table 4 shows that the paper, petro, and mechan groups provided.

Predominance of employees of one sex, the socioeconomic levels of the workforce, or management's response to mandatory pressure might also have contributed to variations in the extent and type of occupational health services provided.

Within the limitations of a cross-sectional survey, we were able to observe that medical services, at least up to mandated minimums, are probably available to most of the workforce in South Carolina. This type of survey does not permit conclusions as to the degree to which these services were established in response to regulatory pressures. The survey indicated that industrial management in South Carolina was not yet taking full advantage of the possible cost-benefits to be derived from offering the secondary level of occupational health services. Also, the national vogue for health promotion and physical fitness was not reflected in the services provided to workers in the State through their employment.

The type of study we conducted permitted observation of interindustry differences in both the level and the type of services, but the reasons for these differences must remain speculative. It is difficult to determine how relevant the findings are to other States. South Carolina is an OSHA Agreement State, but whether this has caused services to develop differently than in non-OSHA Agreement States is

not clear. A large proportion of the plants surveyed are subsidiaries of, or have relationships with, national corporations that have plants in many States, and these relationships may have reduced the influence of purely regional factors. It is of interest that Fielding (7) found levels of health promotion activity in California industry similar to those we observed.

## References

1. Jacobs, P., and Chovil, A.: Economic evaluation of corporate medical programs. *J Occup Med* 25: 273-278 (1983).
2. National occupational survey. DHEW Publication No. 78-114. National Institute for Occupational Safety and Health, Cincinnati, Ohio, 1974, vol. 1.
3. National Institute for Occupational Safety and Health: A nationwide survey of the occupational safety and health workforce. DHEW Publication No. 78-164, Cincinnati, Ohio, 1978.
4. Office of Statistical Standards, Executive Office of the President/Bureau of the Budget: Standard industrial classification manual. U.S. Government Printing Office, Washington, D.C., 1967.
5. South Carolina State Development Board: South Carolina 1982 industrial directory. Columbia, S.C., 1982.
6. Saltzman, B. E.: Adequacy of current industrial hygiene and occupational safety professional manpower. *Am Ind Hyg Assoc J* 43: 254-260 (1982).
7. Fielding, J. E., and Breslow, L.: Health promotion programs sponsored by California employees. *Am J Public Health* 73: 538-542 (1983).

## The Three Mile Island Population Registry

MARILYN K. GOLDHABER, MPH  
GEORGE K. TOKUHATA, DrPH, PhD  
EDWARD DIGON, MPH  
GLYN G. CALDWELL, MD, MPH  
GARY F. STEIN, MD, MOH  
GUY LUTZ  
DAVID GUR, ScD

Ms. Goldhaber, Dr. Tokuhata, and Mr. Digon are with the Division of Epidemiology Research, Pennsylvania Department of Public Health—Ms. Goldhaber as chief, Nuclear Health Research Program; Dr. Tokuhata as director of the division and program manager, Three Mile Island Research Program; and Mr. Digon as chief, Special Studies Section. Dr. Caldwell and Dr. Stein are with the Chronic Diseases Division, Center for Environmental Health, Centers for Disease Control, Atlanta—Dr. Caldwell as deputy

director of the division and Dr. Stein as medical epidemiologist, Special Studies Branch. Mr. Lutz, who is now retired, was regional director of the U.S. Bureau of the Census, Philadelphia. Dr. Gur is associate professor of radiation health and radiology at the Graduate School of Public Health, University of Pittsburgh.

Tearsheet requests to George K. Tokuhata, DrPH, PhD, Division of Epidemiology Research, Pennsylvania Department of Health, P.O. Box 90, Room 1013, Harrisburg, Pa. 17108.

## SYNOPSIS

*Shortly after the March 28, 1979, accident at the Three Mile Island (TMI) nuclear plant outside Harrisburg, Pa., the Pennsylvania Department of Health, in conjunction with the Centers for Disease Control and the U.S. Bureau of the Census, conducted a census of the 35,930 persons residing within 5 miles of the plant. With the help of 150 enumerators, demographic and health-related information was*