

Transactions of the

**TWENTY-NINTH
ANNUAL MEETING**

OF THE

AMERICAN CONFERENCE

OF

GOVERNMENTAL INDUSTRIAL HYGIENISTS



CHICAGO, ILLINOIS
MAY 1-2, 1967

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AMERICAN CONFERENCE OF GOVERNMENTAL
INDUSTRIAL HYGIENISTS

TWENTY-NINTH ANNUAL MEETING

April 29 - May 2, 1967

Chicago, Illinois

- April 29-30, 1967: Meeting of Executive Committee
- April 30, 1967: Concurrent Round-Table Discussions
- May 1, 1967: Two General and one Business Session
- May 2, 1967: One General and one Business Session,
AIHA-ACGIH Joint General Session, and Banquet

ANNUAL MEETINGS AND OFFICERS

Annual Meetings				Secretary- Treasurer
No.	Date	Place	Chairman	
1	June 27-28, 1938	Washington, D.C.	A.S. Gray, M.D.	J.J. Bloomfield
2	Apr. 26-28, 1939	Washington, D.C.	W.S. Johnson	J.J. Bloomfield
3	Apr. 30-May 2, 1940	Bethesda, Md.	M.H. Kronenberg, M.D.	J.J. Bloomfield
4	Feb. 17-18, 1941	Washington, D.C.	C.L. Pool	J.J. Bloomfield
5	Apr. 9-10, 1942	Washington, D.C.	C.A. Nau, M.D.	J.J. Bloomfield
6	May 24, 1943	Rochester, N.Y.	M.F. Trice	J.J. Bloomfield
7	May 9, 1944	St. Louis, Mo.	P.A. Brehm, M.D.	J.J. Bloomfield
8	Apr. 7-13, 1946	Chicago, Ill.	P.A. Brehm, M.D.	J.J. Bloomfield
9	Apr. 26-29, 1947	Buffalo, N.Y.	K.M. Morse	J.J. Bloomfield
10	May 27-30, 1948	Boston, Mass.	L.W. Spolyar, M.D.	J.J. Bloomfield
11	Apr. 2-5, 1949	Detroit, Mich.	H.G. Dyktor	J.J. Bloomfield
12	Apr. 22-25, 1950	Chicago, Ill.	K.E. Markuson, M.D.	L.J. Cralley, Ph.D.
13	Apr. 21-25, 1951	Atlantic City, N.J.	J.J. Bloomfield	J.E. Flanagan, Jr.
14	Apr. 19-22, 1952	Cincinnati, Ohio	L.M. Petrie, M.D.	J.E. Flanagan, Jr.
15	Apr. 18-21, 1953	Los Angeles, Cal.	J.C. Soet	J.E. Flanagan, Jr.
16	Apr. 24-27, 1954	Chicago, Ill.	J. Shilen, M.D.	J.E. Flanagan, Jr.
17	Apr. 23-26, 1955	Buffalo, N.Y.	H.B. Ashe	J.E. Flanagan, Jr.
18	Apr. 21-24, 1956	Philadelphia, Pa.	R.R. Sullivan, M.D.	C.D. Yaffe
19	Apr. 20-23, 1957	St. Louis, Mo.	W.G. Fredrick, D.Sc.	C.D. Yaffe
20	Apr. 19-22, 1958	Atlantic City, N.J.	T.F. Mancuso, M.D.	C.D. Yaffe
21	Apr. 25-28, 1959	Chicago, Ill.	C.E. Couchman	C.D. Yaffe
22	Apr. 23-26, 1960	Rochester, N.Y.	A.L. Coleman	C.D. Yaffe
23	Apr. 9-12, 1961	Detroit, Mich.	A.L. Coleman	C.D. Yaffe
24	May 12, 15, 1962	Washington, D.C.	W.L. Wilson, M.D.	A.D. Hosey
25	May 5-7, 1963	Cincinnati, Ohio	E.L. Schall	A.D. Hosey
26	Apr. 25-28, 1964	Philadelphia, Pa.	C. Einert, M.D.	A.D. Hosey
27	May 1-5, 1965	Houston, Texas	L.J. Cralley, Ph.D.	A.D. Hosey
28	May 14-17, 1966	Pittsburgh, Pa.	B.D. Bloomfield	A.D. Hosey
29	Apr. 29-May 2, 1967	Chicago, Ill.	R.H. Duguid, M.D.	A.D. Hosey

Note: No meeting held in 1945

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

Executive Committee 1967-68

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Occupational Health Program, U.S.P.H.S.
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Washington, D.C. 20201

Phone: 963-7755

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Pennsylvania Division of Occupational
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Health & Welfare Building
Harrisburg, Pennsylvania 17120

Phone: 717-787-6525

Past-Chairman

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U. S. Army Environmental Hygiene Agency
Edgewood Arsenal, Maryland 21010

Phone: 676-1000

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Houston City Health Department
Houston, Texas 77025
Term expires April, 1968

ERNEST MASTROMATTEO, M.D.
Ontario Department of Health
Toronto 2, Ontario, Canada
Term expires April, 1969

IRVING H. DAVIS
Michigan Division of Occupational Health
3500 North Logan Street
Lansing, Michigan 48914
Term expires April, 1970

ANDREW D. HOSEY, Secretary-Treasurer
Occupational Health Research and Training
Facility, U.S.P.H.S.
1014 Broadway
Cincinnati, Ohio 45202
Phone: 202-684-2692

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'67
'57

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Z8	- Mr. Irving Davis (laundry and dry cleaning)
Z9	- Mr. Jeremiah R. Lynch (safety code and exhaust systems)
Z16	- Miss Victoria M. Trasko (work injury experience)
Z37	- Dr. Herbert E. Stokinger (threshold limits)

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- Z49 - Dr. Charles H. Powell and Mr. Irving Kingsley, Alternate (welding)
- Z54 - Mr. D. E. VanFarowe (radiation)
- Z84 - Mr. Richard E. Kupel (glossary on environmental terms)
- Z88 - Mr. Edwin C. Hyatt (respiratory protection)
- Z105 - Mr. Bernard D. Bloomfield and Mr. Paul F. Woolrich, Alternate (air and gas cleaning)
- Z117 - Mr. Peter Breysse (safety requirements for working in tanks and confined spaces)

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TESTING AND MATERIALS

- ASTM D-22 Dr. Ralph Smith (atmospheric sampling and analysis)
- ASTM D-26 Mr. Howard L. Kusnetz (halogenated organic solvents)

REPRESENTATIVE ON A.P.H.A. INTERSOCIETY COMMITTEE ON
AIR SAMPLING AND ANALYSIS

Mr. Robert G. Keenan

REPRESENTATIVES ON INTERSOCIETY COMMITTEE ON DEVELOPMENT
OF NOISE CRITERIA

Mr. Herbert H. Jones

Dr. Floyd A. Van Atta

GENERAL SESSION

May 1, 1967 - 9:00 a.m.

Robert H. Duguid, M.D., Chairman, Presiding

OPENING REMARKS AND WELCOME

Robert H. Duguid, M.D.
U. S. Army Environmental Hygiene Agency
Edgewood Arsenal, Maryland

It is a privilege to welcome you to the twenty-ninth annual meeting of the American Conference of Governmental Industrial Hygienists. This welcome is extended not only to the members of A.C.G.I.H., but also to members of the American Industrial Hygiene Association and to the many friends and associates of both organizations who may find it possible to attend our sessions.

The past year has been a busy one for A.C.G.I.H. has been manifested by the activities and productiveness of the Conference's committees, the committees sponsored jointly by both the American Conference of Governmental Industrial Hygienists and the American Industrial Hygiene Association, and the many liaison representatives we have to other agencies and organizations whose interests have a bearing on the field of industrial hygiene. As in the past, the scope of these activities will be summarized in the scheduled business meetings, one later this morning and the other tomorrow. There is perhaps no quicker nor more profitable way for one to bring himself "up-to-date" on the status of a great many subjects in the industrial hygiene field than to attend the two business meetings, hear the reports that are presented, and take part in the discussions which they stimulate. I therefore urge each A.C.G.I.H. member to attend these meetings.

At this point I would like to commend Mr. Andrew Hosey for the thorough and conscientious manner in which he has performed, during the past year, the complex and oftentimes trying duties of Secretary and Treasurer of the organization. This of course is characteristic of Andy. His ability to bring order out of situations which sometimes seem to approach administrative chaos is indeed remarkable. Thank you Andy.

Always an attractive feature of each American Industrial Hygiene Conference is the commercial and scientific exhibits. Much of the success of the Conference depends upon the interchange of information between exhibitors and the registrants. This year I have been informed by Mr. Jerome Siedlecki, the General Conference Chairman, that the exhibits are of excellent quality. They provide an unusual opportunity to view in one place the full breadth of products and services applicable to industrial hygiene programs. The commercial exhibits will be in the Great Hall on the second floor, and the scientific exhibits in the balcony of the Great Hall on the third floor. You will find no difficulty reaching these locations by escalators, elevators, or stairways. The exhibit hours are from 8:45 a.m. to 5:15 p.m. tomorrow and Wednesday and Thursday from 8:45 a.m. to 4:00 p.m. Please take full advantage of this opportunity which has been made available to you by those who have worked so diligently in organizing and planning the Conference.

Regarding the scientific and technical program for today and tomorrow, the Program Committee, under the Chairmanship of Henry Doyle, has developed an attractive series of papers. The first presentation is entitled, Trends in Labor Department Activities in Health and Safety by Mrs. Esther Peterson, Assistant Secretary, U. S. Department of Labor.

TRENDS IN LABOR DEPARTMENT ACTIVITIES IN OCCUPATIONAL SAFETY AND HEALTH

Mrs. Esther Peterson, Assistant Secretary
U. S. Department of Labor
Washington, D. C.

It is always a pleasure and a challenge to address fellow administrators and a related discipline, especially one we look up to as the intellectual elite of the safety and health profession.

When I began thinking about what I should say today, some remarks I made 4 years ago to a group of your colleagues in both the public and private sector, seemed pertinent. At that time we were celebrating twin birthdays -- the 50th Anniversary of the birth of the safety movement and of the U. S. Department of Labor.

These twin blessed events -- I think I may say to a safety-minded audience -- were no accident. One was conceived fully and the other in major part out of a public conscience aroused by tragic carnage in the mills and mines of America. The period we reviewed was 1908-14. Those years witnessed three times as many annual deaths in Pittsburgh's steel mills alone as occurred in the entire steel industry 50 years later; they saw mine cave-ins, explosions, open gears, unguarded shafts -- and the Triangle Shirt Waist factory fire. These tragedies goaded the public conscience and galvanized the people into action.

So these years also saw the first limited Federal benefits to employees injured on the job, the enactment of some 21 State workmen's compensation acts, and a number of State safety laws and codes. Public conscience was aroused and action followed as it always does.

I'd like to suggest that since those remarks were made, the public conscience has again been aroused and with like results. The carnage has moved from the garment factory to the streets and highways of America. I mention, as an example, one of our distinguished governmental people and his wife who a few years ago always flew in separate airplanes. Now they will fly in the same plane but always go to the airport in separate cars. Just as a few early leaders like Jane Addams and John R. Commons and Florence Kelley bespoke the Nation's troubled heart and its gathering will, so today a young lawyer named Ralph Nader generated the spark for what has become our second safety revolution.

As you know full well, Congress in the past year or so has enacted the auto and tire safety laws, the highway safety act; a new Transportation Department has become reality and we are again struggling with birth pangs, this time to fashion the administration of these laws. And there has been a spin-off -- you see, I must use space-age jargon -- a spin-off from traffic to environmental safety, to product safety, and of concern to us especially today, to occupational safety and health. Congress also passed the metallic and nonmetallic mining Act. Hearings, debate and much interest -- as you people know better than most -- centers around the combined traffic-work public safety problems of air and water pollution.

Safety is sizzling on a dozen fronts. While there is nothing more powerful than an idea whose time has come, the news commentators still remind us how rare and difficult is the capture of public attention and -- thanks to competition -- how short is its attention span. So I am constantly urging my staff in Washington -- and I should like to implore you, if you will forgive a reversion to the village blacksmith's technology with which I am more familiar -- to strike while the iron is hot. Let's use this moment of safety awareness to move ahead.

Safety and health people know how to strike. For they have a proud record. In that speech 4 years ago, I cited the total accident death rate in the United States in 1907 as 93.7 per 100,000 population. By 1962 the safety fraternity had reduced it to 52.2 per 100,000. Over 2/5 of these accidental deaths, of course, were accounted for by automotive fatalities, not a major matter in the first decade of the century.

This reduction was a splendid achievement. It demonstrates that the job can be done, that death and injury can be prevented. But we can't spare much time for self-congratulation because, as you know far better than I, the 1965 accidental death rate went up 3 points and so has the proportion caused by motor vehicles. The injury frequency from work injuries is also rising again. So we are not keeping up with the demand for our expertise. With so much to be done, all of us must do more.

The Labor Department has attempted to respond both to the opportunity offered by the safety revolution and to the greater need for accident prevention. I should like to discuss its response with you today -- for we need your understanding, your comments, yes even your criticism -- and increasingly your help. The Labor Department cannot -- and should not -- do this job alone.

After a careful review of the Department's responsibilities, a review which sought -- and received -- the advice of representatives of industry, labor and the States, Secretary Wirtz within the past year has consolidated all safety functions in the Bureau of Labor Standards under the leadership of a known safety champion -- Nelson Bortz.

To the Bureau's previous responsibilities for administering the maritime safety law and promoting Federal employee safety, has been added administration of the safety provisions of the old Walsh-Healey Public Contracts Act, the new Service Contract Act, and the Arts and Humanities Act. The Bureau now prescribes safety standards under the Vocational Rehabilitation Act as well.

The Bureau had demonstrated in the face of rising industrial injury frequency rates, that concentration on safety in the maritime and Federal service fields could still reduce death and injury. The proper mix of standards development, safety consultation and training, technical information, and, where necessary, enforcement procedures could and did bring down injury frequency over the past six years 38 percent in longshoring and 40 percent in ship repair. These, incidentally, exceed the goal set by President Johnson in launching Mission SAFETY-70 to reduce Federal employee injuries 30 percent in 1970. Since the actual start of this Mission in February 1965, Federal employee injuries have been reduced around 8 percent.

The Secretary hoped to build on the Bureau's demonstrated experience. But the assignment is a heavy one. From responsibility for some 2-3/4 million Federal and maritime employees, the Bureau's new task added 27 million more and with only the most modest increase in staff resources. I think mathematicians might almost call the ratio of resources to responsibility inverse.

So what to do? Obviously the purpose of safety program administration is to reduce death and injuries for employees engaged in producing goods and equipment and performing services for the Federal Government. Their employers enter into contracts with the Government and the law requires that such contracts be performed in a safe and healthful manner. In a war situation, these contracts soar. They involve everything from producing guns and airplanes to washing the windows in my office.

I needn't remind this audience that we haven't eliminated the old familiar causes of accidents from slips and falls and materials handling. But I also needn't remind you of the staggering variety of new and exotic hazards that have poured in on us

from the headlong advance in technology, from the scientific revolution, that some of you helped to generate. Today's problem of the miners who are known to be contracting and dying of lung cancer, in all likelihood the result of work in uranium mines, is a tragic example pointing up the need to keep pace, to anticipate, and to prepare for what we know to be ahead.

You are equally aware that in many instances the voluntary standards-setting organizations have not kept pace with the demand for effective, practical standards to safeguard work in the space age. The safety revolution has dramatized a rising impatience with the old status quo. The question recurs with increasing frequency: "Who will develop the standards, how soon, and what will they be?"

At a National Safety Congress panel on the administration of industrial safety laws last fall, its counsel, Harry Rosenfield, summarized the discussion brilliantly. I'd like to quote only three of what he called the "nine common threads" weaving through the deliberation. He said there was "a sense of urgency; a self-critical spirit; and the necessity of cooperation." He then added three of his own reflections with which I thoroughly agree. "Time's fleeting," he said. "There is more than enough for everyone to do; this isn't a penny-ante game."

I suspect a similar mood lay behind the reorganization of the old American Standards Association and dominated the recent U.S.A.S.I. conference on standards.

There has been, as we know, and as Mr. Francis L. LaQue of the International Nickel Company has so ably observed in evaluating the deliberations and conclusions of his committee, considerable discussion over whether government or industry should dominate the development and promulgation of safety standards. Writing in a recent issue of our Department's Safety Standards magazine, Mr. LaQue said we were debating the wrong question. The real question is not will government or industry be responsible for developing standards but how best to organize competence wherever it exists and make it effective. I couldn't agree more!

I understand, for example, that an ad hoc committee of the former A.S.A. Safety Standards Board in 1965 reviewed the national picture and identified over 150 separate areas of needs for standards development. After deliberation of the full Safety Standards Board, composed of representatives of more than 100 major organizations, only four projects were approved for immediate development through the U.S.A.S.I. voluntary process. This was not because only two or three percent of the suggestions were thought to be meritorious but mostly because of lack of resources or ways to get the job done.

This is not good enough. The voluntary process must be more responsive to public need if it is to survive and serve. It must not only develop standards where the need is demonstrated but it must also anticipate and have standards ready in advance of acute need. The day of the perfunctory safety standard -- or approach -- if not over -- is at sunset.

Much of the present public concern has arisen because neither industry nor government has met its full responsibility for adequately protecting life and limb. So we are both faced with criticism and need to meet it constructively. I think we accept the criticism and move on with the job.

Let me be perfectly frank. I would hope that industry and government can work together as partners in protection. But hope is not enough. Newly awakened to its responsibility to the public for effective safety standards, government must assure their development and use, one way or another.

It is certainly appropriate to turn to you experts and others for help and guidance in forging a viable government -- industry partnership for protection. One might ask: Why shouldn't governmental regulatory bodies base their regulations on existing, nationally recognized, safety standards subject of course to hearings procedures rather than to duplicate the work of others? By a nationally recognized standard I mean one developed by experts drawn from a representative, balanced group of interested parties and responsibly approved on an accepted basis of consensus.

I fully endorse such an approach. But let me be clear that such an approach does not -- or should not -- imply any abrogation of the government's initiative to develop and prescribe its own detailed standards in whole or in part when necessary. And by "necessary" I would include all situations where a standard is nonexistent, inadequate or obsolete.

At times it has been alleged that industry has tended to hold back its best talent from standards development for fear that what is produced will ultimately be enforced against it. If, and to the extent this has been true, it is obviously shortsighted and I feel industry today would recognize it as shortsighted. The result may be a code impossible to defend and much harder to live with. More significantly, today's ethics and sophistication will not tolerate or permit such submarginal thinking.

At this juncture in time and circumstance I believe that a great measure of leadership potential rests in the private sector and in public-private voluntary cooperation. Accordingly, I would urge and recommend that all interested parties and especially industry and labor make available to all standards making bodies the best talent they have to develop voluntarily the best possible standards to help us all in discharging our responsibilities.

We are at a crossroads in our standards work. Time, technology, and tempo will not let us tarry. Nor will it tolerate a lesiurely or less-than-adequate course. We must move forthrightly.

We need more research, more safety standards, more updated codes, more resources, and more participation by the best in industry, in labor, in the safety-oriented organizations, and in government at both the State and Federal level.

