FILE NAME: Industrial Hygiene Foundation (IHF)

DATE: 1947

DOC#: IHF009

DOCUMENT DESCRIPTION: IHF Conference Proceedings - Health in Industry - Transactions Bulletin

HEALTH IN INDUSTRY

TRANSACTIONS

Bulletin No. 8

Eleventh Annual Meeting

To Industrial Hyg Found
from Year, Bill.

INDUSTRIAL HYGIENE FOUNDATION
4400 FIFTH AVENUE
PITTSBURGH 13, PA.

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C. O. Sappington, M. D., Dr. P. H., addressing the Foundation's Annual Meeting.

TRENDS IN INDUSTRIAL HEALTH ADMINISTRATIVE PRACTICES

Progress Report of a Two-year Field Study on Industrial Health Department Functions and Relationships

C. O. SAPPINGTON, M. D., Dr. P. H.

As previously mentioned in the preliminary report given at the last annual meeting of the Foundation, most surveys of this type are done on a quantitative basis—this study is qualitative for the most part, although some quantitative data have been secured. We are interested particularly in finding out what the policies and procedures of industrial health departments are, how they are administered, and what the results are as to the efficiency of their application.

The great majority of the contacts were made in person, although in some instances, on account of restrictions of travel and other difficulties, a minority has been reached by correspondence. Contacts which have been made in person for the past several years have been used and new ones have been made.

The active work began on this study during April, 1945 and has included 278 groups in 33 states, embracing the manufacture of diverse war and peace products, and also various types of services. The total population covered was 1,180,551, of which 861,396 were men and 319,155 were women.

It is important to keep in mind that the data herewith presented indicate trends only, that it would be an impossibility to get an accurate picture of what is being done in industry with respect to the various subheadings which are here considered. The period covered permitted us to get material during the latter part of the war and during the first year of reconversion.

In this interim report, only a few of the many important phases of the study have been selected for presentation and comment, including group classifications; examinations and dispensary service; other functions; intramural relationships; records and reports; and cost of service.

Group Classification

The first table shows the various sized groups and the percentage of the whole number of groups involved in each population grouping:

Size	No. Groups	%
Under 500	43	15.5
500 - 999	49	17.6
1000 - 1499	50	18.0
1500 - 1999	17	6.1
2000 - 3999	42	15.1
4000 - 9999	43	15.5
10000 & over	34	12.2
	278	100.0

* Industrial Health Consultant.

Originally it was decided to have only three population groups, including a so-called small sized plant group, under 1,000 employees; medium sized plants up to 5,000 employees, and large sized plants including 5,000 employees and over. It was decided eventually, however, to use substantially the same classifications as had been previously used in Dr. C. D. Selby's report on "The Medical and Surgical Care of Industrial Workers," published as Public Health Bulletin No. 99, by the U. S. Public Health Service in 1919. Is was found in going over the data in this last-mentioned report that it was possible to make some comparison between the data therein published and the figures in the present study, showing substantial progress with respect to certain types of administrative practices.

It will be observed that the number of groups and the percentages are fairly evenly divided, with the exception of the group 1,500 to 1,999 employees, which is smaller than the others—this apparently was a matter of chance; this is the way it occurred and evidently there is no other explanation for it.

Examinations and Dispensary Service

The provisions for various types of examinations and a dispensary service form a rather important part of industrial health administrative practice and, therefore, data are offered on this subject in the following table:

No. Groups	Size	% Prepl	% Periodic	% Ret to Wk	% Exit	% Disp
43	Under 500	83.7	53.2	65	11.6	46.5
49	500 - 999	53	36.7	49	6.1	47
50	1000 - 1499	62.8	60	64	14	60
17	1500 - 1999	82.3	64.7	70.6	17.7	53
42	2000 - 3999	71.5	59.5	61.8	9.5	59.5
43	4000 - 9999	72.2	67.5	67.5	11.6	74.4
34	10000 & over	91.1	91.1	94.1	52.8	94.1
278	(Average)	72.7	60.7	65.8	16.2	61.8

This table provides data (divided into the various groupings) with reference to the percentage frequency of preplacement, periodic, return to work after illness and injury, and exit examinations and also shows the percentage occurrence of the use of dispensaries.

It will be noted that with some exceptions there was a gradual rise in the percentage of dispensaries used as the population groups increased in size and, as might be expected, the smallest percentage of dispensaries was found in the "under 500" group and the largest in the "10,000 and over" group. It is also seen that the percentage of different types of examinations showed considerable variation in the different sized groups and, as might be expected, averaged lowest in the exit examinations but were fairly close together in the preplacement, periodic and return to work examinations. It should be stated that there are certain organizations in which preemployment examinations are not done routinely, even among some of the larger ones, which would include the shipyards on the Pacific Coast, many public utilities, and certain types of service organizations.

Other Functions

The percentage of organizations providing dental, industrial hygiene, safety and sanitation services, and giving instruction in health and safety, is shown in the following table:

No. Groups	Size	% Dental	% Ind. Hyg.	% Safety & San.	% Instr.
43	Under 500	7	51.2	69.8	41.8
49	500 - 999	4.1	36.7	49	34.7
50	1000 - 1499	12	50	57.8	34
17	1500 - 1999	11	24.3	64.7	64.7
42	2000 - 3999	9.5	47.7	61.8	40
43	4000 - 9999	18.6	65	65	53.5
34	10000 & over	53	88.2	91.2	53
278	(Average)	16.9	54	64.1	43.5

It will be seen that provision for dental services showed the lowest percentage in this table; in the smaller groups the service was emergency care and prophylaxis by outside dentists on reference and there were no inplant dental services. Beginning with the 1,500-1,999 group, there were a few examples of full-time and part-time dentists rendering inplant services.

Industrial hygiene services of some type were rendered on the average in 54% of the entire group of plants, the variations in the different sized groups being shown in the table. This ranged from inspections by safety engineers, nurses, physicians, and others, to technical studies and follow-up work. Technical studies were made in all groups by state departments of health, insurance companies, and parent-company laboratories, with the occasional use of private agencies and consultants. There were a few examples of inplant services by a laboratory owned and maintained by the organization.

Safety and sanitation activities showed inspections in the smaller groups mainly by state representatives, committees, commercial supply companies, nurses, foremen, physicians, and beginning with the 1,500-1,999 group there were organized programs of safety supervision with apparently good coordination between the safety and medical departments. It is noteworthy that among all groups there were frequent examples of the use of physicians and nurses in sanitation inspections.

An average of 43% of all establishments gave some type of instruction in health and safety; this seems somewhat low and perhaps was very definitely affected by the activities of the war and reconversion periods. It is also seen that in the two highest groups only 53% provided some form of health and safety instructions.

Intramural Relationships

This subject was discussed in the preliminary report one year ago and will again be limited to a brief consideration of the relationship of the industrial health department to other departments within the same organization or plant. At the time of the previous report, there was some discussion concerning the varying differences of opinion as to the results occurring when the chief physician or medical director reports to the industrial relations division or officer, as compared with the results when the same medical

officer reports to top management. Reference is made to that discussion and also will be carried more into detail in the final report.

The following table shows the complete data with reference to intramural relationships:

No. Groups	Size	% Direct to Top. Mgt.	% 3 Divs. On a Par	% Health Dept. Final Word
43	Under 500	48.8	30.2	30.2
49	500 - 999	22.4	36.8	30.8
50	1000 - 1499	40	48	54
17	1500 - 1999	23.5	41.2	47.8
42	2000 - 3999	42.8	42.8	50
43	4000 - 9999	38.5	46.5	51.2
34	10000 & over	32.4	35.3	53
278	(Average)	36	39.2	43.2

These figures differ considerably from those given on the incomplete data one year ago, in that the majority of the establishments included at that time reported to top management, had the three divisions of health, safety and industrial relations on an administrative par, and the health department had the final word on health problems. It will be observed here that these relationships are carried out in approximately only 40% of the total number of groups included in this study. It will also be observed that in the percentage reporting to top management, the highest percentage occurred in the groups under 500 employees, and one of the lowest in groups of 10,000 employees and over—this is easily explained on the basis that in the smallest plants top management is very close to all activities and that in the complex administrative arrangements as seen in the largest plants, it appears much easier to delegate supervision to others than top management.

Records and Reports

It is of interest to know what is going on with respect to the health records of employees and allied activities. The following table shows figures with respect to the individual records of employees being under medical control and available to medical staff only; with respect to information being given to individual employees regarding examination findings; the giving of industrial hygiene information to individual employees; and the production of regular reports on health department activities:

RECORDS AND REPORTS

No. Groups	Size	% Medical Control	% Exam Inf.	% Ind. Hyg. Inf.	% Reg. Reports
43	Under 500	16.3	16.3 - 34.8 R	13.9 R	53.5
49	500 - 999	18.7	18.7 - 12.5 R	20 R	27.9
50	1000 - 1499	28	34 - 20 R	16.6 - 26 R	54
17	1500 - 1999	29.4	35.3 - 23.5 R	23.5 R	53.8
42	2000 - 3999	35.7	30.9 - 14.3 R	16.7 R	52.4
43	4000 - 9999	39.6	39.6 - 13.9 R	30.3 R	53
34	10000 & over	88.2	53 - 20.6 R	38.2 - 23.5 R	91.3
278	(Average)	34.8	31.3 - 19.4 R	5.7 - 21.9 R	55.7

On the average approximately 35% of all groups maintained individual health records available only to the medical department staff - of course there are exceptions when records must be consulted for other purposes, but in the before-mentioned percentage individual health records were directly under medical staff control. In this respect, the figures show what might be expected, a gradual increase in the percentage of medical control of health records as the size of the groups increased, except that there was a disproportional increase between the last two groups.