These are the long-range goals. But obviously the Bureau of Labor Standards must now administer these new Acts and in the interim improve services under the old ones. To the extent possible, we are trying to gear our short-run decisions to our long range objectives.

Finally, let me say a word about State codes. Our recent reviews with industry, labor and State representatives showed a general consensus that national standards are now necessary to provide more uniform adherence to safeguards covering a staggering array of hazards in our present technology. This consensus augurs well for the ultimate achievement of closer Federal-State cooperation in this area.

In developing a rational policy, we should consider several factors, for example: industry with multi-State operation finds adherence to 50 separate codes onerous; and some of the more industrialized States are already using national standards under what they call general or "catch-all" authority in their safety laws.

Perhaps even more important than this question is our need of State help in administering proper standards. It would be rather costly to set up the necessary number of Federal inspectors, safety consultants, trainers and others to do the job wholly from Washington. If we can achieve effective Federal-State cooperation and

organization, we can utilize rather than duplicate State manpower, administer the national standards more cheaply, and hopefully extend their benefits beyond Federal law to the full reaches of State jurisdiction. The problem, as of course you know, involves wide variety in State standards and great unevenness in financial and personnel resources.

We are under no illusions that solving all these problems will be quick or easy. We shall make mistakes. But I take heart from three factors: first, over a generation of industry-labor-government experience has demonstrated again and again that concentration on safety reduces deaths and injury; second, our task is in some ways easier than traffic safety because it concentrates on work places, organized centers where aggregates of workers can be reached and where primary responsibility for safety can be placed on management; and finally, the American system of voluntarism where representatives of many views and interests, presented with a common and compelling problem, often work their way toward a solution. In utilizing this system, we need your expertise, gentlemen. I feel you and others will give it to us -- and thus I am content.

LOOKING TO THE FUTURE
WHAT ARE THE OCCUPATIONAL HEALTH NEEDS?

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INTRODUCTION

"What is past is prologue"

The present field of Occupational Health, with its special and urgent demands on the professions concerned with human health, has originated primarily out of the creation of new hazards to the health of our people in the performance of their day's work, and out of the intensification of older and more familiar hazards, through the scientific and technical developments since the turn of this century. The scientific discoveries of the nineteenth century multiplied dramatically in the early part of the twentieth century, and paved the way for their application as an outgrowth, presumably, of the commercial expansion following the sturdy and successful pioneering which opened up the vast resources of this continent for exploitation. The population of the United States had undergone rapid growth, and the demand for food, clothing and shelter, as well as a newly found interest in riches, comfort and luxury, made themselves felt in the market places of the world. The tide was accelerated by the educational and political outlook of a free and self-reliant people, who had come to believe that they could obtain what they wanted through their own efforts.

Our people had lived with multiple natural hazards without being awed or subdued by them, and had developed a tremendous capacity for contending with adversity, hardship, disaster, and death. It is not too surprising, therefore, that its attitude was not "safety first" but rather that of achievement despite obstacles and troublesome consequences. It may not be irrelevant to remark that even yet, the chastening influence of the facts of modern experience, with respect to the well-publicized incidence of accidental injuries and fatalities in our society, has yielded little evidence of a wholesome and reasonable caution on our part. As a people we are still unduly self-assured, venturesome, and much more given, temperamentally, to the pursuit of the immediate advantage than to that of the ultimate benefit. Numerous illustrations of these characteristics in action come to mind, the more readily, no doubt, because we tend to take some dubious but persistent pride in them. And indeed, when coupled with ingenuity, diligence and technical competence, these somewhat brash characteristics have contributed much to the mighty surge of industrial technology that has provided this country with its collective wealth and prestige, along with a widely disseminated high standard of living.

There is a point, however, at which boldness becomes recklessness, and self-assurance becomes intellectual astigmatism if not blindness. That this point in our technical, economic and social development had been passed became clear, to at least a few of our hygienic, technical and commercial leaders, who, through experience, had come to recognize the threats to human life and health that reside implicitly in the productive utilization of new and incompletely explored sources of energy, and in the development of a host of new materials and new uses of familiar materials. Hitherto, skill in technology and commercial enterprise had been expended almost exclusively in the production and exploitation of new products for widening markets. Even the physicians and public health agencies, with their expanding types of paramedical support - the defenders of the national health - shared in the marvels and benefits of applied science without anticipating, seeing or understanding their

underlying dangers. Preventive medicine and hygiene, according to general medical concept, operated in another sphere, and so far as the medical practitioner (or even the sanitary engineer) was concerned, this was a function carried out by scientists and technicians in public health agencies or academic institutions - microbiologists, epidemiologists, chemists, physicists and engineers, who were not practitioners of the healing arts. Among practitioners of medicine, the surgeon, increasingly, recognized the new occupational sources of traumatic lesions, but these only swelled the ranks of patients seeking more or less orthodox curative treatment. A few medical men were drawn into industrial organizations to deal with occupational illnesses and, later, with problems of workmen's compensation for injury and illness. The great bulk of the profession carried on its usual functions of curative medical practice, in essential disregard of the impact of the new work environment on the increasing hordes of those who carry out the work of the nation. Even medical education and academic medical research, while promoting greater knowledge and competence in general and specialized fields, failed almost utterly to appreciate the rapidly changing needs of an highly organized technological society deeply involved in the creation of a new occupational and general environment. Research in medicine and public health delved deeply and productively into the etiology, epidemiology and pathogenesis of the more familiar diseases of man, as these are produced by natural enemies in his environment, and by his congenital, physiological, and biochemical deviations from normal patterns. It is not surprising, considering the intense focus of medical education and systematic training on the etiology and therapy of metabolic, intercurrent, and degenerative disease that this should have been the case, nor is it to be harshly condemned. The precision and skill engendered in the modern physician by the present pattern of professional training will one day have rendered our field a greater service than can now be perceived. The fact remains, however, that medical education in this country has been near-sighted, as has also that of technology. (Nor is this country alone in this respect.) The products of such present day education and training are almost wholly unaware of the challenge presented by a society whose numerical composition, as well as basic economic and social structure, differs widely from that of any previous time. The well-being, health and survival of modern man are threatened by forces and factors and materials that are largely on the outside of the field of present day medical and sanitary engineering practice, as visualized in most of the major centers of professional education. Only a scattered few of the schools of medicine, engineering, and general technology devote an appreciable degree of attention to these new hygienic problems of the community in either undergraduate or graduate training. The result is that their students rarely give consideration to careers in this field.

But this situation, viewed optimistically, has changed in some respects, and is changing further, slowly, but changing. An important feature of the change has been the development of a pattern of graduate professional training in both medicine and hygienic technology which has had favorable acceptance among the candidates for training and also within industry. The number of persons who have undergone such training has been small, but they have gained high status within the field with gratifying promptness. Largely on the strength of such graduate training, formal recognition of Occupational Medicine has been granted by the Council on Medical Education and Hospitals of the American Medical Association, as a full-fledged specialty within the American Board of Preventive Medicine. The certification of such specialists, on the basis of training and experience, has continued since 1955, thus putting Occupational Medicine on a par, in the formal sense, with other board-certified specialties within the professional structure. The formal pattern of certifying procedures in Industrial Hygiene has differed from that in medicine, but a more localized yet similar effect has been achieved in dignifying the trained or experienced technologist in this field. Thus the stage has been set by defining, formally, these professional fields, in terms of the disciplinary training involved, so that no one who prides himself on being

informed need continue in uncertainty as to the professional functions and qualifications of the specialists in Occupational Health. It is at this point, that the present and future needs, deficiencies and weaknesses of our professional situation require careful examination.

SPECIFIC NEEDS

Professional Personnel

The outstanding need that surpasses all others, without regard to any strategic point of application, is that of greater numbers of adequately trained medical, biological and technical personnel. At every point of attack on problems of occupational hazard or ill health, there is a gross shortage of competent professional personnel. Federal, state, city and county health agencies are seriously understaffed, as are also most of the educational institutions and departments that have entered this field of research or training, while the situation in industries that have undertaken to meet their responsibilities, with but rare exceptions, is similar. These statements do not begin to reveal the great lack of professional talent, if it is realized that many of the states and local agencies, most of the educational institutions, and a very large proportion of industrial organizations of the country are not even represented in this hygienic field. In short, while the total number of physicians or technical personnel, trained and untrained, engaged in industrial medicine and hygiene in the United States is not known and can only be estimated very roughly, it is clear that any such estimate would be so far short of the most modest appraisal of the reasonable requirements that a two or three-fold error of estimation on either side would not alter appreciably the gross significance of the shortage.

Some degree of competent, systematic medical and hygienic supervision is needed, in order to prevent avoidable illness and injury among those who do the day's work, in almost every industrial and commercial establishment in this country. A highly conservative estimate of the proportion of our working population of some eighty million people that is without benefit of either medical or technical industrial hygiene in their most primitive form, could not be less than one-half. In all probability it may be as much as three-fourths. The broad consequences of this situation cannot escape the notice of a free-lance consultant who is a combination of "trouble-shooter," in contact with a wide variety of industries, expert witness in compensation hearings, and clinical and toxicologic investigator. It is distressing to encounter familiar forms of occupational disease with the frequency that is common in this country. Equally frustrating are the frequently occurring procedures of a compensation hearing in a case that is controversial because the information required to resolve the controversy was not obtained at the proper time, for the sole reason that no one was available who understood the nature of the information required. These are but two illustrations of the dearth of appropriate professional personnel to deal with the problems of illness or injury, or of medico-legal matters which arise inevitably in our industrial society. The latter would seem to many professional people to be relatively unimportant, but the social consequences of an inept professional performance in such a matter extend all the way from the ludicrous to the tragic. It follows from these illustrations that a much better professional performance is required of the professions represented in the day's work in Occupational Health.

Professional Awakening and Specialized Training

Numbers of physicians and engineers (to use these general terms to cover the two basic types of personnel in Occupational Health) sufficient to cover a reasonable proportion of the professional field of practice, is the primary requirement in the future of this field. But a second and directly complementary requirement is that of specialized professional competence. The physician in industry (which is the

principal site of the professional practice of Occupational Medicine) should be a satisfactory product of general medical education. He must have had a sound training in clinical medicine, even if his function in industry comes to be that of a medical administrator. It is futile and retrograde at this time to think of the practice of Occupational Medicine in any other primary terms than that of good clinical performance. Yet competence in clinical medicine alone is not enough for the practitioner in industry, for he must either be ambivalent or be an understanding and cooperative member of a coordinated, ambivalent group which can handle well a wide variety of patients and situations, or carry out a comprehensive survey or epidemiological investigation, every part of which is done competently. He must also be sufficiently flexible to adapt his work to the changing environment of a growing and differentiating industry. The knowledge and skill that are called for in one industry are not necessarily those of another, but the physician in industry must become highly proficient in the work that is required in the industry within which he practices. This means that he should not be a stereotyped product of a rigid training, but rather that he has been prepared for an adaptive career in which he continues to add to his skill and competence.

The technologist in industry is in no different case than is the physician. Whether he be physicist, chemist, meteorologist, or engineer, he must have the balance and competence that will enable him to deal comfortably and effectively with his technologic peers in the production side of industry, and to work understandingly and in a complementary manner with physicians who recognize and value his collaboration. Incidentally, in our experience, the training of the physician and technologist within the same graduate facility serves well the development of mutual respect.

The hygienic function in American industry has been carried out in the past as a makeshift arrangement, for the most part. The industrial physician has often attempted to function as though he had the knowledge and training of an engineer, and, still more frequently, the industrial hygiene engineer, or even the production engineer, has frequently had to assume the responsibility for the hygienic policy and program of an industry, such as these may be. Such situations have been and will continue to be inevitable, so long as properly trained professionals are not available, but it seems unlikely that this will serve, even as a makeshift, within the increasingly complex structure of modern industry. We should not be willing to settle professionally for such an arrangement without a vigorous effort to correct it.

Sound training in the medical and technical disciplines of Occupational Health, on a scale that will visualize and ultimately meet the more urgent needs of the nation - and will spill over into those of other nations, is a major requirement of the future. How this is to be achieved is a matter that should be given the earliest and most earnest attention of those who are responsible for professional training in medicine and engineering. Their awakening to their responsibilities is long overdue.

It is my considered opinion that this training must be carried out within the field of graduate education. Primary medical and technological training cannot be expected to prepare even the most capable of students for professional careers in this field. The need for specific information and for the cultivation of special skills is too great in scope to be met in undergraduate training without serious impairment of basic scientific education. Moreover, it is wholly unreasonable to expect the well-trained but narrowly educated graduate in medicine or engineering, after his enforced withdrawal, for purposes of intensive study, from most of the general affairs and concerns of society, to achieve specialized competence as well as solid social and professional balance in the midst of the rapidly moving productive and commercial life of the nation, without spending some time in examining and interpreting his special role therein. If this is to be achieved on a scale that will meet the needs of a civilized technological society, graduate training in Occupational Medicine and Hygiene, running

over into the somewhat broader field of Environmental Health - broader at least in the semantic sense, for these terms, from the aspect of professional training, are largely indistinguishable - must be made available in a large proportion of our major schools of medicine and engineering. Only in this manner can some grasp of the significance of careers in these fields be provided to any large proportion of undergraduate students, through the utilization of well-trained faculty members in appropriate areas of undergraduate teaching. The obstacle here, of course, is the lack of competent persons for the composition of the graduate faculties in Occupational or Environmental Health, so that time must pass before these requirements can be met. First, however, there must be an awareness of the need for such a faculty within a school or university. One has the feeling that much further delay in this matter within relevant educational circles may bring about a rude awakening. Certainly it is not inappropriate to invite the educators of the country to reexamine their relationship to a society that has embarked upon a new course fraught with many new and often unexplored threats to its survival.

An Awakening Within Industry

A third urgent need for the evolution of an appropriate performance in the field of Occupational Health is one which some educators, at least, have hesitated to project in forceful terms, until such time as there might be some hope or faith that it could be fulfilled. This need is an awakening to certain hard facts of modern life on the part of industrial management, generally, with respect to the impact of modern technology on the environment of the work place and upon that of our entire industrial society. These facts expressed in their simplest terms are somewhat as follows:

1. The operations of an industrial organization, in both plant and office, bring many types of stress and hazard to bear upon the people who carry them out. The cost of the wear and tear, as well as the overt accidental injuries and intoxications, on the people in the industrial organization, is excessive, and is also an highly important factor in the health, productivity and wealth of the nation.
2. The recognition and the elucidation of the nature and effect of such stresses and hazards, and their limitation or elimination, are feasible through modern methods of physiological and hygienic investigation, and the means of controlling the industrial environment, within limits of human safety are, or can be made, available. The purposes of the professions engaged in Occupational Health are not those of applying special techniques for the limitation of absenteeism, or of reducing compensation costs, or of imposing hygienic disciplines upon industrial employees, but are rather a broad means of securing and improving the health of the industrial population, of increasing its potentiality for productive effort, and of cultivating certain important factors that increase the satisfaction of industrial employees in their day's work. Moreover, the industrial health department should and can often provide wise guidance to the management of an industry in the selection, manufacture, distribution, and offering for use of its products, occupying a position comparable to that of the legal department in its different field, in formulating hygienic policy in relation to the safety of distributor and consumer, and to that of the community generally.

Research

A fourth need is more and better knowledge of the effects of the stresses and hazards of occupation upon the health and well-being of those who do the work of the nation. No one who is reasonably well informed is happy with the scope and the quality of the research that has been performed thus far in the field of Occupational Health. It should be greatly expanded in its scope and improved in its quality. Here is another aspect of the field in which more and better training and, above all,

wider knowledge and experience are required. The basis of professional practice in this field is information, and the life's blood of a graduate educational facility in Industrial Health is research - the expansion of valid information. Such efforts of research should be pursued vigorously in every graduate school in this field, and these should exist in every part of the country. New industrial products and new sources and applications of energy should be investigated for their biological potentialities while they are being investigated for their physical properties and developed commercially, to the end that they may be surrounded with appropriate precautions at every stage of their exploitation. This is not extravagance but mere prudence, and the fact that it is not being done systematically, and that there are not adequate facilities for the performance of such research within the country must be accepted as proof of our social and economic backwardness.

It will be noted, perhaps with surprise, that there has been no mention of the governmental role in Occupational Health in the preceding paragraphs. This has not been unintentional, for although the contribution of government, federal and local, has not been negligible in the past, nor is it likely to be in the future, it has been our traditional national policy, at least in our pronouncements, if not always in our performance, that government should be active and effective in doing for the people of the country those necessary things that they cannot do or bring themselves to do for themselves. Certainly the primary concern, as well as the responsibility, for the immediate preservation of the health of the industrial segment of the working population against the hazards of the industrial environment resides within industry, and it seems highly improbable that this responsibility can be borne effectively in any other manner than through the efforts within industry of expert professional personnel. This is not to claim that the professional and official responsibility of the various designated agencies of government, in connection with threats to the health of the working population, is any less than that which relates to those of any other group of citizens. Such responsibility involves the duty of knowing, through the systematic collection of pertinent information, and through such thorough investigation as may be required in addition, the nature and the effects of occupational stresses and hazards, and the extent to which they are being dealt with and controlled within satisfactory limits. That such knowledge has never been gained by governmental agencies in our cities, counties, states and the nation, in anything approaching a satisfactory and comprehensive manner, is no more remarkable than is any other shortcoming within the field of industrial hygiene, but it is something to bear in mind as an unescapable governmental function to be developed effectively in the future. The industries of the country should collect such information for their own guidance, and a composite body of sound information, covering the industries of the country, should be secured by governmental agencies, with such supplementary information from other sources as may be required. This should be published as vital health statistics, and made the basis for appropriate action, including recommendations, regulations, consultations and legislation as required. It is more than unfortunate that, after several decades of rapidly accelerating industrial development in the United States, no precise knowledge worthy of the name is available to delineate the impact of the industrial environment upon the working population of the country, even in terms of the incidence of specific forms of occupational disease. It is indeed an astonishing sign of professional and governmental ineptitude. Moreover, it is clear that such information will not become available through the establishment of a vigorous and efficient agency (or agencies) for the systematic collection of statistics. The raw data cannot be had until competently trained physicians have found their way into industry, or into access to industry, in sufficient numbers to maintain a reasonably effective surveillance over large and representative segments of our industrial population. This cannot be done at present, nor will it be possible for sometime to come, if for no other reason than that the generally practicing physicians of the country are not sufficiently familiar with industrial operations, hazards, disabilities and diseases, and are not often enabled to see and examine the

victims of occupational diseases at the right time or with such frequency as to arrive at sound diagnoses nor to make satisfactory appraisals of disability. The only really satisfactory solution of this difficulty lies in the adequate coverage of industry by trained and experienced physicians, preferably within industry.

Further features of the necessary role of governmental agencies in the field of Occupational Health in the future may be visualized, I believe, through the performances of several of our States, in those of a few of our cities, and in the undertakings of the Federal Government. Certain comments may be made on each of these areas of official activity.

It would seem unlikely that the direct responsibilities of individual States for the hygienic conditions in industry, as defined by the laws of the land, will be lightened, in the jurisdictional sense, in the near future. If this is true, the quality of the performance in all of the States, with respect to the fulfillment of their responsibilities, must be brought up at least to equivalence with that of the best examples in the country. Certainly the effort made in many of the States is inept both quantitatively and qualitatively, and in some it is almost wholly lacking. If the government of the individual State is to take its responsibility seriously, it should have the facilities in personnel and in equipment that will enable it to function as a source of guidance, specific information, regulations, and when necessary, of disciplinary action, for the industries that operate within the State. This is easy to prescribe, but difficult to achieve, not only because of the lack of a specific social, political and professional background within some of the States, particularly those that have come lately into industrial activities, as well as a dearth of economic resources. As indicated previously in all other aspects of this field, competent personnel are not sufficient in number to man all of the States adequately. It is frustrating, to say the least, in considering the future of this country in this field of professional activity, always to find it necessary to draw attention to this vital factor, but it must be faced. The numbers of those who have sought and obtained professional training in this field within the past two decades have been little more than sufficient to make up for the attrition of time and circumstance. Others have been drawn into the field of action from other medical and technical walks of life, and, in time, some of these have gained real competence. Others have served as technical hands to advantage, in otherwise well-manned laboratories or clinical facilities in which their partial skills can be utilized under appropriate general direction.

As to the activities in Occupational Health of the Health Departments of many, if not most, of the cities of the United States, the situation might seem to require explanation only on the basis of the difficulty - even the virtual impossibility - of the performance of their appropriate duties toward their working population, because of the lack of funds and facilities in personnel and equipment. One might suppose, in this wealthy, productive country, that every large industrial city would have the means of maintaining a reasonably effective degree of surveillance of the health of its own industrial population, but such is not the case. Moreover, many of the cities of the country are running into financial difficulties, many of which arise from other effects of rapid industrial expansion, and are seeking ways of escape from growing financial obligations rather than new outlets for expenditures. It seems unlikely, therefore, that they will find the resources required for prosecuting effective programs in Occupational Health.

In view of the thesis advanced herein that industrial organizations may properly be expected to handle the hygienic problems of their own making, among their employees and in the community generally, it is not to be supposed that there need be a duplication of effort and facilities in every unit of local government. Common experience would indicate, however, that minimum standards of hygienic performance throughout in-

dustry will have to be established by a responsible government agency, and that a reasonable uniformity of compliance therewith will have to be specified, and if necessary, enforced. One cannot conceive of the fulfillment of this responsibility on the part of a city, county or State health department by any division or bureau that is not properly manned and supported, directly or indirectly, by an effective industrial hygiene laboratory. The coordination of all of the professional personnel and facilities within an entire state (or region in some instances), in the interests of good professional practice and economy, should not be a difficult organizational hurdle to surmount.

The Federal Government has the duty of knowing how well or how poorly the industries of the country are guarding the health of their employees against occupational stress and hazard, what supplementary efforts on the part of governmental agencies are required to accomplish the desired result, and to what extent such supplementary efforts are effective. There should be means, under the law and in keeping with appropriate professional practice, whereby the influence of the Federal Government can be brought to bear on local agencies. Not the least of these influences should be advice and assistance both in personnel and funds. The time has come, it seems, when this must be done on a greatly increased scale. Here again, however, such efforts can bear wholesome fruit only if sufficient numbers of professional personnel can be recruited and trained adequately, and if a professional esprit de corps can be cultivated effectively. There is great difficulty in developing and maintaining such motivation within a very large organization even if it be professional. It is doubtful that it can be achieved by any other means than that of promoting high standards of competence and devotion to duty in an highly respected professional field. The latter has not been true of the field of Occupational Health within any general technological, scientific or professional circle in the United States, and it has not been more nearly true within scientific and professional circles in the Federal Government. Occupational Health, until very recently, has been severely down-graded in Federal hygienic, legislative and executive circles, and it will not achieve its proper place easily or promptly. Only an heroic effort on the inside and outside of government can make up for the decades of neglect of Occupational Health within the professional and the governmental agencies. (This is not to minimize the achievements and contributions made by devoted professional men and public servants who have been assigned to this function in government in the past; it is rather to deplore the lack of funds and facilities that have been made available to them through the failure of responsible governmental authorities to recognize the scope and significance of their task.) Some such effort is required, and has been visualized in a recent document, the Frye Report, to the Surgeon General of the U. S. Public Health Service, especially as it deals with past and present shortcomings, and points to the need of greatly strengthening the resources of the Federal Government as employer, professional leader and investigator, and as the possessor of funds and influence within the professional industrial health community. Much can be and should be done by the Federal Government to catalyze, to inaugurate, and to support developments within this field which will unite and implement a professional and educational movement designed to meet the needs of this nation in Occupational Health. Two proposals have been made recently for staging a National Conference on Occupational Health for the purpose of awakening the entire professional and industrial community to an awareness of these needs. It is fervently to be hoped that all of the professional, industrial and governmental groups directly interested in such a Conference will join hands in bringing about this monumental and much-delayed purpose.

OCCUPATIONAL HEALTH IN THE LOCAL HEALTH DEPARTMENT

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and

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The strongest and most successful endeavor of local public health activities have been in those programs that nobody else really wants to do but at the same time pose a threat and challenge to the community.

There is practically no money to be made and not much glamour in treating cases of venereal disease and following contacts. The same can be said of tuberculosis, hookworm, septic tanks and many local public health programs. When such conditions become prevalent and troublesome, George or somebody has to do it, and public health traditionally, almost following the laws of nature, fills the void.

Herein lies our real strength and opportunity.

These views would certainly not be shared by all Health Officers nor all local Health Officers.

In these days of relative availability of large sums of money for the aged, the mentally unhealthy, the retarded, the handicapped, and many other segments of our population, no official local agency seems to express much interest in the most vital segment -- the people who work and produce.

We recognize this as a void in the total health picture of our industrial community. We aim to close the gap and have an even healthier, happier and more productive place in which to live.

HILLSBOROUGH COUNTY

Hillsborough County, its main city being Tampa, is located on the Gulf of Mexico in central Florida. It is an important manufacturing, agricultural, shipping, and tourist center. Present population stands at 464,000 persons, a gain of 17% since the 1960 census, which showed 397,788.¹ About one person in seven is of foreign stock; the major tongue is Spanish, reflecting the migration of these persons to the traditionally Latin City of Tampa.² About 160,000 persons are in the civilian labor force. Tampa is a city of diversified industry and is considered the industrial hub of Florida. Manufactured products include beverages, cement, cigars, citrus products, containers, phosphate products, seafood, and steel. Florida Industrial Commission files show about 3750 companies located in Hillsborough County.³ Ninety-nine per cent of these firms employ fewer than 500 persons; in fact, the average employee-size of all establishments is 23 persons. During 1965 alone, thirty-nine new industries located in Tampa,⁴ and several hundred expanded existing operations. The Port of Tampa handles the greatest tonnage of any port in Florida.

HILLSBOROUGH COUNTY HEALTH DEPARTMENT

The Hillsborough County Health Department operates through constitutional and legislative authority of the State of Florida. The Health Officer is responsible to the

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Board of County Commissioners and the State Health Officer. Technically and legally we are state employees with considerable local autonomy. The County appropriates more than 75% of the total budget.

There are roughly 200 employees composed of physicians, nurses, sanitarians, engineers, clerks and secretaries, dentists, statisticians, nutritionists and others.

During the 1950's, concern was voiced from within the health department about this industrial growth and population increase, and how the department might assist the community in improving the health of employed persons.⁵ It was felt that such activities should be conducted on the local level as far as possible. A number of conferences of representatives of the Hillsborough County Health Department, the Florida State Board of Health, and the Division of Occupational Health of the Public Health Service were held to map a program of research and study which would lead to the establishment of occupational health services at the local level. In June of 1961, a two-year study, conducted in Hillsborough County by local personnel and supported by a Public Health Service grant, was initiated. The occupational environment was to be emphasized, but avenues to improving the total health of the worker were to be particularly stressed. The immediate establishment of services was sacrificed in favor of the long range benefits of studying the behavior and desires of employers, employees, and the community. During the two years, attitudes regarding occupational health held by management, labor, and the medical profession were studied, community resources were assessed, existing services, facilities and needs were examined, and morbidity and mortality rates of employed persons were determined. A detailed industrial hygiene survey of a sample of county industry was conducted. It is not the purpose of this report to present the many facts learned during the two years; suffice it to say that as a result of the study, there was established in June of 1963 a permanent program in occupational health, located within the local health department, and entirely supported and staffed by it. This permanent program, as an outgrowth of the preceding study, was designed to stress both environmental hazard control and total health maintenance of the working adult. It has been determined during the two-year study of 1961-63 that only approximately ten per cent of the county's business establishments were without any existing or potential hazard to worker health. It should be noted here that this was a program arising out of community need and desire, not out of any particular health crisis. Ours was the first such program to be established at the local level within the State of Florida, but since 1963, three additional counties have joined us.

PRESENT OCCUPATIONAL HEALTH PROGRAM IN HILLSBOROUGH COUNTY

The present occupational health program in Hillsborough County stresses control of the work environment through the work of a full-time Industrial Hygienist, and stresses adult health maintenance at the place of employment through the efforts of a specialist in occupational health nursing, assisted by the part-time efforts of most of the department's seventy public health nurses. Additionally, assistance is exchanged between occupational health and other disciplines within the department as needed. Often, joint projects may be conducted with persons concerned with health education, air and water pollution, nutrition, immunization, and even tuberculosis control. Thus the team specializing in occupational health has the backing of virtually all department resources, and they lend assistance to other public health areas whenever the occupational aspect is involved. Just as we advise others to make full use of their community's resources, we use outside aid ourselves. The back-stopping facilities of the occupational health program of the State Board of Health, particularly their analytical laboratory, are used almost to the limit that they will allow. Assistance is received from the Florida Industrial Commission, not only in the reporting to us of occupational diseases, but involving frequent consultations with their industrial safety representatives. Often joint visits are

made with these persons. Much of our health education material comes from voluntary agencies and insurance companies. Much advice and aid is rendered us by the Division of Occupational Health of the Public Health Service. We owe a great deal to the assistance given us by these and other agencies from almost every branch of health endeavor. Other "public health" activities conducted by our occupational health division have included determination of carbon monoxide levels in public parking garages, neighborhood noise levels, traffic noise studies, exposure to solvent vapor from self-service dry cleaning machines, and work involving the purity of compressed air for recreational diving. Cooperation has been lent to the occupational committee of the local citizens safety council. In fact, one of our recent activities was to visit high schools in the area to determine how certain hazardous materials were being handled and how well school fume hoods operated. Out of these visits grew a series of guidelines, written expressly for school teachers, on the toxicity and safe usage of some one dozen commonly used, hazardous laboratory chemicals. Is this occupational health, because we were concerned about the teacher, school health, because we were concerned about pupils, or was it simply good public health in an area of need?

Certain chapters of the Florida Sanitary Code, enforced by state and local health units, are applicable to occupational health, and cover such areas as radiological health, and sanitary facilities of places of employment. The legal basis for a general occupational health program, however, is implied, rather than specific, and is found under provisions for the general control of disease.⁶ The Board of Health has not promulgated occupational health regulations. Such regulations are found in the Florida Workmen's Compensation Law, administered by the State Industrial Commission, and the Commission is authorized to "cooperate" with the State Board of Health.⁷ In practice, the health department serves as a consultant to the Commission in matters relating to occupational disease control.

INDUSTRIAL HYGIENIST

Our Industrial Hygienist has the basic responsibility of controlling hazards to health in the occupational environment, thereby reducing occupational diseases and helping to gain a safer and more pleasant workroom. Attempts to accomplish this objective take several specific forms. Routine, regularly scheduled, and thorough industrial hygiene surveys are performed of certain industries where definite or potential health hazards are known to exist. Examples of these might be pesticide and storage battery manufacturers. Other types of industry, such as cleaning establishments and printing plants, where certain potential hazards may exist, have been visited to assess conditions at least once since the inception of the program, with revisits as necessary. All cases of occupational disease reported to us by the Florida Industrial Commission result in visits to the plants involved, with the goal of preventing recurrence. The largest single activity of the Industrial Hygienist involves functioning in an advisory and consultative capacity in industrial hygiene matters upon request from local industry, individuals, and other agencies. How this service has been accepted by the community is indicated by the fact that six months after its beginning, only 5% of the Industrial Hygienist's time was spent in answering requests for service, whereas today, three years later, about 40% of his time is spent in this fashion.

PUBLIC HEALTH NURSING PROGRAM

Our goal in providing public health nursing service to industry is not to make plant nurses out of public health nurses, but rather to bring public health to "people who work" at their place of employment. Our objectives are several, but chief among them is the provision of health maintenance to the working adult. As a part of this we are interested in non-occupational disease prevention, and in assisting industry to

provide better health services for its employees. As has been mentioned, we are doing this because, we believe substantial benefits can accrue to total community health and nobody else at this time seems inclined to plunge.

The service phase of this program commenced in 1963 when the occupational nursing specialist and two trained staff nurses began visiting certain selected companies employing 100-250 persons. During the first year, activities were expanded to include all places of employment, regardless of size, and to include all seventy staff nurses. At the present time, our "specialist" introduces the program to and provides service at the larger plants in the county -- generally those employing several hundred or more persons. She also acts as a consultant to the fifteen professional industrial nurses employed by some twelve local concerns. She makes every effort to sell management of other large companies having no industrial nurse of their own on the benefits of obtaining such service. During the past two years, our consultant has been instrumental in arranging two short courses for company-employed industrial nurses, courses sponsored by and held at the University of South Florida in Tampa. This educational effort has stressed such topics as compensation, records, and mental health, of interest not only to employed nurses, but also to nurses contemplating entering the field. Persons from all areas of the state have attended, and several management representatives from local industry have visited during each course. Lastly, the consultant serves the entire nursing staff of the health department by providing advice to all nurses and making joint visits with them as requested. Each staff nurse, in addition to conducting a generalized program including visits to schools, clinics, and individual homes, visits the industry in her area. Often, especially where the company employs from 20 to several hundred persons, she arranges a schedule of regular visits, such as one-half hour per week, or one hour per month, whatever the need. At the very small establishment, rather than making regular visits, she simply introduces herself, explains her services, leaves several pamphlets and her phone number, and requests that she be contacted whenever needed. We have been pleasantly surprised at how many companies have called later when a health problem arose.

Activities at the plant have been varied. Perhaps the most valuable has been health counseling. We have found that most persons are quite anxious to do something about a health problem affecting them or a family member, but they need guidance. Usually they follow and very much appreciate advice given them. Needless to say, our nurses are "walking encyclopedias" of community resources. Another service has been screening tests to detect certain adverse health conditions. Health education is a most important endeavor. Not only is health material about almost any subject given to employees, but, in addition, some nurses maintain a monthly health bulletin board in their larger plants. Material for this is prepared by the nurse consultant, working with the Health Education office, and is designed to cover a different health topic each month. One especially fruitful activity has been cross-referral. For example, a nurse may need to visit the mother of a child she has seen during a school visit. If the mother works, as more than a third do, home visits will be most unproductive. But if she knows where the mother works, she has only to request the nurse carrying the mother's plant to speak to her during a subsequent visit to that plant. Certain other services may be given to management for the benefit of employer and employee. For instance, first aid practices, which are often hazards in themselves, may be improved. Assistance may be given in setting up a better records system. It should be pointed out that our visits never interfere with production, unless it is an emergency. Nursing visits are timed to coincide with lunch, break periods, or changes of shifts.

INTERPRETATION OF PROGRAM

How have such services been received by management? Response has generally been favorable. Several plants have asked us to increase our services; several have

offered to purchase extra time that we could not afford to provide free-of-charge. One plant owner thanked the nurse profusely for explaining tuberculosis to him. He said that he had always known that T.B. was inherited, but he never knew until she explained it that the disease was "catching." Unfortunately, all has not been that favorable. One plant owner stated, during an initial visit, "Why should I help do anything for these animals? I pay them, don't I?" Interesting enough, soon after this dialogue, the plant failed, was bought by a competitor, and a nurse now makes regular bi-weekly visits to the premises.

EXAMPLES OF TWO INDUSTRIES

To better illustrate our work, I should like to review briefly for you our experiences involving two types of industry, both somewhat unique to the Tampa area. The processing of phosphate rock presents special environmental hazards to the health of the workers, and is probably the number one industrial hygiene problem in Hillsborough County, both in terms of the severity of exposure and the number of persons involved. The processing of seafood, primarily shrimp, also presents environmental health hazards, but more important, involves a large group of persons covered minimally by any sort of medical care.

PROCESSING OF PHOSPHATE ROCK

More than a dozen companies in central Florida are engaged in the mining and processing of phosphate rock. Three of the largest of the processing plants, known in the industry as "chemical plants," are located in Hillsborough County. Ore is generally washed, concentrated, dried, and screened for size near the mine. Some rock ore is ground and shipped out of state for further processing, but much is processed in Florida into various chemicals. Although small amounts of regular superphosphate and diammonium phosphate are produced, the bulk of the rock is used in the production of triple superphosphate. This material is made by acidulating ground phosphate rock with sulfuric acid, which itself has been produced at the plant. After filtration and evaporation, the phosphoric acid is reacted with additional ground phosphate, yielding triple superphosphate. This material is granulated, sized, stored for aging (curing), and shipped.

Throughout the process, there are three basic hazards to employee health -- noise, dust, and fluorides. Initial surveys of the industry were made by the State Board of Health with assistance from the Division of Occupational Health of the Public Health Service in 1957.⁸ Since then, the state health department has revisited plants sporadically as time and personnel permitted. At the inception of our permanent program in 1963, we assumed basic responsibility for visiting those plants in Hillsborough County. Our goal is to visit each facility every six months, but thus far we have succeeded only in performing visits every 12 - 18 months. Returning to the first mentioned hazard, noise, we have found that noise levels are generally highest in areas around drying kilns, grinding and drying mills, and vibrating screens. The following results were obtained recently at one plant, and are typical of the industry.

<u>Operation</u>	<u>Number of Samples</u>	<u>Noise level in db (All Pass)</u>
Drying Kilns	2	103 - 108
Drying Mill	2	96 - 110
Grinding Mill	2	100 - 106
Vibrator Screens	3	108 - 112

The entire operation, except for wet processes, is a dusty one. Rock unloading, drying, grinding, storage, and shipment all create dusty conditions. Conveyor interchange and discharge points plant-wide are especially hazardous. Luckily, the dust is considered a nuisance dust⁹ -- free silica content being well under five per cent.⁸ Below are some typical dust levels.