Giving Results of Examinations

With regard to giving individual employees the results of various examinations, there was considerable variation, as shown in column 4 of the table. Here we have a split column, on the left being the percentages in which the examination information was routinely given to individual employees; and on the right, when it was given upon request only—it can be seen that on the whole the figures were somewhat larger for routine procedure than with reference to request. Addition of these two columns of figures across from left to right gives the total percentage of examination information given to the individual employees in the various groups; this reached 73% in the largest working group and 51% in the smallest, with an average of 50% for all groups. The method of reporting examination information to individual employees was largely verbal, although there were a few examples of regularly written reports. There were also instances where routine reports were made verbally to individuals with physical defects with recommendations and follow-up.

The giving of industrial hygiene information to individual employees shows a considerably less percentage, as might be expected, in the various groups, with an average of 27% for all establishments, with approximately 22% being on request only, and most of the data showing that the information was given only in this way.

The making of regular reports shows figures which may seem surprising, since approximately only 55% of all groups made regular reports on their health activities to some agency or person. In most instances, reports were made to management, with a few examples of outside agencies, such as state departments or unofficial agencies. It was apparent in many instances that special reports only were issued at irregular intervals, and also in a large number of cases verbal conferences were held rather than depending upon written material. In those instances where regular written reports were made, they were usually monthly and annual in frequency.

Cost of Service

Reference was made in the preliminary report given a year ago to a general discussion with reference to the cost of industrial health services, citing the factors influencing cost, the types of unit rating of cost, and some material with reference to a number of different types of plants. This material need not be repeated here, but additional material will be given.

It was possible to assemble cost figures from a group of nine plants (three in the under 1,000 class—three in the medium sized class—three in the large class) from a large corporation having fairly well centralized control. The following table shows the number of persons in each plant, the original investment, the maintenance cost on a monthly basis, the salaries on a monthly basis, and the personnel and the salary percentage of the total monthly cost:

COST FIGURES

Persons	Orig. Invest.	Maint. (mo.)	Salaries (mo.)	Personnel	Sal. %
557	$ 3000	$ 65	$ 525	2N - 1pMD	89
853	1200	300	250	1N	45
958	1000	55	170	1pN	76
2329	16000	300	850	1MD - 2N	74
3153	12500	550	1000	1MD - 2N / 1Clk - 1Dr	61
3436	11500	950	1300	1MD - 3N / 1Clk	58
7621	12500	650	1100	1MD - 4N / 1Clk - 1Dr	63
10671	13500	1100	2200	1MD - 9N / X-ray / 3Clk - 1Dr	67
14347	15000	1000	2800	1MD - 9N / PT - 3Clk / 2Dr	71

It is immediately apparent that neither the original investment nor the maintenance cost were direct functions of the number of persons served, although there is some relationship; for example, in the fifth group with 3,153 persons as compared with the seventh group with 7,621 persons (the latter more than twice as large) the original investment was the same, $12,500. The monthly maintenance cost was very similar, as was also the monthly item of salaries, and the percentage of salaries of the monthly total cost. The only difference seemed to be that there were two more full-time nurses in the larger group. (With respect to the abbreviations here in the personnel column, all personnel are considered full-time unless otherwise shown, the small letter "p" standing for part-time, and the abbreviation "clk" for clerk, and "Dr" for driver, "PT" for physical therapist.)

It will be noted that the fourth and last groups in this table showed an original investment of $16,000 and $15,000 each—this is accounted for by the large number of rooms and equipment therefor in each instance, the fourth one using 18 rooms and the last one using 14 rooms, with separate women's and men's wards and separate examination rooms for men and women, as well as diagnostic laboratory facilities and physical therapy.

The salary percentage of the total monthly cost varies from 45 in the second establishment of 853 persons to 89 in the first establishment of 557 persons, with an average percentage of approximately 68 for all nine groups.

As might be expected, the cost of monthly maintenance is considerably influenced by the number and kind of personnel. In the main also, the monthly salaries increased as the size of the plant and the personnel increased, with the exception of the establishments 2 and 3, which had no regularly attending physicians.

The subject of cost in the smaller plants has always been a favorite

one with many statisticians and industrialists. We were fortunate in securing similar data on costs for small plants, this being a group of 12 establishments under 500 employees, located in 12 different widely scattered states.

SMALL PLANT COSTS

Persons	Orig. Inv.	Maint. (mo.)	Salaries (mo.)	Other (mo.)	Personnel	Sal. %
430	$17000	$ 240	$ 390	$ 45	1pMD - 1N / 3 Att. (m)	58
357	656	100	339	—	1pMD - 1N	75
175	500	10		-	2cMD - 2 Att. (m)	—
426	7600	108	319		1pMD - 1N	75
349	51800	1067	5084	5000	1MD - 4N / 1sup. - Asst. / 1Dir. - 2 Engrs. / Dieten - Insp	46
196	500	50	125	20	2cMD - 2 Att. / (F & M)	64
143	1500	20	140	—	2cMD - 1N	84
483	3000	100	450		1pMD - 1N	82
345	4000		700	—	1pMD - 4N	—
480	1000	25	600		1pMD - 1N / 2 Att.	96
323	150	100	300		1pMD - 2N / 1p S. Insp / 1pD. Asst.	75
415	2250	50	625		1pMD - 1N / 1pVN - 1pClk	93

It is immediately apparent that the original investment for the first group of 430 ($17,000) and the fifth group of 349 persons ($51,800) is considerably in excess of the original investments of other groups. In the first instance, this is because the original investment included a separate building for the health department, and in the second instance, it included the building of a small hospital and clinic with adequate facilities for major surgery and regular bed patients, in an isolated community. It will be noted also that the fifth establishment in the table maintained a relatively large personnel and a service cost of considerable amount - this was because of the peculiar nature of the industry and the necessity for setting up a very extensive preventive program. It was only in this group that there was a full-time physician-- the rest of the groups shown in this table either had physicians on part-time or on call. The amount of the original investments in all the other instances depended upon the space and equipment of the health department, but it still shows a considerable variation.

The monthly maintenance expense was also subject to considerable variation, as were the salaries- for a group of plants with proportionately less variation in the number of persons served.

The salary percentage of the monthly expense varied from a low of 46 to a high of 96, with an average of approximately 75% for the whole study.

It is, therefore, evident that at least this small group of small plants have apparently done a very good job of financing their health departments and getting adequate personnel.

Comments on General Observations

Before giving a summary of the material presented in this paper, it is probably well to give some comments on general observations made during the course of this study.

1. Greater confidence and mutual respect is apparently needed between medicine and management to accomplish the utmost in industrial health programs. We have encountered instances in which management seemed fearful of delegating responsibility to the medical staff; and also, the reverse has been true. It would seem advantageous that physicians should learn more about health administration in industry; perhaps the less interference with the technical functions of the health department, the better it could be administered—and still management could continue to be well informed about health activities.

2. The pattern of industrial health activities as observed in this study was exceedingly variable because of differences in the health program needs of various groups. There are, however, certain fundamentals common to all groups which will be discussed in the final report. It is obvious that optimum programs can only be tailored to fit each establishment, after adequate study of the group, materials, processes, equipment and products.

3. There were frequently encountered instances indicating that there is still prevalent some misunderstanding and confusion regarding the specific meanings of the terms "industrial hygiene," "industrial safety," and "industrial sanitation," (and one might well include "personal hygiene" and "industrial health"). Although it would be expected that such confusion would occur mostly in smaller plants, especially where the safety engineer may be responsible for industrial hygiene, industrial safety, and industrial sanitation, considerable incidence was also found in medium sized and large groups. A clarification of these terms would be advisable. It would seem appropriate to suggest that physicians and nurses be relieved of the necessity of devoting time to sanitation inspections.

4. There was considerable evidence that the conception of the importance of prevention still lags somewhat; it also seemed that many physicians still call employees "patients," regardless of the type of service rendered.

5. The amount of time devoted to the acquiring of first hand knowledge of processes and materials by physicians and nurses remains comparatively low, even in good sized concerns.

6. Much has been said about the defects of the service in small plants—while it is true that many of them did not have adequate facilities, there were some which did have outstanding programs; and, what seems more interesting, it was apparent that considerable improvement could be made in some of the medium sized and large groups.

Summary

The data from 278 groups of various sizes, involving many types of manufacturing and service in 33 different states, and including a population of 1,180,551 employees, showed the following results:

1. Approximately 70% of all organizations did preplacement and periodic examinations and also examinations on return to work after injury or illness; the smallest of the plants had a very good record in this respect, as did the largest, although there were considerable variations in the other sized organizations. Exit examinations at termination of employment were done in relatively few instances, except in the largest of the plants.

2. A dispensary service was provided in approximately 60% of all groups, varying from 47% in the smallest to 94% in the largest ones.

3. Slightly over half of the establishments rendered some type of industrial hygiene service, running as high as 88% in the largest organizations. Safety and sanitation services were provided for in approximately 65% of the concerns, here the smallest and the largest plants showing the highest percentages of services provided. Dental services were provided in very few instances and were limited almost entirely to emergency and prophylaxis service outside of the plants, while there were examples of part-time and full-time dentists in almost all classifications. Instruction in health and safety was given in less than half of the groups on the average, with slight variations in the different classifications.

4. With respect to intramural relationships, the health department reported directly to top management in approximately 36% of all groups; the three divisions of health, safety and personnel relations were on a par administratively in approximately 40% of all groups; and the health department had the final word with respect to health problems in approximately 43% of all groups.