<u>Operation</u>	<u>Number of Samples</u>	<u>Range of Dust (MPPCF)</u>
Drying Kiln	3	3 - 22
Dry Mill	1	3
Grinding Mill	1	4
Bagging Operation	1	35
Loading Hopper Car	1	427
Conveyor Interchange	1	586
Conveyor Discharge	1	774

Exposure to fluoride is the condition most hazardous to health found in the preparation of soluble phosphates. Mined rock is fluoroapatite - containing as much as 3 or 4 per cent combined fluoride.¹⁰ During both acidulation procedures, fluoride in the forms of hydrogen fluoride and silicon tetrafluoride are evolved. One local company defluorinates rock thermally in rotary kilns. Gases are reclaimed from both processes and converted into fluosilicate byproducts. Small amounts of fluoride remain in the product after defluorination. Thus, fluorides, dust and gas, soluble and insoluble, are factors needing control throughout the plant. Our work has been limited, because of personnel shortages, to sampling only for "total" fluorides, without any separation of gas from dust, or between soluble and insoluble forms. Typical results are shown as follows:

<u>Operation</u>	<u>Number of Samples</u>	<u>Total Fluoride mg/m³</u>
Thermal Defluorination Kilns	5	0.1 - 3.7
Drying Mills	2	0.1 - 0.2
Grinding Mills	6	1.7 - 5.2
Granulator Screening	6	1.0 - 11.5
Hopper Car Loading	5	0.2 - 2.7
Conveyor Discharge	2	3.3 - 6.8
Acidulation	4	0.1 - 2.6

Note: 50% of samples exceeded TLV of 2.5 mg/m³.

Considerable effort to control these contaminants is made by most companies. Much of this effort is tied in to increasingly stringent air pollution control laws. Local exhaust ventilation is used extensively, but is lacking in some and inadequate in many areas. Isolation is used in the sense of isolating men in control rooms. Much of the plants is automated, and most workers can spend a large part of their time in control rooms having adequate fresh air supplied to them. Respirators, both approved and nonapproved types, are used extensively, especially during maintenance operations. Probably our greatest contribution to these companies is that we have given them a more exact idea of actual contamination levels, where control efforts should be concentrated, and where existing control efforts seem to be adequate.

SEAFOOD PROCESSING

The seafood processing industry, employing some 3000 persons in Hillsborough County, primarily handles shrimp, and is entirely different from the phosphate industry. Although fifty per cent of the county's occupational diseases occur in this industry, even more pressing health problems exist. Most of the workers are women, are from the lower socio-economic strata of society, and perform tiring work of long duration in unpleasant surroundings.¹¹ Industry-supported health services are non-existent; contact dermatitis, known in the industry as "shrimp poisoning," contribute, as said, half of the county's reported occupational diseases. In light of these facts, it was decided that this industry would be an excellent area in which to locate an adult health program, conducted by a visiting Public Health Nurse from our department. Accordingly, details were worked out with five of the larger plants, and service initiated in 1964 to provide routine visits by the nursing consultant in occupational health. Objectives were to:

1. Counsel and refer employees having health problems,
2. Assist management to provide some basic health service,
3. Aid in control of dermatitis,
4. Encourage better habits of health and hygiene among workers and their families.

Today, nearly five hundred visits later, some progress has been made. Two plants have established first aid rooms, and a third is planning one. Cases of dermatitis have been reduced, and those cases that do occur are often less serious, thanks to earlier reporting. Most important, over four thousand consultations with individual employees have helped with seemingly every possible problem that could afflict the workers or their families. Because of the number of persons who report that they acted as advised, and who thanked the nurse for her help, we feel we have done much to better the health of this segment of our population.

Our evaluation of the total program has been in terms of community and industrial reaction, and in terms of occupational disease incidence. As elsewhere noted, reaction has generally been favorable; companies now often contact us for assistance in dealing with health problems, usually occupational in nature, but sometimes non-occupational. Yearly incidence of total occupational diseases has dropped since the inception of our program, despite a growing industrial population. Most encouraging, the overall decline has resulted because of a significant drop in cases in precisely those industries, such as phosphate, cement, lead, and seafood processing, where we have concentrated much of our work.

Future plans for the work of our Division of Occupational Health include the continuation of most present activities. We should like to expand the number of small plants visited by an area nurse, and we would like to visit every manufacturing

company in the county at least once to survey for environmental hazards. Quicker response should be provided on all requests for service. On a small scale, to be sure, but very important, we should like to examine the role of the work environment on diseases customarily considered non-occupational in nature. For instance, the role of occupational stresses in the aggravation of chronic diseases deserves much attention. We have a situation in the Tampa tobacco industry in which the ratio of numbers of persons dying of malignant neoplasms to numbers dying of heart disease is much higher than the ratio existing in the general population. Is there an occupational factor? Thus far, we don't know. What we do know is that our working force of the future will be more highly trained and individually productive than ever before, and that the productive capacity of each person will become more dependent on judgement and concentration, and less dependent on physical strength. There will certainly be more workers, especially in such areas as small service companies. More older people, more women, more handicapped persons will be employed. As the character of the work force changes, so will the types of occupational health problems and needs also change. And we of the health profession must adjust our attitudes and procedures to meet these new demands. Thank you.

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PLANNING FOR THE FUTURE IN ENVIRONMENTAL HEALTH

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In recent years, this Nation has become increasingly concerned about its problems in environmental health--and deservedly so. Today our needs for environmental health services are the most complex in history because of changes brought about by economic and technological advances. The job today is to keep up with, or ahead of, the trends. If we do not keep ahead, we may have to suffer the consequences indefinitely.

Environmental health problems have a special urgency because of three factors: The speed of change; the complexity of change; and our increasing synthetic and man-made environment. Thus, the last few years have ushered in a new era in man's struggle to adjust to the bio-community of which he is the dominant member. We are brought face to face with problems that are as baffling and insistent as any that man has ever been called upon to solve.

We can begin to visualize the nature and magnitude of the problems ahead simply by listing some of the dominant trends in American society today: the growth of our population, the growing proportion of older people in the population; the increasing diversity of our technology; the development of new industries--particularly the generation of new and exotic wastes; the increasing use of nuclear power; the introduction of new chemicals into our food, water, air, and consumer products; the coalescence of huge metropolitan areas; altered means of communication and transportation; and increased leisure time and the demand for recreational facilities. These trends will give rise to an increasing array of problems in environmental health. But our basic goal remains constant: to provide people with clean air, water, food, and neighborhoods; to harness our chemical environment to serve man's welfare without threat to his health; to link the workplace with the home and community as sources of vitality and strength. In today's world, a healthful environment is a basic social objective. Environmental health is a positive concept, designed not only to protect but to promote increasing levels of good health.

We have two simultaneous tasks. One is to build on what we have already accomplished, to increase progress in established fields. The other is to probe the unknown, to devise new techniques, instruments, approaches, and solutions.

Environmental health problems are closely related to concentrations of people and machines. The health problems of our huge cities are foremost in our thinking. Large concentrations of population always present special difficulties; but in periods of rapid growth and change, urban health problems become critical. We are in such a period and the end is not in sight. Once a rarity, the giant metropolis is now a commonplace.

* Paper presented by Mr. Malcolm Hope, Director, Office of Compliance and Control, Bureau of Disease Prevention and Environmental Control, Public Health Service

In his book on "The Metropolitan Problem and American Ideas," Luther Gulick says: "There is nothing that so depreciates the United States in the eyes of the world today as the gap between our dreams and beliefs on the one hand and our performance on the other. And in no place is this gap so wide and so visible as in and around our great cities." The visibility is most prominent in such lamentable characteristics of modern American metropolitanism as rotting central-core cities; slums next to high-income areas; polluted air and water; water shortages; open refuse dumps; overflowing septic tanks; and a host of other blights on the community.

Today's urban environment presents infinitely more risks to life and health than in the past. Even with the precision of our modern research tools, the new hazards are more difficult to identify than the risks of infectious disease.

Water and air pollution are prominent among the modern risks for three reasons. First, the new pollutants are chemical and radioactive substances about which we have a great deal to learn. Second, much larger population groups are exposed both to the common environment of the community and to the special environments of occupation. Third, the sources of pollution are far more numerous: they include more manufacturing and commercial establishments; more homes and public buildings; and more than 80 million mobile sources--chiefly automotive vehicles.

Food protection presents new and difficult problems in urban areas. Transportation is faster; there have been many technical innovations in processing, preservation, and distribution of foods. The revolution in food technology has brought mixed blessings. Standards of safety and quality for most foods were established 50 years ago, the criteria for contamination being pathogenic bacteria and obvious filth. Viral contamination, depreciation of nutritive values, the use of chemical additives, and the increased possibility of radioactive contamination are among the threats hanging over our heads today. There are still over one million known cases of illness each year due to unsanitary food and milk.

The ways in which people spend their leisure time also have important implications for environmental health in the future. As the work week shortens, leisure time increases. Providing suitable protection at recreational facilities, parks, campgrounds, and other recreational sites is a growing task of health workers.

In the coming decade, increased attention must be given to the relations between housing and health. This applies both to housing research and to the application of standards to housing construction and rehabilitation. We need to know more about the effects on human health of such factors as temperature, ventilation, light, space and noise. We need to improve our appraisal of what constitutes healthful housing, and to involve health departments more vigorously in the enforcement of housing codes.

Our challenge is no less urgent when we consider the oldest health problems of the city: water supply, waste disposal, and general sanitation. In the present period, they have taken on such vast dimensions and have become involved with so many economic and political issues as to be classed as new city health problems.

As metropolitan areas expand, the mere procurement and distribution of enough satisfactory water becomes a number one problem. Where to get it? For how many people? How to get it to them? The disposal of all types of wastes is scarcely second in importance, and the discharge of fluid wastes in one area usually affects the water resources of another.

The collection and disposal of solid wastes will be a continuing problem as long as some three-fourths of all communities over 1,000 population are using open dumps or other unsatisfactory means of disposal. These antiquated methods contribute to

pollution, the propagation of disease vectors, odors, and ugly conglomerations of garbage and junk. Certainly we need to move up to the Twentieth Century in this field.

The use of individual septic tanks and private wells in urban and suburban residential areas has been a cause of concern both to metropolitan planners and health officials. Private water and sewage disposal systems complicate the problems of basic community sanitation; and they have a limiting effect on suburban expansion.

The rapid growth of Federal involvement in health affairs has long dictated the need for reorientation of the Public Health Service's 22-year-old organizational structure. This health involvement will undoubtedly continue to grow and diversify; and any structure must be dynamic, adaptable to change. A year ago a major step was taken toward putting the Federal house of health in order. Following extensive and thoughtful study by groups of distinguished experts, the President submitted to Congress a plan for reorganization of the Public Health Service. The plan provides for flexibility and gives the Secretary of Health, Education, and Welfare the means to carry out his responsibility to meet the problems of today and tomorrow.

The reorganization is a most important aspect of our lives today in the Public Health Service. We are confident that we are making progress toward our basic goal--to make the Service more responsive to the health problems of the Nation, the health needs of the people, and to build an organization that is more flexible and capable of working on these problems and needs.

One major reason for the realignment of administrative and operational units involved was to provide a firm base for new programs and to reinforce old ones. Another was the need for improved efficiency in our utilization of funds and scarce manpower. A third objective was to assure fuller use of physical facilities. The total purpose of this reorganization and redirection of our program is to provide the public with better health services, including maximum protection against preventable disease and hazards in the environment.

Out of the reorganization emerged a Public Health Service comprised of five operating Bureaus concerned respectively with health research, health manpower, mental health, health services, and health protection. The formal name of the Bureau charged with this last function--health protection--is the Bureau of Disease Prevention and Environmental Control. It is comprised of five national centers: The National Communicable Disease Center; The National Center for Chronic Disease Control; The National Center for Radiological Health; The National Center for Air Pollution Control; and The National Center for Urban and Industrial Health. This new Bureau is dedicated to action in health protection, as compared with the basic research arm--The National Institutes of Health--and the direct medical service function of the new Bureau of Health Services.

In the Urban and Industrial Health Center there are combined under single direction several formerly separate activities in the fields of occupational health, accident prevention, safe water supply, solid wastes disposal, environmental engineering, and milk and food protection.

Our Bureau's programs are concerned with the elimination or reduction of environmental hazards; lowering the incidence of accidental injury and death; prevention or reduction of the incidence of communicable disease; and prevention or amelioration of the effects of chronic disease.

One of our chief functions is to shorten the gap between new knowledge gained from laboratory research and its application to the national need for more effective health protection.

The National Centers work closely with many other organizations such as State and local health agencies, national and local voluntary health programs, official agricultural, food, traffic and safety organizations, industrial management, labor unions, universities, foundations, and similar groups.

Speaking on the Reorganization Plan, the Surgeon General recently said: "My fundamental thesis is that the health of the American people, in its totality, shall be the overriding concern of the Public Health Service and the measure of our success or failure. Our ultimate commitment is not to agencies or institutions but to people....."

Our challenge is to make the machinery of government more effective, and to do so in a creative partnership. Its accomplishment involves both cooperation and competition, and private organization and individuals. Such a partnership, more than anything else, must rely on the expanding role of State and local governments to take on greater administrative responsibility as our Nation grows. The Federal task is to nurture and promote that role.

Public health planning is done at many levels--city, county, metropolitan, State and Federal. However, metropolitan planning is fast becoming the best instrument we have for shaping and guiding the orderly economic growth, the socially sound and esthetically satisfactory development of the new and renewing communities. Metropolitan planning's great importance lies in the fact that it is the new and for the present the most available and appropriate unit for planning and development.

The metropolitan area is where the powerful forces impelling community development are seen today. Here are centered the social and cultural forces forming the people, especially the young people of our free society. The metropolitan community, so suddenly here, may reasonably be called "a community of communities" and likened to a constellation of cities.

We in environmental health are still struggling to get our message across. We find that many appear to understand us and agree with us, but they ignore our warnings when it comes to action on the local or State levels or by the individual citizen, the farmer, or industry. As long as cities are busy with zoning, road building, planning for new sewers, or constructing hospitals, they feel that they are doing their part for environmental health. They don't realize that contributing to the health of a community's population may not be just a matter of more and better buildings, but that air pollution and water pollution control people should be considered and consulted before multimillion dollar projects are started. Something more may be needed in this fantastically advancing world of ours than just new building projects.

PL 89-749, the "Comprehensive Health Planning and Public Health Services Amendments of 1966" revises and initiates several programs of Public Health Service grants to States and communities. These programs--comprehensive State health planning; area-wide health planning; training, studies, health services support; and health services development projects--are interrelated in their operation and in their goal of assuring comprehensive health services of high quality for every person. Comprehensive health planning neither negates nor diminishes the need for continued or expanded functional or specialized planning. Operating State agencies and other organizations should continue to plan for specialized programs, such as the construction of health facilities, the development and expansion of community mental health programs, regional medical programs, programs in environmental control, or services for the chronically ill or mentally retarded, and increasing the supply and effective utilization of trained manpower. Comprehensive health planning provides a framework for strengthening these efforts by relating objectives in these specialized fields to each other and to the overall needs and resources of the State.

The most difficult and yet essential task that confronts us in planning for environmental health is to observe in practice and to get others to observe the interrelated, total effect of the environment on man's health. It is not difficult to convey the idea of individual man reacting to his environment as a whole. It is immeasurably more difficult to get health departments, planners, city governments, Federal agencies, businessmen, and others to weave this approach into practical action.

We must deal with a total environment, which means an immense amount of coordination and planning for health which is not being done at the present time. In a recent discussion, Dr. Prindle emphasized: (1) the person whose health we are concerned with is the total man, not the man as worker, motorist, consumer, or apartment-dweller. In each of these and countless other facets of his life, our typical working man is in need of comprehensive health protection; and (2) the challenge to management posed by the health needs of 80 million workers will have to be seen and dealt with as a major integral part of our efforts to launch a "whole man" approach to environmental public health. With the help of industry, State and local government, professional health practitioners, and the academic community, we can make this comprehensive approach an effective reality. If we do, the gainers will not be 80 million working Americans, but 200 million people whose health, productivity, and happiness are the primary reason for our existence.

The challenge is especially sharp to those of us in the health professions. If we neglect the broad issues facing us today, if we cling to narrow practices, we are in danger of following a downhill path. But the people of this Nation look to us to build and maintain a safe and wholesome environment in which to live, work, and play.

I am confident that we shall all accept this challenge and, in so doing, add new dimensions to our stature and our pride as citizens of a great Democracy.

HOW TO MEET THE NATION'S NEEDS IN OCCUPATIONAL HEALTH

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It would be hypocritical to begin this discussion on the assumption that there is any resemblance between the present situation with the beginnings of a broad and vigorous national occupational health program in the United States.

Reducing and controlling the hazards of the American work-place has a comparable importance to reducing air and water pollution. These are all elements of the over-all environmental threat that man has raised against himself.

There was a period when there was hope that there was dawning such a realization.

In November, 1965, the special report to the Surgeon-General of the United States Public Health Service (the Frye Report) set forth the problem, the resources that could be brought together to meet it, and the broad outlines of a national program and national goals.

The Frye Report was a response to the urgings of many individuals, organizations, and advisory bodies to the Public Health Service that a revised charter of the Division of Occupational Health was urgently needed in light of the problem, the resources available, and needed, to solve it.

I believe all here know what happened after that. The report fell somewhere with the impact of a snowflake. No one in the loftier echelons of the Surgeon-General's office, nor anywhere else in H.E.W. was in a crusading mood. No money for the modest requests of the program's first steps was budgeted.

Even when the President of the United States instructed the Secretary of H.E.W. in May of last year to report to him what the Federal government could do to deal with present occupational hazards and to prevent new ones, it produced only the suspicion of a patellar reflex from the Department of H.E.W., which was perhaps recalling a familiar poetic phrase modified for the occasion:

"Presidents may come, and presidents may go,
But we go on forever."

In all fairness, considerable effort was made at the White House level to bring the Departments of Labor and H.E.W. into the same room together. It has also been reported that somewhere, someone is working legislation that would begin a Federal program.

In 1966, the Division of Occupational Health was absorbed by internal reorganization of the Surgeon-General's office into a larger whole. It is now to become another ingredient in a bouillabaisse of programs dealing with environmental hazards and health situations associated with urban living, together with quarantine and international shellfish sanitation agreements.

The proposed fiscal budget request of the President for the Division of Occupational Health was somewhat larger than the previous miniscule requests for funds, but far under the first year proposal of the Frye Report, which latter has been stoically ignored in the past two years' budget requests.

While the miasma of inertia hangs heavily in the Department of H.E.W., it is simultaneously exhibiting deep concern over one element of the occupational health problem - the awful carnage in the uranium mines.

I sincerely hope that this concern manifested by H.E.W. and other Federal agencies - Labor and the Atomic Energy Commission, in particular, is directed toward the workers, and not in protecting their image at the pending hearings on this matter before the Joint Committee on Atomic Energy.

Amidst this frustration, it is difficult to address oneself to the subject of this part of the day's program, without the feelings of both frustration and indignation.

If the President of the United States, the American Medical Association, organized labor, the national organizations of state health officers, the American Public Health Association, the Group Health Association, etc., etc. are unable to convince the Department of H.E.W. and the Surgeon General that occupational health is a serious national problem, what is the remedy - prayer?

I submit that the recommendations of the Frye Report constituted the basis for a good start in mobilizing the resources of the Federal government, the States, localities, the medical profession and private industry to begin to deal effectively with the occupational health needs of 80 million working Americans now, and an estimated 100 million by 1980.

I believe that the Division of Occupational Health cannot do the kind of job required, lost in the stew in Cincinnati, and lack even a statutory basis of existence.

As organized labor sees it, both Labor and H.E.W. have important parts to play at the Federal level - the former to conduct the enforcement and compliance programs, which have been developed from the standards and criteria developed by the Division of Occupational Health.