5. With regard to records and reports, individual health records were kept in the medical department and available only to the medical staff in approximately one-third of all organizations; with variations from 16% in the small plants to 88% in the largest; examination information was given to individual employees routinely for all groups in about 31% of instances and in about 20% of instances on request only. Industrial hygiene information was given to individual employees mainly on request only on an average of 22% and in very few instances routinely on the average. Regular reports were made by the

industrial health departments in slightly over half of all organizations, as an average, running up to 91% in the largest plants.

6. Cost figures varied greatly even in the plants of a large corporation with fairly good centralized control. These variations were due mostly to differences in the arrangement and number of the rooms used and to original equipment, as well as personnel. It was possible to show an array of figures concerning small plant costs in a group of 12 small plants in 12 widely scattered states. There was also considerable variation here, which was due mainly to the type of housing and equipment originally provided and also with respect to variations in personnel.

7. Finally, with reference to costs of service, there are certain fundamentals and basic principles which can be set forth as follows:

   A. The original investment for a small plant industrial health department usually will run from $500 to $3,000, the upkeep from $300 to $700 a month; for medium sized plants from $5,000 to $10,000 original investment and upkeep of $1,000 to $3,000 a month; for a large plant, from $10,000 to $125,000 original investment and upkeep from $2,000 to $8,000 a month.

   B. The small plants can do and have done very fine programs in industrial health work without the cost being what is termed excessive.

   C. Per capita cost of industrial health work will run somewhere between $10.00 and $14.00 annually in most plants.

FINDINGS FROM FOUNDATION PLANT AND LABORATORY RESEARCH

T. F. HATCH, W. C. L. HEMEON, M. S., and F. R. HOLDEN, Ph. D.*

A primary objective of Industrial Hygiene Foundation is to provide member companies with the services of a central agency devoted to the continuing study of industrial health problems. Accordingly, the technical staff members spend a considerable portion of their time in active investigation of specific problems in industrial hygiene in the plants of companies affiliated with the Foundation.

Facilities for such direct participation in the problems of the member companies were established in the belief that real value would be derived from bringing the varied experiences of many industries together so that each would supplement the other. Thus, the knowledge and "know-how" gained in one investigation aids in the solution of another problem often in quite a different manufacturing field. The selected cross section of American industry and the great variety of manufacturing operations which characterize the membership in the Foundation offer many attractive possibilities in the fulfillment of this objective. An annual review of the activities of the technical staff provides a useful measure of the success attained in this phase of the Foundation program.

Growth of Plant Work

The Foundation has grown steadily from the beginning, in membership, size of staff and extent of plant investigation (Figure 1). Plant studies have been distributed among the different industries which make up the membership, as shown in Table I.

TABLE I

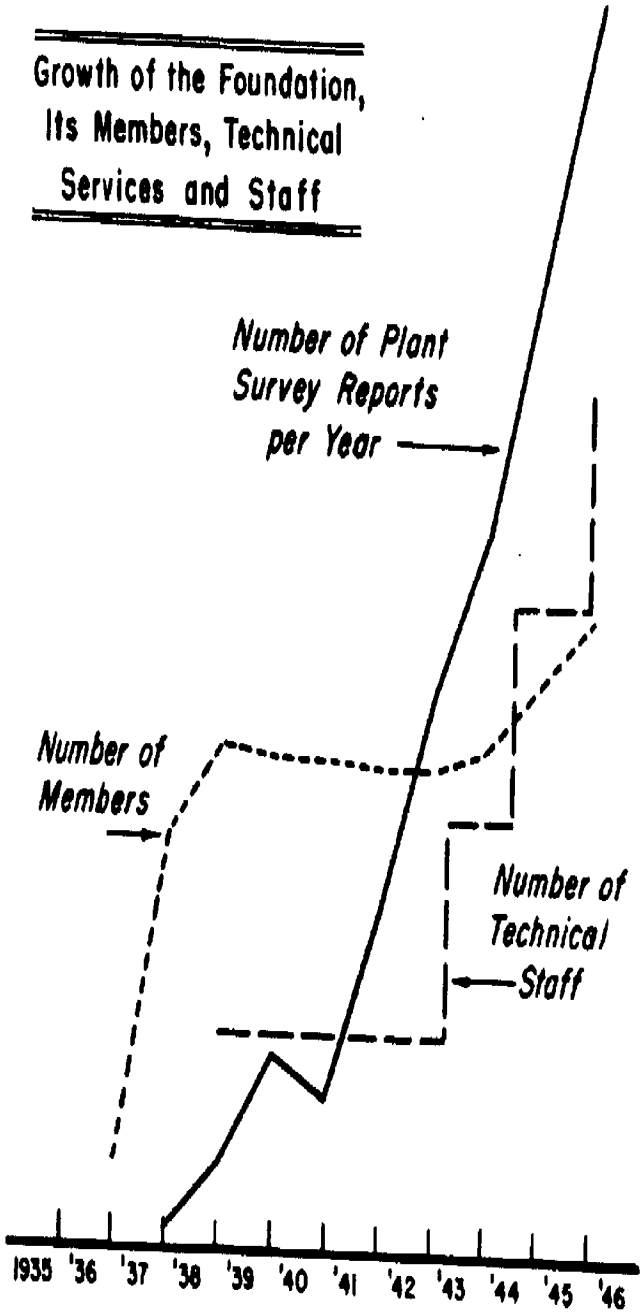
DISTRIBUTION OF FOUNDATION INVESTIGATIONS BY INDUSTRY

(1937-1945)

Industrial Group	Percent of Total Studies
1. Ceramic, asbestos, stone products	33
2. Mining, smelting and refining, metal processing	25
3. Manufacturing, metal and miscellaneous	17
4. Chemicals production	25

* Industrial Hygiene Foundation

Growth of the Foundation, Its Members, Technical Services and Staff



(Figure 1)

With respect to nature of the hazard or process, the investigations were distributed as follows (Table II):

TABLE II

DISTRIBUTION OF FOUNDATION INVESTIGATIONS BY NATURE OF PROBLEM

(1937-1945)

Operation or Exposure	Percent of Total Studies
1. Dust exposures—silica, asbestos, nuisance dusts	41
2. Various chemical exposures	21
3. Metal fumes: welding, soldering, cutting, foundry	9
4. Metal cleaning, plating: degreasing, acid mists, chromic acid	6
5. Dermatitis	5
6. General industrial hygiene surveys	7
7. Studies of atmospheric pollution	8
8. Heat, ventilation	3

Summary of Activities, 1946

In continuation of this work, a total of 51 separate plant investigations have been conducted thus far in 1946, involving the collection and analysis of approximately 2,500 samples, including over 1,200 dust determinations and studies of dust composition. Greatest emphasis has been placed on the dust-producing industries during the year, but a variety of chemical operations have also been studied, as in the past. Table III summarizes the work in 1946:

TABLE III

SUMMARY OF FOUNDATION INVESTIGATIONS, 1946

Number of separate projects	24	
Number of separate plant studies	51	
Distribution of projects, by nature of problem		
Dust exposure and control	10	(35 plants)
Chemical toxicological, miscellaneous	6	
Lead exposures	2	
Community atmospheric pollution	2	(4 operations)
Dermatitis	2	
Metal fumes	1	
Heat exposure	1	
Number of analyses	2559	
Dust	1274	
Lead	275	
Miscellaneous metals	345	
Miscellaneous chemicals	665	

The foregoing tabulations, summarizing the experience of the Foundation in plant investigations and research, demonstrate the variety of undertakings and the considerable coverage in the field of industrial hygiene which has been obtained and certainly lend support to and validate the initial policy which established the technical work as a major activity in the over-all program. A simple tabulation, however, cannot tell the whole story, nor is it completely evident from this summary that the Foundation's activities provide more than could have been obtained by the individual companies within their own organizations or from other agencies. We must turn to a more detailed consideration of the work in order to bring out its full value.

Value of Industry-wide Studies

Attention is called to the fact that during 1946 the 10 projects in dust-producing industries included studies in 35 separate plants. Five of these projects were isolated studies involving single plants; the other five, including 28 plants, were multiple studies set up on an industry-wide basis or as over-all investigations for companies with several different plants. These studies were deliberately designed to bring together for critical study the experiences of as many plants as possible having common problems. Outstanding among the advantages of these industry-wide studies has been the demonstration that sound solutions of most problems are generally found in the industry—not all in one plant, necessarily, but within the total experience.

The "dangerous trades" of our fathers have all but disappeared. Modern industry demonstrates every day that potentially toxic substances can and are being used without hazard. In general, one may say that there are more workers, by far, handling such materials safely than not. The problem today is largely one of discovering the effective control measures in actual use and making them available to the whole industry.

The concept of study on an industry-wide basis is entirely in accord with the primary purpose of the Foundation and, moreover, is of particular value in that it makes the day-to-day work of the organization more valuable to the members than would be possible through independent studies alone.

Value of Quantitative Studies

Industrial hygiene is, above all, a practical field, and there is no place in it for elaborate testing procedures and methods of analysis unless they aid materially in the solution of practical problems. Field experience during this year, as in the past, has demonstrated that systematic, quantitative study is of direct value in a highly practical way. For example, it was our privilege during the year to investigate a large plant in which records of dustiness and medical records extended back for a period of twenty years. These data combined with our own investigation made it possible to provide fairly definite answers to the questions which were put to us: After this prolonged period of systematic effort to eliminate the hazard, how good is the present control; and if further improvement is needed, how can our efforts be expended most effectively? The experience of the company is outstanding proof of the practical value of quantitative study. In fact, this company was so far ahead of the parade that when they started a systematic program of dust control, its scope was seriously limited by the

lack of adequate dust-counting instruments and techniques. That was 25 years ago.

In another project, involving the systematic study of some 28 plants, over a five-year period, only three were found to have a silicosis hazard. The fact that 25 were operating with a high degree of safety demonstrates clearly that adequate protection is practical. The reasons for failure in the three were not obvious and the most effective and, therefore, least costly improvements were made only after quantitative study to determine the exact causes of failure.

Still another illustration comes from a study of heat exposure, in which fundamental analysis revealed that the major heat source was radiation rather than simple air temperature. From this it was evident that ventilation, the common method of control, was not the method of choice and would produce relatively little benefit from the money expended.

One of the most valuable items in the year's experiences was a request to investigate a new process while still in the pilot stage and to determine the probable control requirements for the final manufacturing operation so that proper plans could be made in advance. This represents the highest appreciation of the value of quantitative analysis and is a procedure highly to be recommended.

Design of Ventilating Systems and Other Control Measures

Analyses of industrial ventilation systems and other control measures during the year have shown, as in the past, that full advantage is not being taken of all of the basic engineering knowledge which is available to assist us in the design of control measures. It is particularly disturbing to find inadequate performance after the expenditure of considerable money. Thus, in a comparative study of two plants doing the same work we found the poorer results in the plant having the more expensive system of ventilation and using the higher rates of ventilation.

Plant engineers will undoubtedly agree that the design of control equipment generally takes a secondary place in the engineering organization, and they frequently complain that not enough time or money is appropriated for basic engineering analysis. Thus, they are forced to resort to empirical design data which, too often, results in inadequate performance. Too much money and effort is being spent by industry to improve working conditions without securing the desired results. The solution lies in fuller utilization of existing engineering data and the systematic development of additional basic information. In our experience, such an approach pays for itself. It is the function of the Foundation to assist in this development.

Appraisal of Dust Hazards and of Dust Control Measures

It is of great practical significance that dust continues to occupy the major place in the entire array of industrial problems with which we are concerned. The dust studies have taken us into many industries in which systematic correlations between incidence of lung damage and nature and magnitude of exposure have not been made. Thus, it has been necessary to draw heavily upon the experiences gained in a few industries for which such correlations exist in order to make the best possible appraisal of each new situation. In reviewing this work, one is impressed with the need for

much more extensive information than we now possess. Investigators warn against generalizing from the experience of a few studies and emphasize that the silicosis problem of a given industry is characteristic of that industry and that the relationships which obtain may not apply to another industry. Thus, it is proper to inquire critically into the universal applicability of our appraisal techniques and "yardsticks." Some progress has been made in refining techniques through improvements in the determination of dust composition. The new procedure, reported at the 10th Annual Meeting, has continued to give interesting and valuable data. Other improvements in appraisal methods are currently being investigated.

We are impressed with the significant difference between the silicosis problem in industry and the far more general nuisance dust problem. It is necessary to distinguish between them since, more often than not, the nuisance dust is the more spectacular and is likely, therefore, to receive more attention. Situations have been encountered in which an exposure has been judged hazardous through incomplete study and appraisal and money and effort expended for control which could have been better spent on less spectacular but more hazardous operations.

Another aspect of the dust problem which has interested us during the year has to do with the different criteria of dust control. One approach is to apply control measures to all processes which are obviously producing dust, without regard to the relative contribution of each to the total hazard. The other is to weigh each source of dust by proper quantitative techniques and set up the control program accordingly. Under the latter procedure, certain operations receive secondary consideration compared with others which appear less dusty. Such a course has resulted in misunderstanding in certain instances. Recommendations governing the control of silicosis should distinguish between hazardous and nuisance dusts.

Summary

This summary of technical work during the year serves to point up some of the highlights which have been selected for emphasis. Extensive facilities for quantitative investigation are available in the several State Divisions of Industrial Hygiene and an increasing number of industries are setting up their own facilities. The work of the Foundation supplements these agencies and provides a medium for broad investigation and research by virtue of the wide coverage of American industry which the membership represents.

DR. LEROY U. GARDNER

A. J. LANZA, M. D.

Mr. Chairman, Ladies and Gentlemen: My associates in the Industrial Hygiene Foundation have asked that I pay a tribute to Dr. Gardner.

He was only 57 years old when he died. He was a native of New Britain, Connecticut, and graduated from the Yale Medical School in 1914. During World War I, he was an officer in the Army Medical Corps. For two years he was an instructor in Pathology in the Harvard Medical School. He then went to his Alma Mater as Assistant Professor of Pathology for several years; while there he broke down and went to Saranac.

He became Director of the Saranac Laboratory in 1927 and later was made head of the Trudeau Foundation and the Sanitarium.

He was also active in civic affairs. He was a Trustee of the Village of Saranac Lake, and a member of the Village Planning Commission.

In 1935 he received the Trudeau Medal for his work in the pathology of pulmonary disease and in 1940 he received the Knudsen Award from the Association of Industrial Physicians and Surgeons for his outstanding work in industrial medicine, and also in 1940 he received an honorary degree of Master of Science from Yale.

So much for the record, which does not tell us very much about this extraordinary man. I have known Dr. Gardner for over 20 years and was not only very closely associated with him in various projects in which we had mutual interest, but also I was a very close friend of his. He was a very versatile person and a brilliant figure in the medical research world.

Early in his Saranac Laboratory career he became interested in the possible connection or relationship between occupation and tuberculosis, and from that stemmed his world-famous studies in silicosis and other pneumoconioses. At the same time he became more and more identified with industry, which was most fortunate and fitting, because all of us who were interested in the industrial field as far as health was concerned felt that industry merited the very best kind of service, technical and professional, that it could get in order to help it solve the problems that faced it in dealing with occupational hazards.

And out of that necessity there grew up the really very unusual work of the Saranac Laboratory, which has not been duplicated anywhere in this country. Dr. Gardner brought to his work an unusual character as well as ability. He followed and was associated with a remarkable group of men. I don't know how many of you have ever been to Saranac; those of you who have been there have always been impressed by the earnestness, the sincerity, the honesty, of the group of men who have made Saranac possible. They were a remarkable group, starting out of course with Edward Trudeau who initiated in this country the outdoor treatment of tuberculosis, followed by Dr. Baldwin who, though retired, is still alive and active at the age of 82 in Saranac, Dr. Lawrason Brown and Don Cummings, now dead, and their associates.

These men were pioneers. They had enormous courage as well as

* Chairman, Medical Committee, Industrial Hygiene Foundation

sound medical education and good technical ability. They had the courage that it takes to fight a long uphill battle against not only the circumstances surrounding them but against their own disabilities, their own ill health. They all had certain qualities in common, qualities of leadership and devotion to their work.

I made the comment the other day in Saranac that having known Dr. Gardner for 20 years, 20 years of a fairly active lifetime, my summary of his character I thought could best be expressed by saying that he was the most unselfish man that I have ever known. He never gave thought to himself or his own troubles and handicaps; always he was working for the project in hand, aiming at the target ahead of him, and driving himself with unsparing energy and enthusiasm.

I won't attempt to go into his technical accomplishments; there isn't time enough to even detail them. Suffice it to say that he was the first one who was able to induce silicosis in experimental animals by dusting processes, and thereby helped to take the clinical knowledge of silicosis and its pathology out of the realm of speculation and bring it within the confines of fact; and for that alone he was universally recognized both in this country and abroad. I could go on for an indefinite period on his professional accomplishments.

He had a laboratory there, the Saranac Laboratory, where the roentgenologists and the pathologists and the chemists and laboratory technicians and nearly all the staff that was necessary to carry out the large amount of work that that laboratory turned out, were ex-patients of the Sanitarium. As far as I know from my dealing with them, there were but few exceptions and all of them were actuated by the same motives and by the same high purpose.

I just want in closing to read a couple of quotations--one from an editorial in the New York Herald-Tribune; it is quite long and I am going to read only one paragraph. The Herald-Tribune editorial writer said this:

> "The gallantry that can transform a personal affliction into a benefit for mankind has seldom been more dramatically exemplified than by the career of Dr. Leroy Upson Gardner. Stricken by tuberculosis as he was planning to resume his position as Assistant Professor of Pathology at Yale after service in the First World War, Dr. Gardner established himself at Saranac Lake, New York, and began to study the part played by the inhalation of dust, a hazard in many occupations, in diseases of the lungs. He cured himself and in the process laid the foundation for a lifetime of work devoted to the prevention and cure of similar illnesses in others."

And then the local paper at Saranac Lake:

> ". . . for Dr. Gardner, like Dr. Trudeau, brought unusual gifts to the work of fighting the good fight to free humanity from needless pain and waste and loss. Each was a pioneer, a sufferer, a victor. Each was a great man among men, a great spirit in the battle for a better race."

SUMMARY OF MEDICAL CONFERENCE*

C. RICHARD WALMER, M. D. (Medical Director, Industrial Hygiene Foundation): At the Medical Conference which was held yesterday the following topics comprised the agenda:

1. A discussion of beryllium;
2. A discussion of chemical injuries to the eye;
3. Selective job placement;
4. Specific job training.

The conference was one of complete informality, limited to physicians from member companies, having, as stated before, an agenda rather than prepared papers. A round-table discussion was the order for each topic.