The State and local governments should be given the usual Federal grants in aid incentives to come out of the wilderness and do their proper share, but with a time certain hanging over their collective heads that if they don't, the Federal government will.

Such a program should immediately come to grips with the woefully short supply of doctors practicing occupational medicine, with a majority of them in middle age or beyond. There is an equivalently short supply of industrial hygienists, health physicists, engineers, and other skills that must be had. More Federal money for training programs, in-service training, and better pay must be made available.

Existing medical resources in communities, including those of industrial physicians, are needed, particularly in thousands of smaller communities where the local industries have small work forces and have no recognizable industrial health programs.

It goes without saying that no such contemplated nationwide attack on occupational health hazards will succeed without the research, nationwide standards, adequate enforcement personnel, and sharp teeth written into law, to sink into the flanks of wilful violators.

The health on the job of America's working men and women is not at stake in one locality, in one kind of industry, or from one set of hazards. There are still most of the old enemies of the work place which take their toll, as well as the newer ones spawned from the rapid advance of technology.

It is too pervasive and too broad a challenge to be met by the States, the localities, by private industry. Neither can it be brought to heel by the Federal government alone.

But unless the Government of the United States, through its responsible departments and agencies, and with the support of the Congress, assumes its necessary responsibility, demonstrates that it really cares, even does a little cautious crusading, things will go along as they are now, getting slightly worse with each passing year.

The only policy that American workers will be expected to spend their job time under will be that which has generally prevailed since the early days of the Industrial Revolution in the United States - that the worker be willing to pay for his job with his health or with his life.

Organized labor will not accept this policy, and it is its earnest hope that this administration and the Congress will also reject it.

(Note: These remarks were made by Mr. Taylor at the beginning of a panel discussion on this subject. Members of the panel were: Dr. Kehoe, Dr. Felton, Dr. Neill, and Mr. Hope.)

SIGNIFICANT DIMENSIONS OF THE DOSE-RESPONSE
RELATIONSHIP IN INDUSTRIAL TOXICOLOGY

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I have chosen the above title for this lecture in order to emphasize certain points of importance in the application of toxicological information to the handling of hazardous materials in industry. We have to go beyond the general toxic properties of the hazardous agent and consider additional modifying factors that enter into the problem when man encounters the agent under the peculiar circumstances of his work. These can significantly change the situation from another involving the same agent but under other conditions, so that the end result (nature and magnitude of ill-effect) may be quite different. This is implied, of course, in our consideration of health problems in industry, when we make a distinction between the basic toxicity of a substance and the degree of health hazard created by man's contact with it. These can be two quite separate things. To use a ridiculous example, consider a factory stacked high with billets of lead. So long as these remain undisturbed the potential toxicity will never be realized, simply because the circumstances do not permit it. A more sophisticated example is seen in the elimination of the frit manufacturing process from potteries, thus limiting opportunity for contact with lead to a relatively insoluble form of lead silicate of coarse particle size in the final frit itself. Because of this state of the frit and for other reasons, the lead hazard was largely eliminated from this industry, although a theoretical toxicity potential remained.

It is on such basis that I would like to discuss the significant dimensions of the dose-response relationship as applied to situations in industry, recognizing fully that other important dimensions will enter into the relationship when one is concerned with the toxic agent as a food additive or as a component of pollution in a river or somewhere else.

This is an appropriate subject to open the present lecture series, since it bears directly on the central interest and concern of the Institute and of the sponsors of these lectures. One sees clearly in the statement accompanying the supporting funds a recognition of the growing concern with this basic question: Can man indeed find a way successfully to live with the endless number of new chemical and physical stresses that our science and technology have brought into being, the returns from which are so obviously beneficial in other respects, and to handle the consequent health problems successfully in real life?

Meaning of the dose-response relationship.

One important requirement for a successful program of industrial control of a potentially hazardous physical or chemical agent is that there be available a systematic, quantitative statement of the relationship between magnitude of exposure to the stress agent and the kind and degree of response in a population exposed to that agent. It is only on the demonstrated reality of such relationship that we can securely argue for a tolerable dose of the noxious agent at some level above zero, such that no significant fraction of the exposed group will experience an unwanted ill-effect. The need to establish such relationships, of ever-greater refinement, is increasing. With the introduction of more and more synthetic chemicals and other new stresses into our environment, the very concepts upon which the reality of a

systematic dose-response relationship rest are being challenged and doubts are expressed as to the acceptability of any tolerance limit above zero. The criteria for defining ill-effects are becoming increasingly nebulous in the public view and, even among some scientific and professional groups, the mere finding of a measurable quantity of a toxic substance in some body tissue is regarded as sufficient evidence of existing or expected poisoning. According to this position there would appear to be no way to avoid health risks other than by complete elimination of potentially toxic substances from our environment; that is to say, by stopping the manufacture and use of such substances. It is the particular responsibility of industrial toxicologists, physicians, and other occupational health specialists to show when these extreme measures are not necessary and to establish sound conditions for the safe production and handling of potentially hazardous agents in industry.

The dose-response relationship is shown in Figure 1¹ as a three-dimensional presentation. The two coordinates on the horizontal plane represent the magnitudes of dose and response, respectively, the latter varying along the scale in degree only and not in kind. The vertical plane indicates a third dimension which we all know about but which is not commonly represented in this way. This is the scale of relative susceptibility to the toxic agent by the target organism. We all know how individuals vary in susceptibility to a given kind of stress, so that within an exposed population one may encounter a wide range in the magnitude of individual responses to the same dose and, conversely, find that a wide range in dose is required to produce in the various members of a group the same level of response. Thus, in its full portrayal, the dose-response relationship must present the varying probability within a group of exposed subjects of responding with different levels of effect to the stress agent encountered over a range of dose levels.

For a full delineation of the relationship we must further distinguish between a basic presentation of the very fundamental dose-response characteristic at the primary site of toxic action within the target organism and the presentation of a practical working relationship on which to build a program of control of the hazardous agent in industry. Between these two are many factors that intervene to complicate the movement from one set of scales to the other, as suggested in Figure 1, and it is these factors that I want particularly to explore.

Dimensions of dose.

We have first to ask what is meant by dose? Not only must it be determined according to an appropriate quantitative scale but, to be basic, it has to be an expression of the effective dose at the critical site within the body, stated in terms of the active form of the stress agent as it operates at that site. In more cases, perhaps, than not, the actual damaging agent is different from the external agent from which it stems, being the consequence of a metabolic process, for example, or of some other biochemical or biophysical reaction which is involved as the body copes with the external agent. The biological effect from radiation is thought to be proportional to the degree of ionization at the critical site and the RBE is a factor which attempts to convert the different kinds of radiation exposures measured externally into biologically equivalent effective doses in terms of ionization at the appropriate sites. The physiological effect from carbon monoxide is related to the magnitude and duration of oxygen deficiency at the tissues rather than the blood level of CO and this may not be directly proportional to the external atmospheric CO concentration. Man's deleterious response to a hot environment is not related to the external heat load

directly but, is the consequence of a restriction placed on the unloading of body heat, brought about, in turn, by the environmental heat stress. A variety of chemically unrelated gaseous substances appear to produce the same kind of pulmonary irritation, suggesting that the basic reaction is not one of chemical specificity, but follows from a common physiological change in pulmonary tissues in consequence of a variety of initial chemical reactions. Thus, basic doses of ozone, phosgene, NO_2 , etc., might be expressed in terms of equivalent physiological "units of irritation," if such could be determined.

Of further concern in fixing the scale of effective dose at the critical site is the quantitative aspect. Is the response related to the intensity of the toxic agent at the critical site (concentration per gram of tissue) or to the dosage rate (rate of delivery to the site) or does it depend on the accumulated amount delivered over time regardless of the rate of supply? Undoubtedly, there is no one answer and some particular characteristics of the mechanism of intoxication determine the significant relationship in each case. It might be reasonable, for example, to expect an acute, reversible response to be proportional to dosage rate, whereas a response which builds up over time would be more closely related to the accumulated dose.

In a practical situation it will be rarely possible to measure the actual dose of the damaging agent at the critical site and we must accept as a reasonable indicator of dose the magnitude of the stress agent found at some more accessible point in the body (blood, urine) or, more commonly, in the external environment. This leads at once to the question of goodness of the correlation between the stress level so measured and the real dose.

First among major items of concern are the characteristics of the various portals of entry into the body as receptors for the external stress agent and how these vary in their acceptance of the agent in relation to its physical and chemical properties. What are the relative efficiencies of the skin, gastrointestinal tract and respiratory systems as portals of intake? In general, we regard the inhalation route as most effective mainly because of the very large interfacial area and extreme thinness of the alveola membrane that separates the air from the blood in the lungs. Offsetting this, however, is the possibility of greater solubility rate for certain particulate materials in the stomach than in the lungs and it is possible to have a very much higher quantity of an agent on the skin, thus providing a greater pressure difference to move the agent across the skin barrier to make up for its more limited area.

The respiratory system has quite sharply defined performance characteristics that limit the uptake of both gaseous and particulate substances. The site of removal within the system and the percentage removal of gases are related to the different gas-exchange capacities at different depths and to the solubility of the gas in body fluids. Similarly, anatomical dimensions of the respiratory system and air flow characteristics during breathing, together with the varying aerodynamic dimensions of inhaled particles produce different uptake rates and remarkably different preferential sites of deposition of inhaled particles. Clearance mechanisms operate along the airways and in the pulmonary spaces to produce further differences in the respiratory retention of such particles after initial deposition. For certain gaseous pulmonary irritants, the work of Dr. Mary Amdur and others shows an important potentiation of ill-effect when the irritant is inhaled with certain aerosols that apparently act as carriers of the absorbed gas. When these particles are deposited in the lungs, high local concentrations of the irritant gas are produced.

Of next concern, in tracing the events between initial intake of a noxious agent and effective dose at the critical site, are the pathways and rates of transport of the agent from portal of entry to various tissues and organs within the body and the rates of equilibration of the various storage depots. The theory of uptake of gases

in the lungs and by the various tissues and organs has been quite well worked out for chemically inert gases. This theory shows the importance of the gas solubilities in blood and in fat and the influence of the rate of blood supply (per unit weight of tissue) to various organs and tissues in determining the rate of equilibration and the final equilibrium level to be reached by the several storage depots. But the theory has not been well tested and has scarcely been applied to the analysis of uptake of gases which are metabolized or otherwise react with body components. Much needs to be done to provide quantitative relationships from which to predict the time rate of build-up of the total body burden of an absorbed gaseous compound and its distribution in important organs and tissues storage depots after various periods of exposure to known atmospheric concentrations and, similarly, to trace its elimination in time after removal from the exposure.

The research needs are even greater for tracing the history of uptake, transport, storage and elimination of substances taken into the body as inhaled particles deposited in the lungs. What is the rate of solution of the particulate material in the lungs and transfer into the blood and how does this compare with the rate of mechanical clearance by way of the upward movement of the mucous blanket coating the airways? What is the relative likelihood of systemic uptake of dissolved substance from the stomach after lung clearance and swallowing compared with solution and direct transfer into the blood from the lungs? How do these rates vary with solubility and size (solution rate) of the particles? What are the correlations between the blood and urine levels of a noxious agent and the lung burden or amount stored in the bones or other important depots of the body? What are the equilibration rates for these various storage compartments? These last questions are especially important when the exposed individual is employed as his own sampling device in place of a physical sampling instrument and the rate of build-up of the noxious agent is measured in the blood or urine as an indicator of intake and body storage of the agent. The sampling rate in this case will be directly related to the rate of respiratory intake of the atmospheric contaminant, thus giving full recognition to any fluctuation that may occur in atmospheric level, but the blood or urine level may or may not be directly related to the amount of material accumulated, say, in the lungs.

Finally, in an attempt to relate external level of contact with effective dose, the physical and chemical state of the agent in the environment has to be considered. What changes may take place between the point of generation and release of the noxious agent and the point of human contact? Gaseous agents may react with other components of the atmosphere, as in the case of the complex photochemical interactions reported in Los Angeles atmosphere; particulate contaminants tend to settle out, thus, in time and distance, reducing the size of the particles remaining in suspension. Aerosol particles may act as nuclei to collect various condensed substances and hygroscopic particles will grow in moist atmospheres. These points have to be considered in the selection of sampling and analytical procedures for assessment of environmental exposures.

It is clear from the foregoing that the relation between level of external contact with the stress agent and internal dosage can be quite different from one substance to another, depending upon the biophysical and biochemical properties of the agent, the circumstances of exposure, the performance characteristic of the portal of entry and pathways of transport to the critical site. To establish a basic scale of dose requires that the critical site of intoxication be known and that the mechanism of damaging action be understood in such fundamental terms as to distinguish clearly between the nature of the active agent operating at the critical site and the form of the external agent. Considerable progress toward such understanding has been

made for a few toxic substances, but for most a great deal of further study is needed.*

Dimensions of response.

The same kind of distinction between basic and practical scale values applies to the representation of response as well as of dose. In the practical situation, where primary concern is with health maintenance among industry workers rather than with basic toxicological research, the scale of response should be in terms of real ill-effects, as revealed by loss of integrity of the whole organism with associated illness or demonstrated increase in the potential for illness. For a basic relationship, however, the response has to be expressed in terms of the most significant event at the critical site, as the direct reflection of the disturbance brought about by the stress agent. This response may not be bad in its own right, but it should serve as an early indicator of impending ill-effect if allowed to develop beyond a certain level. Like the dose scale, too, the scale of response must be quantitative, so that equal increments in response will have the same meaning along the entire scale.

Historically, there is a rough correlation between the kind of event recorded as the response to a noxious agent and the rate of advance in analytical and diagnostic skills. Chronological changes in the selected index event have taken place somewhat along the following time path: death --> gross pathology and frank illness --> microscopic pathology --> loss of physiological function --> biochemical changes --> psychophysiological impairment --> psychological and subjective disturbance --> transitory annoyance. The wide range in kind and sensitivity of response suggested by this scale really encompasses both the basic and the practical indices of response. At one extreme, it has to do with the most disastrous loss of health -- death -- and at the other, it is concerned with a subtlety of response far beyond the limits of significant ill-health. There is no clear dividing line between those indices that fall on the basic scale because they are the direct result of the toxic action and those that belong in the second category as indicators of the consequence of such underlying disturbances. In earlier days concern was with rather simple cause-and-effect relationships in which the time between impact of stress and consequence was short and, because of heavy exposures, both the nature and magnitude of response was revealed at high levels where the observed changes were indeed unique. The finding of a certain kind of response pretty well identified the causative agent. Such gross manifestations of ill-effect are well beyond the scale of basic response. In recent years, as we have adopted more sensitive methods for measuring response, there has been a shift from the practical health scale to the basic toxicological scale without realizing, perhaps, that such shift has taken place or without giving full recognition to the significance of the shift. There is no doubt about the need to employ a fundamental index of response to portray a basic dose-response relationship. The use of a secondary index of consequential ill-health instead of the fundamental disturbance has delayed the development of full understanding of some toxic relationships in the past. But the differences in meaning of the basic and practical scales must be kept in mind and particular attention has to be given to the sequence of steps that operate between the fundamental event and the development of ill-health. In an occupational health program,

* Much more quantitative recognition has been given to those interrelationships in radiobiology and health physics than in older areas of toxicology and industrial hygiene. This is accounted for, no doubt, by the strong theoretical mathematical-physical base upon which radiobiology has been built from the start.

a basic dose-response relationship will have little value unless one can move from it to the practical relationship.

As we move back to the more fundamental relationship there is a risk and, indeed, almost a certainty that the response will become increasingly non-specific and reflect more and more a kind of general response, characteristic of a whole family of stresses and even coming from apparently unrelated stress. We must continue, therefore, to emphasize the search for evidence, the nature of which is so unique that we can say with a high degree of certainty that the observed response is indeed the consequence of exposure to the agent under study. Spurious correlations are difficult to avoid. These increasingly basic indices of response will also become less and less significant as predictors of ill-health. This is one of our big problems in industrial toxicology today, to keep from going too far in the selection of an index of response which, under laboratory conditions is unquestionably indicative of exposure to the particular agent, but which has very little value as a predictor of ill-health under conditions of real exposure. At the moment I am not defining health and ill-health, but simply noting the implications. When we get all through selecting an early, sensitive and basic index of response we will still have to find a point on the response scale that will tell us how to operate in a practical way without creating a health hazard.

I have attempted in Figure 2* to portray the difference between the basic and practical scales of response. The underlying event in direct consequence of the stress I have called impairment, and this is presented on the horizontal axis. As a result of this basic impairment, the integrity of the whole organism is threatened and varying degrees of disease may develop, as suggested on the vertical axis. Starting with minimum impairment and maximum health, the individual moves down the impairment scale as the inevitable consequence of living and his rate of movement will be determined in part by the environmental stresses to which he is subjected. Because of a normal endowment of homeostatic and compensatory capacities there is limited consequence of impairment (ill-health) over a considerable span of the scale. Beyond a certain level of impairment, however, the limit of compensatory processes is reached and further increments in impairment are accompanied by increasing increments of disability which, in the extreme, proceed to death. It is in this region of gross ill-effect beyond the compensatory limits that much of our past interest centered. Our problem now and in the future is to focus on dose-response relationships that precede frank breakdown. Basic indices of response have to be found along the impairment axis but these must still be translated into the consequential responses on the vertical axis to provide a sound basis for fixing tolerance limits.

Dimensions of population response.

The third axis on the dose-response diagram in Figure 1 allows for the varying susceptibility among the members of an exposed group. For the development of a basic relationship we must make use of a well chosen test group having definable characteristics that will be reasonably reproduced from one sample to another drawn from the same universe. Research toxicologists go to great lengths in choice of animal species and in standardization and protection of the animals in order to secure, with the aid of statisticians, a stable population yielding reliable results. The same needs apply when humans are used as the test subjects. Such groups are rather artificial, however, and a big need is to select a test group so that we do, indeed, have a reasonable basis for translating the results so obtained into practical

* From: Changing Objectives in Occupational Health, Am. Ind. Hyg. Assn. Journal, 23:1 (1962)

relationships that apply in a real situation. Here, again, the problem is complicated by the subtlety of the response selected to represent the basic relationship. Variation in inherent susceptibility of the several members of a test group is not the same as the difference in ability to withstand a given stress because of varying degrees of impairment in the population brought on by other causes not related to the toxic agent under study. A low grade of impairment may have little effect on a dose-response relationship when the response is measured at relatively gross levels but it can dominate the picture when a relationship is sought at the basic level. This can give rise to a spurious relationship, in which the observed response is attributed to the unique action of the agent when, in fact, it is the condition of the host that determines the results. Low grade pulmonary infection in test animals, for example, can interfere seriously with the establishment of a primary dose-response relationship for a pulmonary irritant like phosgene.