Beryllium was the first topic on the agenda.† Some of the salient points were reported as follows by George W. Wright, M. D., an associate of the late Leroy U. Gardner at the Saranac Laboratory: (1) Beryllium, a toxic substance, is and has been used in the manufacture of fluorescent lighting, as an alloying material, by inference in atomic energy, in radio tubes, etc. (2) Two large companies in the past few years had a series of painful experiences resulting in a relatively high mortality rate. (3) The question of etiology is still in doubt; however, beryllium is under close scrutiny in the medical and toxicological laboratories. One point which might be mentioned here is that the injuries to humans have not been reproduced in animals.

The second topic dealt with chemical injuries to the eyes. A summary of this paper appears elsewhere in this bulletin.

The third and fourth topics, selective job placement and specific job training, were combined. There were a number of things we hoped to bring out under these two headings. However, we started with job analysis and seemed to remain there. We did want to discuss job standards, physical standards, mental requirements, and various other points. These will be considered at a future Conference.

SUMMARY OF ENGINEERING CONFERENCE*

PROF. PHILIP DRINKER (Chairman, Preventive Engineering Committee): This was the second of the Engineering Conferences. Our first was held last year, and this was held in the same spirit of informality and general give and take and argument that makes such discussions stimulating.

The first item we had in the morning's discussion was on radiant and convectional heat control in hot industries, a topic of intense interest to all those there, and I think the immediate result was an expression of what we lacked and what immediately might be done to help get knowledge which we all want.

Then general atmospheric pollution, particularly in relation to member

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* Held November 6

† See page 39 for full report

company problems, was discussed in some detail, and I think I can say that all those present learned a lot from it.

The afternoon sessions included illuminating discussion on dust collection, control of fumes from metallurgical electric furnaces, windowless factories, and a general discussion on hood design.

Frankly, I think as an engineer, I derive as much from these informal meetings and discussions as anything I can get from the Foundation, and I speak wholly selfishly. If you attend engineering meetings at any of our societies you usually listen to formal papers, formally presented, in which discussion is limited; we don't go in for that much in this country and I think it is a shame we don't.

In informal gatherings like this, when the topics are well prepared and the discussion is limited to a comparatively few minutes, men are tempted to get up and say what they think, and come away with many refreshing, new ideas. I am sure this type of meeting is going to be a fixture in the Foundation and one which, again from purely selfish motives, it is well to attend.

SUMMARY OF CONFERENCE ON CHEMISTRY AND TOXICOLOGY*

Industrial Hygiene Foundation held its first round-table Conference on Chemistry and Toxicology in connection with the Eleventh Annual Meeting of Foundation Members. Forty-eight chemists, research directors and toxicologists from Foundation-affiliated companies attended. The discussions were informal, but the following is a summary of subjects covered on the agenda:

1. Comparative Toxicity of Chlorinated Hydrocarbons

Maximum allowable concentration was defined as the maximum concentration that a man can inhale for a long period of time without injury to health. It was stressed that exact information of this nature is available for only a few substances. Therefore, our present tables of M. A. C.'s will be changed frequently as experience dictates. In the interim our present tables of limits serve as quasi-legal limits and are valuable for progress in control.

The order of toxicity of the more common chlorinated hydrocarbons was discussed from the viewpoint of recent toxicological research.

2. Warning Labels Upon Hazardous Chemicals

It is of primary importance that there be uniformity in labeling hazardous chemicals so that the exact type and degree of danger will be presented. The Manufacturing Chemists' Association Manuals L-1 and L-2 provide guidance. For mixtures, only the dangerous constituents need be mentioned. Under no circumstances should chemicals be over-labeled, i. e., the degree of hazard should not be exaggerated.

* Held November 8.

3. Evaluation of the Hazard of Siliceous Dusts

Data on the variation of composition of dust with particle size were presented. It was of interest that similar to silica, uranium becomes significantly toxic only when the particle size is fine comparable to that of hygienically active quartz. New techniques provide data on composition of air-borne dust in relation to size that more closely parallel the effects of dust in the human lungs.

4. Chemical Burns of the Eye

Techniques for saving the sight of eyes damaged by chemicals were described. (See Dr. McLaughlin's paper, page 60 of these Transactions.) It was stressed that many neutral chemicals can damage eyes as severely as acids or alkalis. The treatment, however, is identical for all chemicals.

5. Skin Penetration of Chemicals

Extensive contact of certain chemicals with the skin for relatively short periods of time can have fatal issue. Removal from the skin at once is therefore imperative and because of availability of water it should be used copiously. Contaminated clothing should be removed immediately.

6. Evaluation of Hazard of Contact Dermatitis by Experiment

Techniques which have been used successfully by one Member Company were described. The methods are particularly applicable for study of chemicals destined for use in the cosmetic, food or textile industries.

This Conference will be continued annually and your suggestions are invited as to subject matter and mechanics of procedure that will insure the maximum benefit. It is hoped that rather than a one-day meeting once a year, the Conference will become a year around source of information and a vehicle for the exchange of data between Member Companies. The Conference is sponsored and directed by the Foundation's newly formed Committee on Chemistry and Toxicology.

COMMITTEE ON CHEMISTRY AND TOXICOLOGY

H. F. SMYTH, JR., Ph.D., Chairman.
FRANCIS R. HOLDEN, Ph.D., Secretary.

DISCUSSION

C. F. KUTSCHER, M. D. (Consultant, Industrial Hygiene Foundation): If one were to examine textbook after textbook on diseases of the eye he would find a certain uniformity: First, they are uniform in telling us what to do; we take out all visible portions of the alkali, then wash the eye. That is taken care of in a line or two. Then we have page after page of how to handle complications.

Practically—and of course that is what you men are most interested in—these cases under the old treatment were of months' and even years' duration. During this interval of time the employee could not work, because of the extreme pain. You ended up by paying in a great number of these cases for a loss of industrial vision.

Dr. McLaughlin's large practice among chemical workers forced him to find the answer. What he did was to do exactly what was recommended, but he proved many points; he proved that we did not know how to handle these cases, we did not know the distribution of the chemical within the layers of the eyeball, and he proved that we did not adequately irrigate the eye. A most significant contribution made by this group is the fact that following exposure to alkali much of the chemical remains in an active state. Lying between cells in the deeper reaches of the cornea, the chemical resists removal by cursory irrigation.

This explains why, when a person spills alkali in his eye he gets along fine for a day or two, only to be confronted at a later time with a very serious condition.

The work that Dr. McLaughlin has done certainly has been thorough, it has been painstaking, and it has consumed a tremendous amount of his time, but his statistics prove that he has the answer to the alkali burn. He shows 91% of his cases getting well in 48 hours. It simply means that those cases were either minor burns or he kept them minor by the speed with which treatment was instituted and the thoroughness of his treatment. There is no way for me nor for anyone else to compute what constitutes a serious eye burn when first seen, but we certainly know in a series of 500 cases a great number of them are potentially lost eyes; and when with this treatment 91% of them are well within 48 hours we know absolutely the efficacy of this treatment has kept them from becoming serious eye problems.

You might complain because this treatment takes a half or three-quarters of an hour and keeps the worker away from his job. That is nothing. If that were to be a full-blown keratitis or inflamed eye from alkali, that patient may spend day after day at the ophthalmologist's office, only to end up with you people paying the bill.

LEGAL DEVELOPMENTS RESPECTING OCCUPATIONAL HEALTH

THEODORE C. WATERS

During the past year only a few of the State Legislatures have been in regular session, with the result that there have not been many changes in state legislation relating to occupational health. In a number of states, codes of industrial hygiene have been prepared and have been proposed; hearings thereon have been held and in several instances such codes have been adopted and have become effective.

The general trend of court decisions construing compensation statutes has continued to be liberal with the result that the liability of employers to pay compensation for occupational injuries has been extended.

On behalf of our Committee, I would like to review briefly some of the legislation that has been enacted during the past year and to call the attention of members to State Codes of Industrial Hygiene that are presently effective in those states in which our member companies are operating. This subject has and will assume increasing importance with the enactment of enabling statutes, granting powers for control of potential hazards to Bureaus of Industrial Health. The Managing Director has also requested that our Committee include in our report reference to the subject of health clauses in Union Contracts.

I. OCCUPATIONAL DISEASE COMPENSATION STATUTES ENACTED OR AMENDED DURING THE YEAR 1946

A. New Occupational Disease Compensation Laws

Georgia has enacted an occupational disease compensation law which became effective April 30, 1946. This act made compensable a scheduled list of diseases caused by exposure to twenty-two named chemical poisonings, diseases caused by exposure to x-ray or radioactive substances, and the diseases of asbestosis and silicosis.

With respect to the named dust diseases, there is limitation of monetary liability of employers in the amount of $500.00 upon the effective date of the act, with monthly increases at the rate of $50.00 until full benefits of the compensation act are attained. The act created a Medical Board of five physicians appointed by the Governor from a list of nominees proposed by the Medical Association of Georgia. Provision is made that one of the members of the board is required to examine the claimant and file a report of his findings with the Medical Board. The Board then renders its decision in the case, from which an appeal may be taken to the State Board of Workmen's Compensation, provided, however, that the findings of the Medical Board upon the questions of medical fact may not be disturbed except upon the ground that the Board acted in excess of its powers or that its findings were procured by fraud, or that there was not sufficient competent evidence in the record to warrant the Medical Board in making the decision complained of, or that the decision of the Board was contrary to law.