Some of the most valuable systematic studies on the relationship between exposure to noxious agents and consequent ill-health have been carried on in industry, making use of appropriate statistical and epidemiological procedures to relate levels and duration of environmental exposures with nature and magnitude of ill-effects in exposed workers. The dimensional considerations in such field studies are necessarily greater than in laboratory studies where many factors are deliberately held constant to avoid disturbing complications. Without doubt, some of these studies revealed useful etiological relationships despite weaknesses in the quality and quantity of measurements of both exposure and response and in the epidemiological aspects of these investigations. This was because the dose-response relationship was operating at such a gross level as to overcome these inadequacies. As the problems of concern have become more subtle and complex, the need for expanding such industrial studies increases, for we need more than before to buttress the results from laboratory studies with systematic findings on groups of people exposed to the suspected agent under real conditions. Many of the arguments raised by those who see a wholesale threat to health from the components of our modern environment are simply not answerable by animal studies which ignore what may be the dominating dimension in the host-agent-environment triad: the vitality of the host. This is especially true when the environmental stress does not operate as a primary causative factor but functions in a secondary way to aggravate a state of impairment or ill-health in the host. The utmost sophistication in epidemiological procedures is required in this situation in order to demonstrate that the environmental stress has, in fact, increased the potential for illness of a kind found generally in the population, as distinguished from the requirements for demonstrating simple cause-and-effect relationships in the etiology of a unique occupational disease. The choice of an appropriate control population against whom to match the sickness experiences of the group under study becomes of paramount importance and the failure to meet this need can result in some improper conclusions concerning the specific role of a particular environmental stress agent in establishing a dose-response relationship. Unemployed men, for example, are not suitable controls to compare with a group of men of the same age, but actively employed in a given industry and within a given industry one group of workers may come from a quite different socioeconomic background than another and thus prove unsuitable for matching with the group under study.

Application to the determination of tolerance limits.

A statistically dependable dose-response presentation which portrays the relationship over a range of responses from essentially zero up to a level of disturbance which is clearly unacceptable provides the basis for fixing a limit of tolerable exposure below which an unwanted level of disturbance will not occur in a group of exposed individuals with a frequency in excess of a stated probability. There are three main decisions involved in fixing this limit. First, what kind of response is

to be restricted? Second, what maximum degree of response of the stated kind is to be accepted? Third, with what probability of occurrence are responses in excess of the stated limit to be permitted?

These decisions must be made in the order given, for the second depends on the first and the third depends, in turn, on the second. At one extreme, suppose that reduction in a primary physiological function is taken as the kind of response to be kept under control and assume that such functional loss beyond the limit of man's compensatory capacities can lead to disease, disability and, finally, death. Then, the allowable degree of functional loss will have to be restricted to keep within safe compensatory bounds and only a very low probability of occurrence of damage in excess of this allowable level could be permitted in view of the seriousness of the possible consequences. At the other extreme, think of a response expressed in terms of a sensory reaction which, within limits, is a completely reversible process of a type that man draws on regularly to maintain his balance in a normally varying environment. Here the allowable degree of response could be set quite high up on the scale toward the limit of reversible response and the permitted probability of occurrence might be put at 50% of the exposed population. This would be proper since nothing more is implied than a kind and degree of disturbance that falls well within man's homeostatic and compensatory powers to offset.

These two extreme examples make it clear that a great deal of broad understanding and wisdom must enter into the fixing of tolerance levels quite beyond the limits of specific knowledge pertaining to the toxicity of the substance of concern. Nonetheless, a well developed dose-response relationship provides the essential information from which to start, and without it, no amount of wisdom and judgement will insure a correct answer. This final point is of great importance today, for we need more than ever before some firm guidelines to help us in dealing with the many new environmental threats to health. At the same time, they should help us to distinguish these from other man-environment stress relationships which, whatever other problem they may create (esthetic, economic, nuisance), do not threaten health. We are rapidly approaching a point of confusion where this distinction is becoming lost and much well-intentioned effort of health specialists is being diverted to deal with environmental problems that are related to health risks in only the most tenuous manner.

FIGURE 1

Dose- (population) response relationship, with suggested distinction between basic (toxicological) and practical (health) scales on the three axes. The illustrative curve drawn on the horizontal plane portrays the dose-response relationship for the middle (50%) of the exposed population; the curve on the vertical plane shows the percentages of population response of the indicated degree over the whole range of doses. The vertical line from the dose scale indicates the magnitude of dose needed to produce the indicated degree of response at the 50% population level.

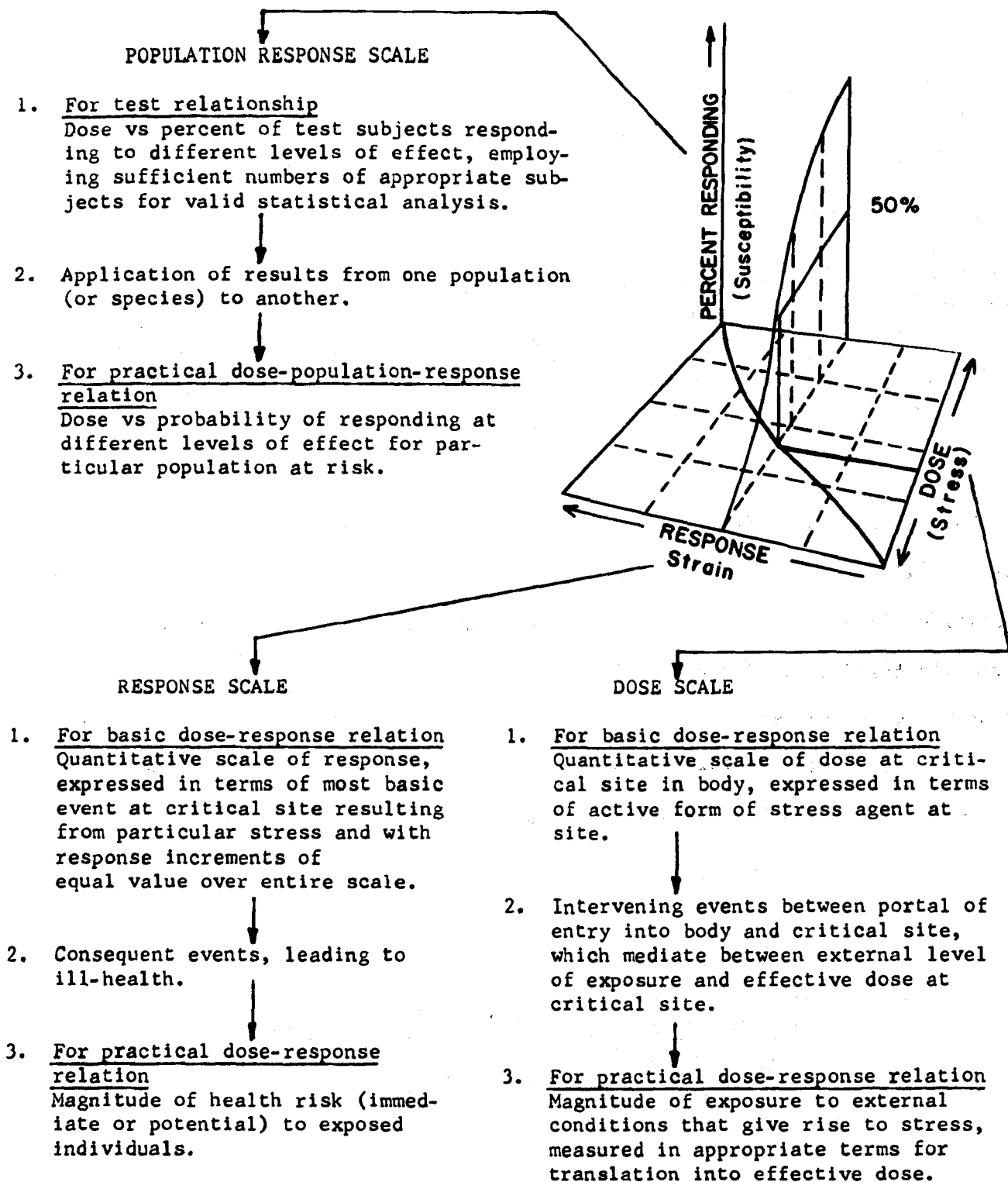
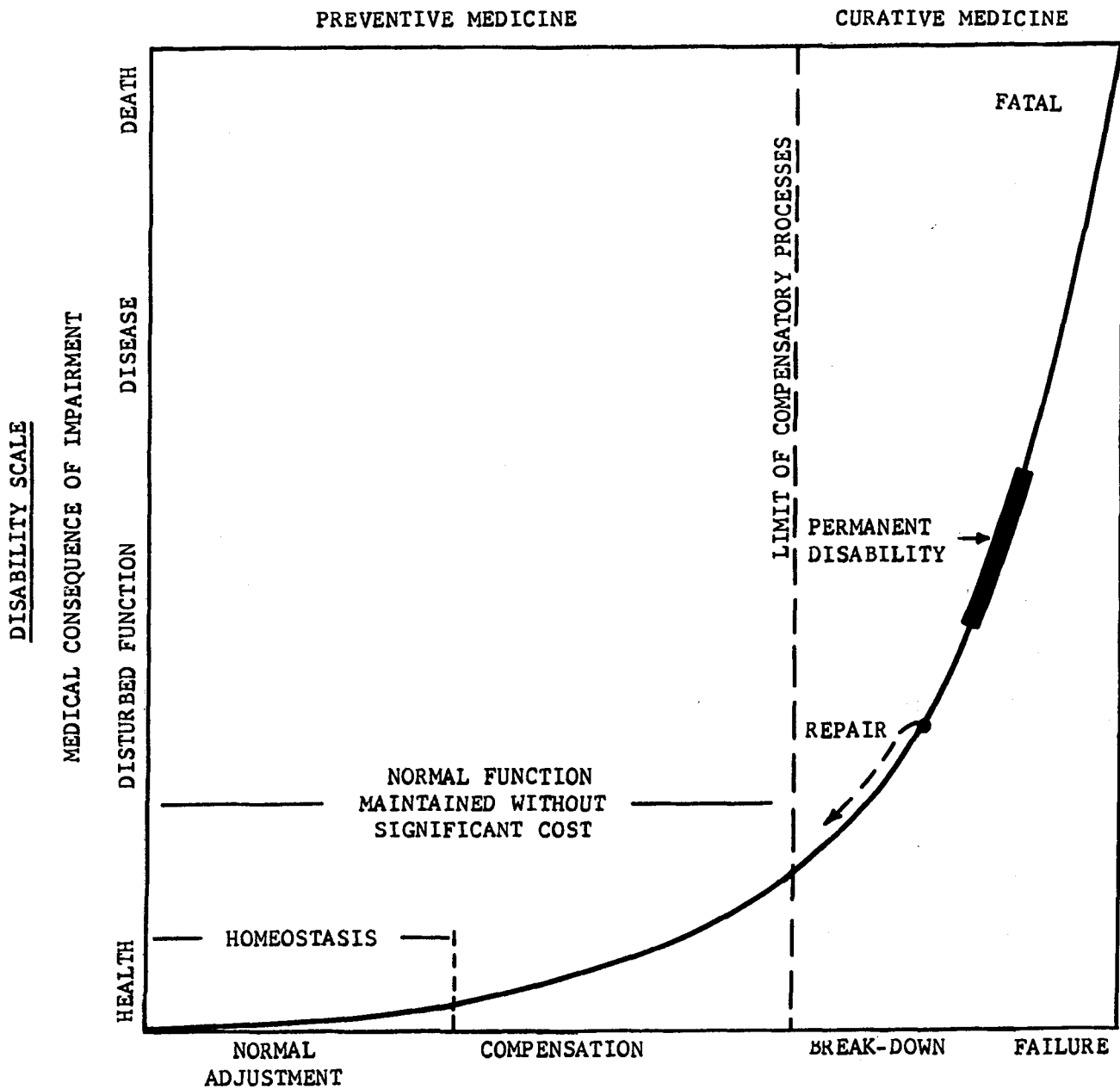


Figure 1

FIGURE 2

Suggested relationship between impairment and disability. Considerable movement along the scale of impairment accompanied by relatively little disability. Basic man-environment relationships are between environmental stress and impairment, the precursor of disease.



IMPAIRMENT SCALE

IMPAIRMENT INCREASES: WITH AGING

AS RESIDUAL OF ILLNESS

FROM EXCESSIVE ENVIRONMENTAL STRESS

Figure 2

Membership in the Conference has continued to increase and is now 993 or 83 more than last year. A fair number of these new members are from countries outside the U. S. and result from the efforts of Mr. Henry Doyle during and after his stay in Europe about two years ago. We are looking forward to a fruitful association with our foreign colleagues. I hope that our membership will exceed 1,000 next year, which will be an increase of 300 during a five-year period.

During this year total assets increased by about \$3,260.00. Our total net worth is now \$43,535.45, compared with \$40,270.56 last year. As usual, surplus from sales of the Ventilation Manual, which amounted to \$5,748.00, accounted for a substantial portion of our revenue. (On April 19 a check for \$2,791.50 was received from the Ventilation Committee as the first payment for 1967-68.) However, interest in, and sales of, other publications has continued to increase. More and more sales are made as a result of long distance telephone calls, which is a good indication that our reputation is well-known throughout the country.

Worthy of note, however, is the fact that our total income was about \$2,000.00 less this year and our expenses about \$1,000.00 more than last year. Expenses of operating our committees, primarily travel, accounted for \$2,861.00, or about 20% of our total expenses. Expenses for TLV Committee meeting travel amounted to 40% of the total committee expenses.

Two-hundred ninety-five copies of the Trade Names Index have been sold and the first printing of 300 copies has been exhausted. In addition, 100 copies were ordered on March 1. A supplement to the 1964 edition of the Index should be available for distribution soon. The price will be \$2.00.

Publication of the 3rd edition of the Air Sampling Instruments Manual was delayed unnecessarily because the printer lost over 100 photo negatives used in the 2nd edition. In fact, this has been a bad year with printers! Twenty-thousand TLV's had to be reprinted because of uncorrected errors. Pages were found missing in the Membership Booklet so these had to be replaced; a diagram was omitted from the recently reprinted Air Pollution Control Flow Sheets, and just last month 100 extra copies of the Trade Names Index were reprinted and several pages were not in proper order. On the bright side, however, we have back orders for about 250 copies of the Air Sampling Instruments Manual.

Sales of our other publications have been good this past year. Leading the list, as usual, were TLV's - 18,500; Ventilation Manual - 5,312; Documentation of TLV - 565; Air Pollution Process Flow Sheets - 132; and Analytical Methods Manual - 103.

Most of the 12 standing, eight ad hoc, and five joint committees with A.I.H.A. have been busy during the year, as you will hear later. Also, A.C.G.I.H. representatives on most of the 16 U.S.A.S.I. standards committees, two A.S.T.M., one A.P.H.A., and one Intersociety Committee on Noise Criteria have been active during the year. On behalf of the Executive Committee, I wish to express our appreciation to the members of all our committees for their efforts and contributions.

I am happy to report that Marlene Schmidt is rapidly improving from her extended illness and expects to return to work in June. In the meantime, Carol Keys will continue to assist in the affairs of this Conference. Carol was quick to learn the many facets of our office routine and truly pulled me out of a jam when she began working last January. In spite of all the confusion and work backlog, we were able to get our books balanced to within \$11.00 - I can't even do that good with my own checking account!.

BUSINESS SESSION - May 1, 1967

Robert H. Duguid, M.D., Chairman, Presiding

The May 1st Business Session of the American Conference of Governmental Industrial Hygienists was called to order at 11:05 a.m. at the Pick-Congress Hotel, Chicago, Illinois by Robert H. Duguid, M.D., Chairman.

CHAIRMAN DUGUID: Gentlemen, we are already five minutes late. I would like to call this meeting to order. We are ready to start the first Business Session.

The first duty of the Chairman is the appointment of the Resolutions Committee. The membership of this Committee is as follows: Mr. Lynn Schall, Chairman; Dr. Curtis McCammon and Miss Victoria Trasko are the other two members. Any resolutions from the floor should be given to the Chairman of the Committee.

In the conduct of this meeting I would ask that anyone desiring to comment from the floor state his name so that we can get it into the record.

At this time I would like to ask for the Report of the Secretary, Mr. Andrew Hosey.

SECRETARY HOSEY: Mr. Chairman, members of A.C.G.I.H. and friends, before I make my report I would like to read a portion of a letter which I received last Thursday from Professor Marcus Wassermann, who has been a member of this organization for a number of years and who is located at the Hebrew University in Jerusalem. His first paragraph reads: "May I ask you to present for my part my best wishes to the Industrial Hygienists of Chicago," and he goes on to say he is going to be in New York attending another meeting at this same time, but that he would like to have attended his first annual meeting with the American Conference of Governmental Industrial Hygienists.

The report of the Secretary is as follows: This year's Nominating Committee consisted of Lynn Schall, Chairman, Dr. Christine Einert, and Mr. Howard Ayer. Nominees were: Chairman-Elect, E. J. Baier and Paul Caplan; Secretary-Treasurer, Andrew D. Hosey and J. R. Lynch; and Member-at-Large, Irving Davis and John Lumsden.

Nine-hundred fifty-two ballots were mailed and 543, or about 57 percent, were returned.

It is a pleasure to announce at this time that Mr. E. J. Baier is the Chairman-Elect and Mr. Irving Davis is the new Member-at-Large for a three year term. I am still your Secretary-Treasurer.

Mr. Bernard Bloomfield, Past Chairman, and Dr. Jan Lieben, Member-at-Large, will retire from the Executive Committee this year. On behalf of the Executive Committee, I wish to express our sincere appreciation for their many valuable suggestions and constructive criticisms in regard to the operation of this Conference. They deserve a rest after spending three years on the Executive Committee.

Our annual meeting in Pittsburgh last year was a big success. As a result of the excellent papers solicited by Dr. Duguid for this meeting, the Transactions contained more pages than for any previous meeting -- 235. In spite of the improvement in the format and content of our annual Transactions, only 16 copies were sold to non-members this past year.

A resolution, expressing the gratitude of A.C.G.I.H., will be sent to the Chairmen of the various Conference committees for their efforts in making this a successful meeting.

Our next annual meeting will be held at the Chase-Park Plaza Hotel, May 12-17, 1968 in St. Louis, Missouri.

It has been a privilege and pleasure to have served another year as your Secretary-Treasurer. I appreciate the efforts of the Executive Committee and the many hours spent by them to conduct the affairs of this Conference. Without their guidance, constructive criticism, and words of encouragement from time to time, my job would not have been as pleasant and rewarding.

Mr. Chairman, this concludes the Report of the Secretary, and I move its adoption.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there discussion?

MEMBER: I would like to suggest you remove the word "profit" and replace it with "surplus" so Uncle Sam doesn't get after us.

SECRETARY HOSEY: O.K., we will edit it.

CHAIRMAN DUGUID: Is there any further comment? If not, all in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: Next is the Report of the Treasurer, but since this will be printed in its entirety in the Transactions, I think the main thing you would be interested in is a summary, and we will put it in terms of the auditor this time, Herb, so we won't use the word "profit." The excess of cash receipts over cash disbursements was \$3,265.99. So, unquote, this is our net profit for the year. We now have a net worth of \$43,535.45. If any of you have questions I would be happy to answer them, but this entire report will appear in the Transactions, so I move that the Treasurer's Report be adopted, or accepted.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

CHAIRMAN DUGUID: Any discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: Next is the Report of the Executive Committee, and this is going to be a little bit long, as usual because, as many of you know, we spend many hours discussing matters of the Conference. The Committee met last October at the Carlton House in Pittsburgh and we also met prior to the Annual Meeting in Chicago on this past Saturday and Sunday morning.

The Executive Committee held a meeting in October 1966 at the Carlton House in Pittsburgh and also met prior to the Annual Meeting in Chicago on April 29 and 30, 1967. All members of the Committee were present during both meetings and, in addition, Mr. E. J. Baier, Chairman-Elect, and Mr. Irving Davis, the newly elected member of the Executive Committee, were invited to attend the meetings in Chicago.

STATEMENT OF FINANCIAL TRANSACTIONS
FISCAL YEAR 4/1/66 to 3/31/67
AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

Cash Receipts

Sale of Air Sampling Instruments Manual (published and expensed 1960 and 1962 and reprints)	\$	326.00	
Sale of Analytical Methods (published 1958 and Supplement 1961, expenses 1958, 1961, and 1963)		690.00	
Received from Ventilation Committee from Sale of Ventilation Manuals		5,748.00	
Sale of Guide to Uniform Industrial Hygiene Codes or Regulations and Supplements		26.45	
Sale of Guide to Health Services (published and expensed 1960)		27.50	
Sale of 1966 Transactions		80.00	
Sale of Trade Names Index (published and expensed 1965)		700.00	
Sale of Threshold Limit Values for 1966		2,127.90	
Sale of Documentation of Threshold Limit Values (published and expensed 1966)		2,659.60	
Sale of Process Flow Sheets and Air Pollution Controls (published and expensed 1964 and 1966)		111.50	
Sale of Bibliography of Radiation Protection Organizations (published and expensed 1963)		34.25	
Received from Braun-Brumfield (Sale of Respirator Manual - published and expensed 1963)		563.03	
Sale of Plans for Standard Reports		27.00	
Membership Dues		1,172.34	
Share of Profit from 1966 American Industrial Hygiene Conference		1,154.50	
Sale of Miscellaneous Publications		270.83	
<u>Total</u>			\$ 15,718.90
Interest Earned - Eagle Savings and Loan Account	\$	508.78	
Interest Earned - Provident Bank Account		226.77	
Interest Earned - PHS Credit Union Account		254.10	
Interest Earned - Mercantile Bldg. & Loan Account		342.61	1,332.26

Total Cash Receipts \$ 17,051.16

Cash Disbursements

Expenses for Secretary-Treasurer to 1966 Conference		\$	165.50	
Expenses for Mrs. Schmidt to 1966 Conference			135.00	
Miscellaneous 1966 Conference Expenses:				
Banquet	\$	51.75		
Banquet Tickets		21.00		
Honorarium for two Banquet Speakers		151.29		
Stenotypist		217.05		
				441.09
Miscellaneous 1967 Pre-Conference Expenses				141.70

Printing Costs

1966 Transactions and Mailing	\$ 3,259.67
1966 Threshold Limit Values	1,440.75
1966 Membership Booklet	455.00
Air Pollution Process Flow Sheets	517.25
Miscellaneous Printing	38.01
Stationery, envelopes, etc.	412.33
Documentation of Threshold Limit Values	2,215.77

Committee Meeting Expense

1967 Program	60.80
U.S.A.S.I.-Z4	291.20
U.S.A.S.I.-S3	308.58
Ad Hoc - Occupational Health Programs	200.99
Threshold Limit Values	1,165.79
Industrial Hygiene Aspects of Mining	155.10
Ad Hoc - Liaison	31.00
Executive Committee	281.99
Air Sampling Instruments	100.00
Conference of State Sanitary Engineers	107.90

Other Committee Expense

Shipping Cartons - A.S.I. Manual	107.46
Secretarial Expenses for Guide on Lasers	50.20

Office Expenses

Audit of Treasurer's Report	75.00
Surety Bond for Secretary-Treasurer	63.00
Rebates on Dues and Publications	23.70
Multilithing, addressing, etc., of Bulletin Board and maintenance of addressograph plates	795.64
Postage	520.00
Bank Collection Charges	7.07
Miscellaneous Office Expenses	205.68
Copyrights	12.00

<u>Total Cash Disbursements</u>	<u>\$ 13,785.17</u>
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Excess of Cash Receipts over Cash Disbursements	\$ 3,265.99
Add: Balance in Checking Account 4/1/66	\$ 10,320.85
Balance in Savings Accounts 4/1/66	<u>29,948.61</u>
	<u>40,269.46</u>

<u>Cash Balance as of 3/31/67</u>	<u>\$ 43,535.45</u>
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Represented by:

The Provident Bank, Cincinnati, Ohio, Checking Account	\$ 12,763.36
The Provident Bank, Cincinnati, Ohio, Savings Account	5,811.59
Eagle Savings & Loan, Cincinnati, Ohio, Savings Account	11,000.00
Cincinnati PHS Federal Credit Union Account	5,599.14
Mercantile Bldg. & Loan, Cincinnati, Ohio, Savings Account	<u>8,361.36</u>

<u>Total</u>	<u>\$ 43,535.45</u>
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The following is a summary of the items discussed and actions taken at the October meeting:

1. The Committee agreed to an increase in the registration fee for the 1967 Conference to \$20, which includes one banquet ticket - either A.I.H.A. or A.C.G.I.H. Additional banquet tickets may be purchased for \$5 each at the time of registration. In addition, the Committee agreed to a \$15 registration fee, which includes the A.I.H.A. Abstracts but no banquet ticket, and to a \$5 one-day registration fee. The above decisions were transmitted orally by Mr. Hosey to Messrs. McCormick and Siedlecki that evening.

The Executive Committee further agreed that A.C.G.I.H. would continue to hold a separate banquet, except on special occasions where we might join with A.I.H.A.

2. The Committee approved the "Guidelines for Noise Exposure Control" prepared by the Intersociety Committee chaired by Herb Walworth. This information was also relayed to Mr. McCormick that evening.
3. Dr. Duguid discussed the minutes of the June 6, 1966 meeting of the "Joint Committee on Occupational Health" of the Conference of State Sanitary Engineers and A.C.G.I.H. which recommended that this Committee be continued and outlined four charges (projects). Dr. Duguid agreed to write to Mr. Fletcher and explain that a joint committee had not been appointed but that A.C.G.I.H. would appoint the following to serve as liaison on this Committee: Miss Trasko, Fred Berghout, and the Chairman of A.C.G.I.H. - Dr. Duguid. These persons will work with C.S.S.E. to evaluate the need for model occupational health legislation and the other objectives outlined in item (3) of the June 6, 1966 report. Dr. Duguid wrote to Mr. Fletcher on October 25 stating the above.
4. There was considerable discussion on the I.M.A. proposal for an I.M.A. Advisory Committee on TLVs. It was finally agreed to appoint Dr. Zavon to act as A.C.G.I.H. liaison to the I.M.A. Dr. Duguid wrote to Dr. Golz on October 25 to that effect.
5. The A.E.C. proposed system for records and reports on radiation workers was discussed. No action was necessary.
6. The Committee agreed to Honorary Membership for Al Coleman, who retired from the Connecticut Occupational Health Section. He was so notified by Mr. Hosey on October 31, 1966.
7. A proposal by Leo Greenberg to include a listing of members by employers in the Membership Booklet was rejected by the Committee.
8. It was ascertained that the Joint Ad Hoc A.I.H.A.-A.C.G.I.H. Committee on Qualifications for Industrial Hygiene Personnel had been abolished by both organizations. Therefore, no action was taken on Bloomfield's letter of June 1, 1966, to Dr. Duguid concerning this Committee.
9. After considerable discussion, it was agreed that Mr. Hosey would draft a resolution, to be sent to the Executive Committee for approval, concerning the request made by the Joint A.I.H.A.-A.C.G.I.H. Committee on Respiratory Protective Devices for continuing and expanding the U. S. Bureau of Mines' Respirator Testing Program. This was done on November 3, 1966.

10. A lengthy discussion was held concerning the need for recruitment of persons in the field of industrial hygiene. Alan Love described a plan developed by the Houston section of A.I.H.A. to publicize this field in the public schools. Henry Doyle spoke about the need for publicity and proposed the establishment of a speaker's bureau of qualified individuals to discuss this field before professional societies at various colleges. Alan and Henry agreed to study these proposals and others and to report to the Executive Committee later.
11. Mr. Hosey read portions of Vic Sussman's letter containing proposed projects for the Committee on Air Pollution. These involved the development of additional flow sheets toward the ultimate goal of combining these into a manual. Incidentally, the supply of recently reprinted Air Pollution Control Flow Sheets is exhausted so 300 more will be obtained. No action was necessary.
12. The Executive Committee agreed to send copies of all of our publications, free of charge, to the International Occupational Safety and Health Information Centre (Marcel Robert, Geneva, Switzerland).
13. Elbridge Morrill's request to proceed with the publication of a supplement to the T.N.I. to sell for \$3.00 to previous purchasers of the T.N.I., but to include it free of charge with all new sales of the Index, was approved.
14. Mr. Hosey distributed copies of mid-year financial transactions which showed income to 9/30/66 of \$6,945.14 and disbursements of \$10,249.78.
15. Mr. Doyle proposed the names of several individuals from foreign countries for membership in A.C.G.I.H. These applications were approved and it was agreed that their checks for dues would apply to 1967-68 and their membership would be effective on November 15, 1966. (Mr. Doyle retained most of the applications to be forwarded to the Secretary-Treasurer later.)
16. Mr. Doyle discussed a proposal to develop a position paper outlining a State and/or local occupational health program, giving objectives, etc. The Executive Committee agreed that a Committee should be appointed for this purpose and named Mr. Doyle, Chairman, Drs. Kleinfeld and Lieben, and John Soet. This Committee will develop preliminary plans and report at the next annual meeting.
17. The proposed guide on Lasers, sent to the Executive Committee in September, will be reviewed and comments should be sent to Mr. Hosey. These will be compiled and sent to Fred Berghout, who in turn will send them to his Committee for approval. If the Committee on Industrial Hygiene Codes and Regulations agrees with these changes, the amended guide will be sent to the membership as a proposed guide and it will be presented at the next annual meeting for adoption as a guide.
18. The Executive Committee authorized a gift for Dr. Sven Forssman, not to exceed \$50. He will be the speaker at the next A.C.G.I.H. banquet.

There being no further business, the Committee adjourned at 5:45 p.m., and met for dinner somewhat later.

The following is a summary of the items discussed and actions taken at the meetings on Saturday and Sunday morning.

1. It was agreed that a coordinator of technical committees should begin functioning. This responsibility was assigned to the Past-Chairman each year. Therefore, Dr. Duguid will be coordinator of the committee and Mr. Bloomfield agreed to assist him. Some of the duties of this committee were discussed.
2. In order to reduce the time involved in approving applications for membership in this Conference, the Executive Committee delegated to the Secretary-Treasurer the authority to approve those applications where the individual is unmistakably eligible. Applicants whose qualifications are questionable will be referred to the Executive Committee for review.
3. The Secretary-Treasurer was authorized to hire temporary help to prepare mats for the Transactions and to assist in mailing back orders for the Manual on Air Sampling Instruments.
4. The matter of subsidizing A.C.G.I.H. banquets was discussed. It was agreed to defer this matter until our next meeting in October so that the Committee would have time to determine the experience from the Chicago meeting.
5. Dr. Duguid discussed technical and other editorial errors in the revised edition of the Documentation of Threshold Limit Values. After considerable discussion of this matter, the Committee agreed to send a letter to the TLV Committee citing the problem that has developed and ask the TLV Committee to evolve or develop the methodology to produce a Documentation that is technically correct.

(Dr. Murray C. Brown, Chief of the Occupational Health Program, P.H.S., met with the Executive Committee during the afternoon and in connection with the above discussion suggested that the Occupational Health Program would appreciate this Conference supplying him with information regarding the needs for reviewing present standards and also new information leading to the development of standards and criteria. He suggested that the P.H.S. may be able to finance some of these projects through its grants mechanism and that perhaps this Conference could act as a "watchdog" concerning information needed to improve the field of Occupational Health.)

6. Nine applications for membership were approved.
7. The Committee discussed at length various proposals to reduce the over-all length of the annual American Industrial Hygiene Conference. It was agreed to defer action on this matter until a report has been received from Vince Castrop and his committee. The Executive Committee, however, was in general agreement that the Conference should be shortened.
8. Honorary Membership in the Conference was approved for Dr. W. L. Wilson and Mr. James C. Johnston, both of whom have retired from active work in the field of industrial hygiene as governmental employees.
9. The Executive Committee agreed to increase the price of TLVs as follows: 50¢ for one-49 copies; 40¢ for 50-999 copies; and 30¢ for 1,000 or more copies.
10. Appointments were made to the Conference Committees for St. Louis and Denver. The Secretary was instructed to supply this information to the Conference Chairmen, and to the President of A.I.H.A.

11. There was considerable discussion on "Guidelines for Noise Control" prepared by the Intersociety Committee with Herbert T. Walworth, Chairman. The Executive Committee had approved the original draft at its meeting last October. Since that time several editorial changes were made by the Intersociety Committee. These editorial changes included several typographical errors. The Executive Committee agreed that if the Guidelines were approved by the Intersociety Committee the Guidelines will be published separately and mailed to the membership at a later date.
12. The Chairman of the Joint A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee requested the Executive Committee to write to the Director of the Health and Safety Research and Testing Center of the U. S. Bureau of Mines to urge that they develop a test and approval schedule for non-emergency type respirators (chemical cartridge respirators) for protection against low concentrations of acidic and alkaline gases. Similar requests were made to the Board of Directors of A.I.H.A. and I.S.E.A. It was agreed to write such a letter to the Director and Mr. William Revoir, Chairman of the Joint Committee, will be requested to prepare a draft copy of the letter for the Chairman's signature.
13. The Executive Committee was informed that the Board of U. S. Civil Service Examiners for Scientific and Technical Personnel located at the Potomac River Naval Command has been abolished. It was understood that at the present time each Federal agency now has the authority to review applications and to rate applicants. Since these Boards included one in industrial hygiene, the Executive Committee felt that some action should be taken to continue the previous system of ratings by a Board composed of individuals engaged in the field of industrial hygiene from various Federal agencies. Mr. Henry Doyle was instructed to write such a letter to the Hon. John W. Macy, Chairman, U. S. Civil Service Commission.

Mr. Chairman, this concludes the Report of the Executive Committee, and I move its adoption.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion, any question? If not, all in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: Next come the committee reports and appointments.

The report of the Committee on Air Pollution was approved, including the recommended changes in the Bill of Particulars, as indicated. Mr. Sussman was re-appointed Chairman, and Drs. Helwig and Purdom, and Messrs. Marlow, Proulx, and Smith and Col. Meyer were reappointed to the Committee.

The way we have handled this before, Mr. Chairman, is that you move that each of these committee reports be approved, because there may be discussion on some of them. I therefore move that this report of the Air Pollution Committee be approved.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion?

SECRETARY HOSEY: One other thing we have done, if anyone wants to speak on behalf of any one of these reports he is at liberty to do so.

CHAIRMAN DUGUID: At this point if there is no discussion, all in favor say "Aye." Opposed. The motion is carried.

REPORT OF COMMITTEE ON AIR POLLUTION

On July 26, 1966 a memo was sent to the members of the Committee. As a result of their replies, a number of people have been contacted and requested to prepare flow sheets. A final list of flow sheets and authors will be prepared by June and a schedule for receipt of the flow sheets established.

Essentially, we have changed the Committee's charge and will concentrate on the development of a comprehensive publication on "Process Flow Sheets and Air Pollution Controls."

I request the Executive Committee's concurrence in this activity. (I have no suggestions to make with respect to Committee membership.)

Respectfully submitted,
Victor H. Sussman, Chairman

SECRETARY HOSEY: The report of the Committee on Air Sampling Instruments was approved. For your information we are supposed to have a copy of the Third Edition available for display at our booth today or tomorrow, and we should receive the entire shipment in the near future. Mr. John Blankenhorn was appointed Chairman and Messrs. Jones, Caplan, Craig, Lippman, and Vance were reappointed to serve on the Committee. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

REPORT OF COMMITTEE ON AIR SAMPLING INSTRUMENTS

The publication of the Third Edition of the Air Sampling Instruments Manual did not move ahead as rapidly as hoped at the time of the last Annual Meeting. The delay has been due to the heavy work load of the chairman and members of the Committee which prevented meeting deadlines and a number of small delays with the printer including the loss of approximately 150 negatives for graphs and photographs.

The Manual has been received from the binder and the Secretary-Treasurer will be busy for quite some time in filling the backlog of orders. To the members of the Conference please accept our apologies for the delay and if you have placed an order for the Manual please be patient with the Secretary-Treasurer, the orders will be filled as soon as possible.

The Committee activities for the coming year will be centered around the promotion of the sales of the Manual through book reviews and promotional flyers.

Respectfully submitted,
Herbert H. Jones, Chairman

SECRETARY HOSEY: The report of the Committee on Awards was approved. Dr. Elkins and Miss Trasko were reappointed to the Committee and Dr. R. B. Sutherland was appointed to replace Miss Neubert.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Any discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

REPORT OF COMMITTEE ON AWARDS

1. As of the present date, February 20, 1967, a recipient of an award has not been named. An announcement was placed in the Bulletin Board of the A.C.G.I.H. requesting suggestions and reasons. None have been received, but the deadline for submitting nominations does not expire until March 23. The Committee will be contacted for a decision in this matter. Three people are presently under consideration.
2. When a selection is made, a citation will be prepared under the auspices of the Executive Committee. This should be published in the Transactions.
3. No changes are recommended in the Bill of Particulars of this Committee.
4. The present Committee should be retained.

It is believed that no funds are necessary from A.C.G.I.H. for the Committee to continue functioning. The plaque presented to an award recipient is provided by the officers of the Conference.

Respectfully submitted,
E. Lynn Schall, Chairman

SECRETARY HOSEY: The report of the Committee on Environmental Factors in the Pneumoconioses was approved. Mr. Ayer was reappointed to serve as Chairman and Messrs. Harris, Bianconi, and Davis were reappointed to the Committee. Messrs. Philip Zullo and Glen Sutton were appointed to replace Ed Baier and Alan Coleman, respectively. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: For the information of any new members to the Conference, these reports are reproduced in their entirety in the Transactions.

REPORT OF COMMITTEE ON ENVIRONMENTAL FACTORS IN THE PNEUMOCONIOSES

1. Activities during the year.

- a. Five members of the Committee served as A.C.G.I.H. representatives on the A.C.G.I.H.-A.I.H.A. Joint Committee on Uniform Methods for Dust Counting. This Ad Hoc Committee did not complete its work, but expects to make its report during the forthcoming year.
- b. The Committee presented a four-part discussion on evaluation of dust exposures at the 1966 American Industrial Hygiene Conference in Pittsburgh. These presentations were included in the A.C.G.I.H. Transactions of that meeting. A paper, developed primarily by Dr. S. A. Roach and with him as senior author, covering these discussions has been submitted to the A.I.H.A. Journal.
- c. Dr. Roach and Mr. H. E. Ayer, in the course of their work in the past year have accumulated data on companion samples by impinger and size selective mass sampling methods. Such data are of value in the effort to promote an orderly development of a mass standard for assessing exposures to mineral dusts.
- d. Mr. E. J. Baier has conducted for the Committee an experiment on determination of silica in mixed dusts. Analyses of referee samples by a number of laboratories have been made. Results will be reported at the 1967 American Industrial Hygiene Conference. This is a continuation of the work Mr. Baier reported in the Committee presentation at the 1966 Conference.