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* Mullikin, Stockbridge & Waters, Chairman, Legal Committee, Industrial Hygiene Foundation

Another interesting feature is the requirement that the State Board of Workmen's Compensation shall, within thirty days after the effective date of the act, designate by order the specific occupations found subject to exposure of hazards of silicosis or asbestosis, and shall notify the employers of the necessity of compulsory examinations provided under the law. Thereupon it becomes the duty of every employer in the named occupations to provide, prior to employment or within thirty days after employment, a medical examination of all new and prospective employees to determine if they are in any degree affected by silicosis or asbestosis. Failure of an employer to provide such examination constitutes a misdemeanor and is punishable as such.

In cases of silicosis or asbestosis, the term "disablement" means the event of an employee becoming actually incapacitated because of silicosis or asbestosis from performing his work in the last occupation in which injuriously exposed to the hazards of silicosis or asbestosis, or from performing any work in any other occupation for remuneration. "Disability" means the state of being so totally incapacitated.

B. Amendments to State Workmen's Compensation Acts

New York State amended its compensation act to increase the maximum aggregate compensation payable for total disability or death due to silicosis from $6,500 to $7,500. The act contains the escalator clause increasing the total amount of compensation payable for disablement or death at the rate of $50.00 per month.

C. Summary of States Wherein Occupational Diseases are Compensable

There are now sixteen states,[1] the District of Columbia, one territory[2] and Federal jurisdiction wherein the Longshoremen's Act is applicable, providing general coverage for all occupational diseases. There are seventeen states[3] and one territory[4] wherein schedule coverage is provided for named occupational diseases. Therefore, in thirty-three states, as well as the District of Columbia, Hawaii and Puerto Rico, occupational diseases are now compensable.

Compensation is also provided by the Federal Employees' Compensation Act and the Longshoremen's and Harbor Workers' Act. Under the laws of eighteen states,[5] compensation payable for dust diseases is limited with respect to the employer's monetary liability, and in twelve states,[6] compensation for the dust diseases is payable only for total disability or death.

1. California, Connecticut, Florida, Illinois, Indiana, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New York, North Dakota, Ohio, Oregon, Washington and Wisconsin.

2. Hawaii.

3. Arizona, Arkansas, Colorado, Delaware, Georgia, Idaho, Kentucky, Maine, Maryland, New Jersey, New Mexico, North Carolina, Pennsylvania, Rhode Island, Utah, Virginia and West Virginia.

4. Puerto Rico.

5. Arizona, Arkansas, Colorado, Florida, Georgia, Idaho, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Utah, and West Virginia.

6. Colorado, Florida, Idaho, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Ohio, Pennsylvania and Utah.

II. CODES OF INDUSTRIAL HYGIENE

In any discussion of legislative provisions dealing with compensation of occupational diseases, there has been considerable controversy as to the form of legislation providing such compensation. However, upon one subject there seems to be general agreement among employers, employees and their insurance carriers; this is that occupational diseases can be and should be prevented. Industry has become health conscious and realizes that it has become good business to prevent the incidence of disease, rather than to pay compensation for such injuries. Since the enactment of occupational disease compensation statutes, there has been increased activity among State Departments of Health, State Departments of Labor and Industrial Commissions to effect the regulation and control of occupational hazards to prevent disease. Various State Codes of Industrial Hygiene have been promulgated and in many instances adopted, and it is probable that in all of the industrial states necessary legislative provisions will be enacted to enable proper state agencies to establish such codes.

Mr. J. J. Bloomfield of the United States Public Health Service is going to submit a report at this meeting outlining in detail the codes of industrial hygiene in the various states. I would like to make general reference to these codes and to discuss briefly the legal authority for their adoption, their scope and subject matter, with brief comment with respect to administration.

There are thirty-five states[1] that have codes of some type which are presently effective. None of these are uniform. They represent the attempt of individual State Departments to promulgate rules and regulations for the control of occupational hazards in a manner that seems proper to the particular state agency involved. In form some of these codes are applicable only to specific industries, as for example the codes in New York State. In other states the codes are inclusive of all industry, establishing permissible concentrations of dusts, fumes, gases and vapors without specific reference to a named industry.

I think it may be fairly stated that many of these codes, while well intentioned, were adopted without full consideration of the various problems of industry to which they would apply. In many instances they establish arbitrary standards of permissible concentrations of toxic dust, fumes and gases and say to industry, "Thou shalt not permit concentrations exceeding a stated limit." In most instances the codes do not attempt to advise industry of the way and means to accomplish compliance. It is submitted that one of the functions of Bureaus of Industrial Hygiene should be to assist industry to control occupational hazards and to find the best method for compliance.

Authority for Codes

The legal authority for codes may be found either in the constitution of the state or specific legislative provision authorizing the creation of Bureaus of Industrial Hygiene and the grant of authority to such Bureaus

1. Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Idaho, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Mexico, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, Washington and Wisconsin

to formulate codes, or the powers incident to the functions of State Departments of Health, Labor or Industrial Commissions. Most of the codes establish maximum allowable concentrations of toxic materials with penalty provisions for failure to comply. Enforcement is generally given to the State Departments of Health, Labor, Bureaus of Mines or Industrial Commissions. In most instances, no specific provision is included for methods by which industry may attain compliance.

In the administration of these codes, it would seem desirable for the administrative agency to cooperate with industry in the attempted solution of industry's problems by educational processes, rather than by police enforcement of the penalty provisions.

Industry has accepted its responsibility to provide its employees safe places in which to work and safe tools with which to work. Management is not indifferent to health hazards and is seeking to attain effective engineering methods to control hazards. Many problems are presented in the perfection of such methods, and these cannot be and will not be solved overnight.

Changes in industrial processes and newly developed uses of chemicals and other toxic materials will continue to create new problems for the control of hazards. Some large industries have adequate engineering staffs and personnel to study these problems and control potential hazards. Many small industries do not have available personnel for this purpose.

The primary object of Bureaus of Industrial Hygiene is to correct hazardous conditions in industry and by assisting management in the discovery, correction and control of hazards, this purpose will be achieved. If administration takes the form of an educational program, I believe that industry will gladly cooperate and the results obtained will be more effective than in any other manner.

It is unfortunate that there is not greater uniformity in the state codes presently effective. Under the leadership of the United States Public Health Service it should be possible to prepare some uniform code that would be suited to industry of all industrial states. If this were done, the codes now effective could be repealed and the proposed model code enacted. With the cooperation of employers, employees and the state agency administering the codes, occupational hazards could be reduced to a minimum and diseases practically eliminated.

III. HEALTH CLAUSES IN UNION CONTRACTS

This subject is one of increasing importance and emphasizes the role of industrial hygiene in labor relations. Perhaps detailed discussion of the subject would be more appropriate in meetings that are devoted to a consideration of industrial relations. It is not the purpose of our Committee to recommend the inclusion or exclusion of clauses of this type and we believe it will be of interest to members to consider certain provisions that have been included in contracts which have been published and are fairly representative of the trend of clauses now being considered by Departments of Industrial Relations.

In the agreement, dated March 19, 1946, between General Motors Corporation and the United Automobile Workers—CIO, we find the following incorporated as paragraph 146 of that agreement:

> "A report of physical examination and any laboratory tests made by physicians acting for the Corporation will be given the personal physician of the individual employee involved upon the written request of the employee."

Again in an agreement, dated March 13, 1945, between Carnegie-Illinois Steel Corporation and the United Steelworkers of America—CIO, we find Section 12, dealing with safety and health, provides as follows:

> "The Company shall continue to make reasonable provisions for the safety and health of its employees at the plant during the hours of their employment. Protective devices, wearing apparel and other equipment necessary to properly protect employees from injury shall be provided by the Company in accordance with the practices now prevailing in each separate plant. Proper heating and ventilating systems shall be installed where needed."

In the agreement, dated July 6, 1945, between Industrial Silica Corporation and the United Steelworkers of America—CIO, we find the following sections under Article 14 dealing with the subject of physical examinations:

> **"Section A. Conditions of Examination**
>
> "It is hereby mutually understood and agreed that the Corporation shall have the right, from time to time, to require employees, at its own expense, to submit to medical and physical examinations by physicians or specialists of its own choosing, and to terminate or suspend employment of any employee or transfer him to another department if such examination shows that said employee cannot with safety satisfactorily continue the kind of work he was doing at the time of such examination or is suffering from any disease which could be communicated to the other employees.
>
> **"Section B. Effect on Employee**
>
> "No such employee shall be permanently laid off, suspended or transferred as the result of any such examination until he has been given five (5) days' written notice of the intention of the Corporation so to do and the records of the Corporation with respect to any such examination shall be open to inspection by the employee's personal physician upon the written request of the employee."

In certain instances representatives of labor have made public statements in opposition to requirements by employers for pre-employment physical examinations as a prerequisite to employment. Similar opposition has been expressed with respect to recurring annual physical examinations. You will recall previous reports of our Committee pointing out statutes of various states under which in certain occupations pre-employment physical examinations were required by law, and in which annual recurring physical examinations were similarly required. Certainly in those industries where potential hazards to health exist, one of the most effective methods of con-

trol of the incidence of disease is the use of physical examinations to determine whether or not the claimant may be suffering from, or peculiarly susceptible to, a given occupational disease, and for his own protection and that of his fellow workmen, it is desirable that he should be excluded from such employment. Furthermore, the use of annual physical examinations in certain industries may well develop information as to the incidence of occupational diseases and protect employees against potential disability or ultimate serious illness.

While the use of physical examinations may have been and may be abused, they are certainly desirable for the promotion of programs of medical control. With respect to the employment of physically handicapped employees, such examinations are essential to the proper placement of these individuals so that their ability may be evaluated and they may be assigned to do those jobs where they are best fitted.

Conclusion

During the year 1947 the Legislatures of all of the States of the Union will convene except Kentucky, Louisiana, Mississippi and Virginia. It is to be anticipated that legislation relating to amendments to existing workmen's and occupational disease compensation acts will be introduced, and in many states enacted. Our Committee suggests to members that it will be to their interest to follow these legislative sessions with care to see that whatever provisions may be adopted are reasonable and suited to their industrial operations.

The promulgation of codes by the various states will proceed and it is reasonable to expect that Bureaus of Industrial Hygiene will increase their activities in an attempt to eliminate potential hazards and assist industry in effecting control of health conditions. Much has already been accomplished in the field of industrial hygiene. Much remains to be done. Let no member company minimize the importance of this subject and let constant care in your operations be your watchword so that industrial accidents and diseases may be kept at an absolute minimum.

CODES FOR THE PREVENTION AND CONTROL OF OCCUPATIONAL DISEASES

J. J. BLOOMFIELD*

One of the major causes of lost time in industry is workers' ill health, some of it caused by physical conditions in the job environment. Although industrial hygienists now have the techniques to prevent almost any kind of occupational disease, unfortunately the application of this knowledge has not progressed as rapidly as it has been acquired. The problem, then, is the promotion of industrial hygiene techniques so that they reach every industry in the country.

One effective means of disseminating and applying information on good industrial hygiene practice has been through the promulgation and administration of reasonable rules and regulations designed to set forth systematically the principles involved in such practice. Such rules and regulations, or codes, as they are sometimes called, can be of significant aid to industry in achieving safe and healthful working conditions, if they are based on scientific fact, are practical and adequate.

It is the purpose of the present discussion to examine the subject in the light of recent trends in the enactment of codes by the States. The major features of a code are also discussed, on the principle that their aim should be to inform management what its responsibilities are and how safe and healthful working conditions may be achieved.

Present Legislation on Prevention

One of the inherent weaknesses of nearly all occupational disease legislation enacted to date in the United States is the omission of any provision for the prevention and control of occupational diseases. In nearly every instance, with but three or four notable exceptions, the desire has been to provide compensation for occupational diseases, whereas the prevention and control of such diseases should really be one of the prime considerations. As a matter of fact, even in those States where the laws make some provision for the prevention and control of occupational diseases, unsatisfactory conditions exist, simply because the powers and duties in this field are assigned to several state departments. In many instances, the laws are so worded as to be vague and indefinite; and what is most discouraging, they do not provide the essential machinery for an effective control program. Everyone will concede that no matter how well a code has been developed, its provisions are completely nullified unless the State has set up a technical agency to administer such a code. Such a technical agency is one staffed with trained industrial hygiene personnel, who can develop the necessary standards based on scientific fact, investigate the working conditions in industry in the light of such standards, and then aid industry in attaining these standards.

In view of these facts, it may be well at this point to examine the development of industrial hygiene in this country and the part which industrial hygiene divisions have been playing of late in the promulgation of industrial health codes.

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The growth of industrial hygiene activities in our state governments has been phenomenal during the past decade, largely through the impetus given to this program among the states by the U. S. Public Health Service, which has assisted the states both financially and through technical consultation services. At the present time, there are 41 states with full-time industrial hygiene activities, several large cities and counties, as well as territories. In all, we have 52 industrial hygiene units and, unquestionably, there will be industrial hygiene services available to industry in every state and territory in the Union within the next year or two. Since industrial hygiene in its broad interpretation is conceded to be an integral part of public health, the development of such services in this country has been largely in state health departments. At present, there are 50 industrial health units in health departments and two in labor departments.

If we examine Table I (see pages 80, 81, 82), which summarizes industrial hygiene activities and the trend in the development of industrial hygiene codes, we will note that the basis of authority for carrying on industrial hygiene activities in the 50 health departments is evenly divided between specific legislation and that emanating from the broad powers given to health departments in their organic act. With regard to the two labor departments, specific legislation has been enacted charging these departments with the responsibility of carrying on certain activities in the industrial hygiene field. We also find that among these 52 industrial hygiene agencies, only 35 have promulgated rules and regulations, or codes, for the control and prevention of occupational diseases.

Codes Variable in Nature

A close study of these 35 codes shows a great divergence in their provisions. It is obvious that large industrial concerns operating in several states must find it difficult to develop a policy on safeguarding the health of their employees. In 17 states, obviously, there are no guides to follow, while in the 35 states which do set up certain criteria, we find that these are variable in character. For example, a study of Table II, which is an analysis of the 35 code provisions, shows that most of the codes make some reference to maximum allowable concentrations of atmospheric contaminants. In 49% of the states these M. A. C. values have legal status, while in 51% they are merely suggested guides. Only 6% of the states deal with prevention of disease through skin contact, while none of the codes so far examined by us deals with the prevention of infection from contact with certain materials employed in industry. Forty percent of the codes deal with the subject of illumination and 37% have some provision as regards temperature, humidity, and air movement. Only 6% of the codes deal with the subject of noise, while not a single one covers the effects of vibration on health. Twenty-three percent of the codes deal with the subject of excessive pressures, 12% with radiant energy, 34% discuss the subject of personal protective equipment, and 57% housekeeping. The two subjects receiving most attention in the 35 codes which have come to our attention are ventilation, which is a subject dealt with in 72% of the codes, and general sanitation, which is found in 83% of the codes.

It is patent, therefore, that the entire situation with regard to industrial hygiene codes leaves much to be desired in the way of uniformity, adequacy, and preciseness as to administration. In summing up the entire subject, the major weaknesses of present-day codes, as we see it, are

TABLE II

ANALYSIS OF STATE INDUSTRIAL HYGIENE ACTIVITIES, CODES AND THEIR PROVISIONS

Total number of industrial hygiene units	52
Agencies conducting industrial hygiene activities:	
Health departments	50
Labor departments	2
Authority for carrying on industrial hygiene activities:	
Health departments	
a. Broad power	25
b. Specific legislation	25
Labor departments	
Specific legislation	2
Total number of codes	35
Code provisions	
	Percent
1. Maximum allowable concentration	
a. Legal status	49
b. Guide	51
2. Skin contact	6
3. Infectious material	0
4. Illumination	40
5. Temperature, humidity, air movement	37
6. Noise	6
7. Vibration	0
8. Pressure	23
9. Radiant energy	12
10. Ventilation	72
11. Personal protective equipment	34
12. Housekeeping	57
13. Sanitation	83

(1) our present state laws give authority to several agencies in the field of rule making and enforcement, which makes for confusion and, at times, duplication and conflict among the several agencies; (2) 17 of the states have as yet not set up guiding principles to assist industry in achieving good working conditions; and (3) the codes which have been promulgated to date are inadequate in providing any specific information which would show industry how it can comply with the rules and regulations promulgated.

What we need in industrial hygiene today, and we need it badly, is a code which would be patterned after the U. S. Public Health Service Standard Milk Code.[1] This particular code, which was developed after many years of arduous effort, contains but one page in the way of an enabling ordinance, but approximately one hundred pages of detailed and specific information, which shows clearly what the milk industry must do to comply with the ordinance. For these reasons, it may be well to consider the possibility of re-orienting our thoughts regarding codes in industrial hygiene as to their purpose and content.

Principal Features of a Code

In our opinion, the main purpose of a code is to provide reasonable guides or principles which would enable industry to maintain the health of its workers at a high level. If a code is to accomplish this purpose, it must also be reconciled with the chief aim of industry, which is to turn out goods and services in the most efficient way possible so as to achieve maximum production at minimum cost. To accomplish all this, a code of the type envisaged in this discussion should contain rules and regulations for the prevention and control of occupational diseases. This should be the first section of the code and should be brief and the terms well defined. The second part of the code would be in greater detail and would repeat the rule, state the public health reason behind it, and then show industry how it can satisfactorily comply with the rule by an informative discussion of the subject at hand. Perhaps this will be made clearer if we indicate some of the principal features which such a code should contain.

In the introductory material to the code itself, there should be a definite statement indicating the authority or law behind the code. The purpose of the code should be stated and the industries to which the code applies. The code should contain a statement as to who is to administer it, in other words, the enforcement agency should be named. It should also contain a provision for appeal, or a modification of any of the rules when conditions warrant such action, and a penalty for violation of any of the rules. This material should be followed by clear definitions of the various major terms employed throughout the entire code.

What Rules Should Cover

The rules themselves should cover the following subjects, which can be conveniently divided into two parts. Part one of the rules should deal with those regulations pertaining to environmental hygiene, while the second part should deal with the hygiene of the individual. In this way, all factors involved in industrial hygiene practice will be treated. Under environmental hygiene regulations, the rules should cover such subjects as (1) maximum allowable concentrations for atmospheric contaminants, (2) skin contact with hazardous materials, (3) infectious materials, (4) illumination, (5) temperature, humidity, and air movement, (6) noise, (7) vibration, (8) abnormal atmospheric pressure, (9) radiant energy, (10) ventilation, (11) personal protective equipment, (12) housekeeping, and (13) sanitation.

Part two of the rules, dealing with personal hygiene, should contain material on (1) first-aid emergency services, (2) prompt and early treatment of all illnesses resulting from occupational exposures, (3) impartial health appraisals of all workers, (4) recording and reducing absences due to all types of disability, and (5) health education programs.

The last part of the code, and the one which will require considerable detail and, needless to say, careful thought, effort, and much labor, will be that portion dealing with the legal interpretation of the rules or, better still, information of the most up-to-date character which would actually show how these rules can be met through good industrial hygiene practice.

Controversial Features

Perhaps one of the most controversial features of present-day codes has been the matter of maximum allowable concentrations and the divergencies in the limits set among the various states which have labored with this subject. It seems to us that one of the first considerations among those responsible for the development and promulgation of codes is whether we are going to consider merely the toxicity of substances when setting a limit or if attention will also be directed to their nuisance aspect. This is especially applicable to those fumes, smokes, gases, vapors, and dusts that are not necessarily toxic in nature and to other contaminants which may be present in nontoxic concentrations. We, as industrial hygienists, feel that our job is not only to prevent injury to the worker's health, but also to make him reasonably comfortable and efficient in his work environment. It is in this border-line stage that the most controversy exists, that is, where there are incipient poisonings of physiological responses causing discomfort and unpleasantness, but not necessarily injury to health. Enlightened management finds it good operating practice to control the working environment, so that even the mild physiological responses that are causing discomfort are kept at a minimum. In fact, it is a good practice to keep them at a minimum because quite frequently such uncomfortable conditions make a worker accident-prone, as, for example, when a worker becomes inebriated from inhaling trichlorethylene or petroleum solvent vapors. Certainly, no one in industry has questioned, for example, the standard universally adopted in this country for chromic acid mists resulting from chromium electroplating operations. These mists do not cause systemic injury, but do produce, under certain conditions, irritation of the mucous membranes and destruction of a part of the nasal septum. Through educational efforts within the electroplating industry itself, it has been a relatively simple matter to obtain good operating techniques, so that chromic acid levels are kept well below the point where these minor injuries and discomforts can occur.

At the present time, there is a committee within the American Conference of Governmental Industrial Hygienists which is concerned with developing maximum allowable concentrations which can be adopted by all the states. This committee recently inquired into the subject, and at the moment has received replies from 24 states and three cities as to maximum allowable concentration values. Table III shows the variation of maximum allowable concentration values among these 27 jurisdictions for some 21

1. Public Health Service Milk Ordinance and Code: 1935. U. S. Public Health Service. Public Health Bulletin No. 220. July, 1935.

TABLE III

VARIATION OF MAXIMUM ALLOWABLE CONCENTRATION VALUES (24 STATES, 3 CITIES REPORTING)

SUBSTANCE	Agencies reporting MAC values		Values Reported and Number of Agencies Reporting — Maximum Allowable Concentration									
	Established values	No values reported	Value in ppm*	Number	Value in ppm	Number	Value in ppm	Number	Value in ppm	Number	Value in ppm	Number
Acetone	14	13	200	4	400	3	500	6	1000	1	—	—
Amyl acetate	20	7	100	1	150	1	200	2	400	16	—	—
Benzene	25	2	75	8	100	17	—	—	—	—	—	—
n-Butanol	16	11	25	1	50	2	100	9	200	3	300	1
n-Butyl acetate	19	8	100	1	150	1	200	2	400	15	—	—
Carbon disufide	23	4	15	3	20	20	—	—	—	—	—	—
Ethyl alcohol	10	17	100	1	250	4	500	1	1000	4	—	—
Ethyl bromide	6	21	400	2	1500	1	1700	3	—	—	—	—
Fluorine (HF)	24	3	3	24	—	—	—	—	—	—	—	—
Formaldehyde	22	5	10	16	20	6	—	—	—	—	—	—
Gasolene	20	7	500	2	1000	18	—	—	—	—	—	—
Methanol	24	3	100	6	200	17	300	1	—	—	—	—
Methyl chloride	11	16	100	2	200	5	250	1	500	3	—	—
Naphtha (petr.)	15	12	500	2	1000	10	5000	3	—	—	—	—
Nitrobenzene	19	8	1	2	2.5	1	5	16	—	—	—	—
Nitrogen oxides	25	2	10	6	20	2	25	16	40	1	—	—
Phosphine	19	8	1	11	2	8	—	—	—	—	—	—
Sulfur dioxide	25	2	3	1	5	1	10	23	—	—	—	—
Turpentine	21	6	100	2	200	16	400	1	700	2	—	—
Xylene	22	5	100	4	200	18	—	—	—	—	—	—
Carbon tetrachloride	26	1	50	7	75	5	100	14	—	—	—	—

* Parts of substance per million parts of air by volume

commonly used substances in industry. In most cases, the variations are not too great, and it is felt that perhaps too much emphasis has been placed on this point. In those instances where there is a divergence, the error has been on the safe side. For example, in dealing with the highly toxic substance of benzene, of the 27 jurisdictions which have reported to the committee, 25 had established values and two had none. Of the 25 which had established a value for this substance, 17 used the American Standards Association value of 100 parts per million, while 8 used the slightly lesser value of 75 parts per million. Again, with regard to carbon tetrachloride, a substance which has received considerable attention of late and one on which it has been difficult to obtain unanimity on a threshold value, we find that only one of the 27 jurisdictions has no value for this chemical, while 26 have established a criterion. Of these 26, 14 employ the value of 100 parts per million, five use 75, and seven use 50 parts per million. Altogether, there are not too many substances which we find have variable limits among the states, whereas, on the other hand, there are many materials for which there is complete unanimity. Among some of the commoner toxic substances employed in industry, such as lead, mercury, TNT, zinc oxide, and cadmium, there is complete unanimity among the states as to maximum allowable concentrations for these substances. (See Table IV.)

Realistic Approach

It is our desire to emphasize the need for a realistic approach to this whole subject. To begin with, we feel that there is a definite responsibility upon the governmental agencies administering industrial hygiene to establish M. A. C. (maximum allowable concentration) values only after a great deal of study and thought have been given the subject. So far, on the whole, these have been established in such a manner as to cause no serious handicap to industry. Furthermore, administrative agencies should realize that the determination of whether a working condition is safe or unsafe depends on other factors besides that of maximum allowable concentrations in the atmosphere. Of late, more and more reliance has been placed by industrial hygienists upon the exposure determinations alone, without regard to other factors in the working environment. It seems to us that before an industry is told that it should make certain provisions to control a condition suspected of being inimical to health, a complete health survey is in order. Such a health survey should involve at least two criteria in determining the safety of an operation. First, it is essential that the health of those workers exposed to a certain material or condition should be carefully inquired into. This may involve not only an examination of the worker's health record, but also an examination of the worker himself. Second, careful environmental studies should be made, which would not only include certain determinations of the atmosphere, but also a thorough sanitary survey and occupational analysis. All these put together should yield data of real value in helping to control industrial health hazards.

Developing Standards

At the present time, we have several agencies concerned with the development of standards on limiting atmospheric contaminants. All of us are familiar with the splendid work of the American Standards Association on this subject. The American Conference of Governmental Industrial Hygienists, whose membership consists of those responsible for administering indus-

TABLE IV

MAXIMUM ALLOWABLE CONCENTRATION VALUES FOR WHICH GOOD AGREEMENT EXISTS

Gases and Vapors

Substance	Number Agreeing	Number Disagreeing	Percent Agreein,	M. A. C. (ppm)*
Acetic acid	3	0	100	10
Acrylonitrile	12	0	100	20
Ammonia	21	0	100	100
Aniline	22	0	100	5
Arsine	21	1	95	1
Carbon monoxide	27	0	100	100
Chloroform	9	1	90	100
1-Chloro-1-nitropropane	4	0	100	20
Cyclohexane	3	0	100	400
0-Dichlorobenzene	21	0	100	75
1, 1-Dichloroethane	4	0	100	100
1, 2-Dichloroethane	16	0	100	100
Dichloroethyl ether	13	0	100	15
Dimethylaniline	11	0	100	5
Hydrogen chloride	24	0	100	10
Hydrogen cyanide	25	0	100	20
Hydrogen fluoride	25	0	100	3
Hydrogen selenide	3	0	100	0.1
Hydrogen sulfide	26	0	100	20
Monochlorobenzene	15	1	94	75
Mononitrotoluene	9	0	100	5
Phosgene	23	0	100	1
iso-Propyl ether	3	0	100	500
Styrene	11	1	92	400
Tetrachloroethylene	22	0	100	200
Toluene	22	2	92	200
Trichlorethylene	24	2	92	200

Toxic Dusts and Fumes Mg/M³†

Barium peroxide	6	0	100	0.5
Cadmium	24	0	100	0.1
Chlorodiphenyls	12	1	92	0.1
Chromic acid	23	0	100	0.1
Dinitrotoluene	7	0	100	1.5
Lead	26	0	100	0.15
Mercury	22	0	100	0.1
Tetranitromethylaniline	10	0	100	1.5
Trinitrotoluene	11	0	100	1.5
Zinc oxide	20	1	95	15.0
Asbestos	17	0	100	5‡

* Parts of substance per million parts of air by volume.
† Milligrams of substance per cubic meter of air.
‡ Millions of particles of substance per cubic foot of air.

trial hygiene in this hemisphere, has recognized the importance of the subject of codes, and has a committee working on the development of a uniform code, one which could be adopted by all the states. The Industrial Hygiene Division of the U. S. Public Health Service, which is intimately concerned with the activities of this Conference, as well as with the state agencies administering industrial hygiene, is urging the development of a code of the type outlined in the present discussion. Such a code will probably take several years of effort, although a considerable amount of information is already at hand for inclusion. The main problem, as we see it, will be to obtain unanimity among the various states. It is felt that if such a code is based on scientific fact and is so worded that it takes into consideration the various social and economic aspects of the problem, then it should meet with great favor among the state agencies and the public. This will be especially true if it is administered in a spirit of cooperation with management and labor.