2. The Committee has no material proposed for publication at this time.

3. a. The Committee has no recommendation for action by the Executive Committee at this time.

b. The Committee should continue and intensify its current effort to promote mass related methods and standards for assessing exposures to mineral dusts.

4. No change in Committee membership is recommended. It is recommended that all present members be invited to remain on the Committee.

The present Chairman cannot continue to serve as Chairman and recommends that another person from the present membership of the Committee be appointed as its Chairman.

Respectfully submitted,
Robert L. Harris, Jr., Chairman

SECRETARY HOSEY: The report of the Committee on Industrial Hygiene Codes and Regulations was approved, and it was agreed to publish the Guide on Lasers including a Bibliography in the Transactions (see Appendix A). (Note: If no comments from the members are received by the Chairman of this Committee by December 1, 1967, the proposed Guide will be submitted to the membership for approval as a Guide.) The Committee was authorized to continue with the preparation of a Guide on Dry Cleaning Establishments and to poll the various States to determine the need for a Guide on Air Recirculation Systems and Makeup Air. Messrs. Jensen and Knauber

were reappointed to the Committee. Mr. Baier requested that he be relieved from this Committee. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

REPORT OF COMMITTEE ON INDUSTRIAL HYGIENE CODES AND REGULATIONS

1. Activity

- a. During the year a draft of a Guide for Uniform Industrial Hygiene Codes or Regulations for Laser Installations was prepared and submitted to the Secretary for review by members of the Executive Committee. Detailed comments have been sent to the Codes and Regulations Committee members for consideration. These comments appear to be acceptable to these Committee members. Presently the guide and comments are being reviewed by Dr. Ham, an authority on lasers. When his review comments are returned a corrected copy of the Guide, will be sent to Secretary Hosey for reproduction and distribution to members for their review and comments.
- b. In another effort of the Committee a Guide for Uniform Industrial Hygiene Codes or Regulations for Dry Cleaning Operations has been revised in draft by Committee members. When all members have been heard from a composite revision will be drafted and sent to Secretary Hosey for reproduction and distribution to the Executive Committee.

2. Publications. As stated above, the Laser Guide will be readied for publication soon. A revision of the Dry Cleaning Guide should also be ready shortly.

3. Recommendations

- a. I.H.C.R. Committee members did not make any recommendations for action by the Executive Committee on membership.
- b. Future Committee activity, in addition to the work of completing the Guides already undertaken, will be to poll the various States to determine what guidance is in the books with reference to air recirculation systems. The need for a guide on this subject appears to be needed.

4. The present committee membership have agreed to continue.

Respectfully submitted,
C. Fred Berghout, Chairman

SECRETARY HOSEY: The report of the Committee on Industrial Hygiene Records and Reports was approved. The Executive Committee suggests that this Conference investigate methods for transferring data obtained from surveys and investigations for analysis by electronic data processing systems. This is a timely recommendation, incidentally, in view of Dr. Felton's talk this morning.

CHAIRMAN DUGUID: You mean the Committee. You said the Conference.

SECRETARY HOSEY: The Committee's recommendation. Mr. Hill was reappointed Chairman and Messrs. Brandford, Douglas, and Knauber and Dr. Kendrick were reappointed to serve on the Committee. I move its adoption.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion? All in favor say "Aye." Opposed. The motion is carried.

REPORT OF COMMITTEE ON INDUSTRIAL HYGIENE RECORDS AND REPORTS

The "Guide to Records and Reports for Evaluating Environmental Conditions in Industry," completed by the 1964-1965 Committee, was placed on sale by the Conference during April 1966 after approval by the Executive Committee. Unfortunately, due to time factors, announcement of its availability for purchase could not be included in the brochure describing Conference publications until early 1967. This has resulted in relatively few sales of the Guide to date and no comments as to its practicability for field use have been received from purchasers.

Your Committee has been unsuccessful in developing a new project or approach within the area covered by our Bill of Particulars -- "To develop and recommend forms and methods for the reporting and appraisal of industrial hygiene activities, and standard systems of records and reports for the evaluation of health and environmental conditions in industry."

We therefore conclude that this Committee's next project will be to revise the Guide as required after field tests elicit the need for changes.

It is suggested that all present members of the Committee be reappointed. The current Chairman wishes to be relieved of this responsibility for the coming year.

Respectfully submitted,
Philip C. Hill, Chairman

SECRETARY HOSEY: The report of the Committee on Industrial Ventilation was approved. I announced previously that we had already received a check in the amount of about \$2,800 from the Committee to begin their first quarterly payment. Mr. Marvin Schuman was appointed Chairman and Messrs. Barrett and Hama were reappointed. Mr. Lou Dickie was appointed to replace Mr. Dave Bonn as consultant. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Any discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

REPORT OF COMMITTEE ON INDUSTRIAL VENTILATION

The Industrial Ventilation Manual continues to "sell" itself as a practical guide for the design of industrial ventilation systems and is - without much doubt - the most widely-read book published on the subject. Through its use at the Industrial Ventilation Conferences in East Lansing, North Carolina, and Seattle, Washington, and through the endorsement of thousands of users, including the members of

A.C.G.I.H., publication of the manual has continued at record-breaking levels. National advertising throughout the year has helped also but the principal asset of the manual continues to be the approval of its users.

It is the aim of your Committee to maintain the Manual as a practical, technically accurate and up-to-date publication to serve the needs of the growing industrial ventilation industry. To that end we rely upon the experience gained from the use of the manual at the Industrial Ventilation Conferences, from criticisms and suggestions forwarded by members of A.C.G.I.H. and from requests for information and assistance that are received weekly. We trust that we will continue to receive helpful information from these and other sources to keep the manual informative and current.

The present 9th Edition has been in such demand that it was necessary to reprint the first year (1966); at current levels of distribution it now appears that a third printing will be necessary in 1967. In the meantime we are conducting a review of the 9th Edition with particular attention being paid to Section 9, "Testing of Ventilation Systems"; and Section 11, "Air Cleaners". These are two areas of the industrial ventilation field where modern technology is providing equipment unheard of a few years ago and where applications and techniques are changing rapidly.

For the current fiscal year distribution of the manual set another all time record. 5312 books were sold through the Committee office and by individual Committee members, and these sales resulted in a record return of \$5,743.00 to A.C.G.I.H. With this report we submit a check for \$2,791.50; \$791.50 representing the first quarterly return of fiscal year 1967-68 and \$2,000.00 representing a "surplus" made possible through large-volume printing orders. Accompanying this report also is the certified audit of our Committee accounts for fiscal year 1966-67. We trust that our Committee activities and this report will receive your approval.

Respectfully submitted,
James C. Barrett, Chairman

Mrs. Arlyn Donovan, Secretary
Committee on Industrial Ventilation
P.O. Box 543
Lansing, Michigan

April 19, 1967

Dear Mrs. Donovan:

I have completed my audit of the Statement of Assets, Liabilities, and Net Worth as of March 31, 1967, and of the Income and Expense for the year ended March 31, 1967. The records were well kept and only minor adjusting entries were necessary.

In my opinion the accompanying statements of Assets, Liabilities, and Net Worth as of March 31, 1967 and of the Income and Expense for the year then ended present fairly the financial condition and the results of your operations on the basis of cash receipts and disbursements adjusted at the year end for accounts receivable, inventory, and major accounts payable on a basis consistent with the preceding year.

Respectfully submitted,

Charles Lawrence
Certified Public Accountant

COMMITTEE ON INDUSTRIAL VENTILATION

American Conference of Governmental Industrial Hygienists
Statement of Assets, Liabilities and Net Worth - March 31, 1967

ASSETS

Cash:			
in bank	\$ 6,741.28		
in savings account	<u>2,081.50</u>	\$ 8,822.78	
Accounts Receivable:			
current	767.50		
over 30 days old	<u>637.00</u>	1,404.50	
Inventory and Supplies:			
Flexible cover	1,820.00		
cloth cover	623.50		
calculation sheets	60.00		
packing materials	126.80		
postage	<u>150.00</u>	2,780.30	
	<u>Total Assets</u>		<u>\$ 13,007.58</u>

LIABILITIES AND NET WORTH

Sales and withholding taxes payable	\$ 78.32	\$ 78.32	
Net worth:			
Balance, April 1, 1966	11,593.26		
Surplus for the year	<u>1,336.00</u>		
Balance, March 31, 1967		<u>12,929.26</u>	
	<u>Total Liabilities and Net Worth</u>		<u>\$ 13,007.58</u>

COMMITTEE ON INDUSTRIAL VENTILATION

American Conference of Governmental Industrial Hygienists
Statement of Income and Expense for the Year Ended March 31, 1967

Sales of "Industrial Ventilation" and calculation sheets	\$ 19,196.89	
Cost of materials sold		<u>7,769.94</u>
Gross margin		11,426.95
Expenses:		
Secretarial	\$ 1,864.19	
Advertising	907.87	
Postage	777.38	
Office supplies and expense	273.44	
Committee expense	242.95	
Storage	169.65	
Auditing and other contractual services	125.00	
Refunds	28.99	
Other	<u>61.29</u>	<u>4,450.76</u>
		6,976.19
Add: Interest income		<u>103.81</u>
		7,080.00
Payments to A.C.G.I.H.		<u>5,744.00</u>
Surplus for the year		<u>\$ 1,336.00</u>

SECRETARY HOSEY: No report was received from the Committee on Ionizing Radiation. Dr. Dauer and Messrs. Coleman, Galpin, and Roessler were reappointed. Dr. Williams and Mr. Gerusky requested that their names be withdrawn from the Committee. I move the adoption of these appointments in this case.

MR. BALES: Mr. Chairman, we had no meeting until yesterday. I would like to present a report at this time, if I may. It is very brief.

SECRETARY HOSEY: Do you want to come up here?

MR. BALES: The only subject of discussion that seemed to be of sufficient importance has to do with the proposed record system for radiation workers which was reported as having been discussed in October at the Executive Committee meeting, and at that time no action was indicated. However, the discussion by the Committee yesterday indicated we feel this should be pursued by some working group appointed by this Conference for the purpose of assembling the current information and keeping our membership informed. I realize this is a function that may be coordinated between the Ionizing Radiation Committee and the Legislative Committee. It is our suggestion that this be done by the Conference in order to bring forth the necessary information that the membership of the Conference can be kept informed as to the proceedings on this legislation. We feel that this legislation is of such importance to all of us in setting a precedent for record keeping that we should be up to date on this. I have more discussion, but I think I can present this later.

SECRETARY HOSEY: Do you want to make a motion that the Committee be appointed consisting of members from the Ionizing Radiation Committee?

MR. BALES: I so move, that the subcommittee or a working group be appointed from the Ionizing Radiation Committee and the Legislative Committee to provide the input necessary to maintain current knowledge of what is going on in this particular field, and report back to these Committees, to the Conference, which may enable the Conference to make a stand or to be knowledgeable in this area before this legislation is passed. Thank you.

CHAIRMAN DUGUID: Is there a second to this motion?

...The motion is seconded.

Any discussion?

DON ROSS: Yes. There is a gentleman from the A.E.C.'s task force that is working on this legislation who is going to come Wednesday and talk to the A.I.H. group. It is comparable to the one you are setting up. If you were to set up such a group it might be appropriate to have them meet sometime on Wednesday and you can have the benefit of this fellow's discussing the problem with them.

MR. BALES: I would feel that whatever is finally assembled for this purpose of maintaining information on this that we do include, if we can, some resource people from the A.E.C. and perhaps from the Public Health Service. I am sure there are a number of people in the States who are on top of this matter and they should be appointed to this working group.

CHAIRMAN DUGUID: Is there any further discussion on this? All in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: Incidentally, I have a copy of the latest report from this group sent to me by Mr. Eason, so if the Committee, if it is appointed soon, wants to use it I will be glad to give it to them.

REPORT OF COMMITTEE ON IONIZING RADIATION

The major discussion between Committee members during the year has been relative to the missions and goals of the Committee relative to its responsibilities to the A.C.G.I.H. membership. It was recognized that several other organizations fulfill certain needs of some A.C.G.I.H. members but that there is a special need for Committee actions for those industrial hygiene personnel who are not closely related to Radiological Health Conference or Health Physics activities. A greater effort is required to fill the gap and keep the A.C.G.I.H. membership informed of the current actions in the field which are pertinent to industrial hygienists.

At the Committee meeting held April 30, 1967 the Committee discussed several matters which deserve the attention of the A.C.G.I.H. membership. The most important of these was the "Proposed Employer-State-Federal Records and Reports System for Radiation Workers." This is of vital concern to all industrial hygiene as well as radiological health programs. This is precedence setting legislation and should be recognized now as such. Therefore, this Committee recommends that the Conference membership be apprised of any further developments of this proposed legislation, enabling the Conference membership to readily evaluate and judge the proposals. To assist in communications on this matter it is suggested that a working group be selected from the I.R. and Legislation Committees to obtain the pertinent information, assess the current status, and provide the communication with the membership.

The content of the proposed record keeping is essentially that of those required of licensees by the U.S.A.E.C. or required of radiation users by the agreement States. The individuals reported upon are also essentially the same.

The Health Physics Society has opposed this records program as proposed March 1966 and as modified September 1966. (Health Physics Journal 13, pp 83-86, Jan. 1967). They do not object to record keeping, but rather to the central record concept on the basis that the benefits do not justify the cost; reasoning that (1) it is essentially impossible to demonstrate a causative relationship between radiation and injury in any case involving long delayed effects, (2) the research value of such records is limited because non-recorded medical and dental radiation exceeds, on the average, occupational exposures of most monitored personnel, and (3) the research value of such records would be limited because most exposures would be measured by film badges, devices which are invaluable when used in conjunction with other radiation control measures but which do not measure whole-body and critical organ exposure in a degree of accuracy compatible with research on chronic, low level effects of radiation.

We tend to agree with this stand of the Health Physics Society. If the value of such record systems has already been accepted for such exposures as sound, pressure, heat, chemicals or dust, it would be difficult to exclude ionizing radiation. However, such a precedent has not been set.

Respectfully submitted,
Ronald E. Bales, Chairman

SECRETARY HOSEY: The next report is one from -- I should start out differently. No report was received from the Committee on Legislation. Miss Trasko informed me last evening that a meeting was held yesterday afternoon and that it was agreed to abolish the Committee, so now in view of what Mr. Bales just recommended, would the Chairman of that Committee wish to change its mind, Vickie?

MISS TRASKO: No. We thought the charge as it reads now was most impractical. Moreover, there is really no way to evaluate the effect of legislation in occupational health, and thirdly, there is very little legislation on the books that could be evaluated, so unless the Executive Committee wishes to give it a more specific charge, we recommend the Committee be abolished.

SECRETARY HOSEY: You have heard the report from the Chairman.

MR. DOYLE: Give us a choice. You are working with the Committee as an interim measure.

CHAIRMAN DUGUID: Would this be a feasible procedure? Do you think so, Miss Trasko?

MISS TRASKO: You mean on legislation for occupational health programs?

SECRETARY HOSEY: No, on the A.E.C.'s proposed regulations for persons who work with any radioactive materials. It is a record system.

MISS TRASKO: I think you should get somebody on the Committee who knows something about radiation exposures.

SECRETARY HOSEY: I recommend and suggest that we appoint, with the help of Mr. Bales, a committee to handle this specific situation. I so move.

CHAIRMAN DUGUID: Is there a second to that motion?

...The motion was seconded.

CHAIRMAN DUGUID: Is there any discussion on this? Any questions? If not, all in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: No report was received from the Committee on Recommended Analytical Methods. Mr. Robert Graul was appointed Chairman, and Messrs. Burke, Dubois, Levadie, Teichman, and Dr. Saltzman were reappointed. Miss Theresa Donovan was also appointed to the Committee. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Any discussion? All in favor say "Aye." Opposed. The motion is carried.

1967
SECRETARY HOSEY: Now we come to the one that we always have a little discussion on, the report of the Committee on Threshold Limit Values. This was accepted with the following modifications:

A. It was agreed to insert a tear sheet order blank or a separate page insert in the 1967 TLV booklet for the Documentation of Threshold Limit Values.

- B. The Executive Committee did not agree to the proposed package deal for the Documentation in the TLV booklet or to announcements or advertising of the Documentation at this time.
- C. The Executive Committee recommends that the TLV Committee thoroughly review the preface in the TLV booklet and the statement prepared by the Joint A.I.H.A.-A.C.G.I.H. Ad Hoc Committee on the Use of Threshold Limits, and to use this as a basis for preparing the preface for the 1967 TLVs.

Dr. Stokinger was reappointed Chairman of the Committee and Dr. Elkins was reappointed for another two year term. Since Mr. Allan Coleman has retired his name should be deleted from the Committee and Colonel Melvin was appointed to replace Dr. George Wright. Mr. Chairman, I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion?

SECRETARY HOSEY: Herb, do you want to say a few words?

DR. STOKINGER: Sure. Before I submit for approval the changes in the TLV list for 1967 that I think you all have copies of, I might call your attention to one or two important matters that have occurred in the format of the TLV list and also in the actual activities and mode of operation of the Committee.

The first one I want to call your attention to is indicated in the title of that sheet that you have. It is entitled "Notice of Intended Changes for 1967." This is going to be a replacement for the category formerly called "Tentative Values." This was done for this purpose, we wanted to forestall premature adoption of these tentative values in the legal codes and regulations. We will have the changed value in the appropriate place and we will also retain the recommended values and if they are able to put these into legal codes in this manner they will have to get up early in the morning to do this.

Now the next item that seemed to us important was this: Through the instigation and sponsorship of the Industrial Hygiene Foundation they have indicated an interest in acquiring anonymous industrial hygiene data that will be of value for the Threshold Limit Values Committee in setting up new limits, and they felt in this way much of the information that is available in industry's files, by having it come in from an unknown source, it would be made more readily available. To date we have had some success in this line, although it is not as good as we would like to have. As you know, annually the Threshold Limit Values Committee has put out a plaintive cry to acquire such data and very little has been forthcoming. This is an attempt to have such information come through a disinterested group and in an anonymous manner, so that we hope we have unlocked the materials in the company files.

Now we proceed to the discussion of some of the items on this changed list for 1967 and I might call your attention to the ethyleneglycol dinitrate and/or nitroglycerine, which has an asterisk on it. This looks very unimportant and trivial but this new information was developed in a very novel way through cooperation with the Committee. Last year the Committee made an attempt to take into consideration the serious effects from intermittent exposure to these dynamite explosives, and we listed a value in a manner that was unsatisfactory to the Institute of Explosives Manufacturers. A meeting was held with their

representatives and some members of the Committee, and in one morning, we threshed out a statement that was satisfactory to both parties.

The only other important change is under uranium in which we are upgrading the level and having a single level for both soluble and insoluble compounds. This was done on the basis of the fact that we have now had nearly 25 years' experience with exposure to the uranium industry and 20 years since the limit has been set at 50 micrograms per cubic meter for soluble and 200 micrograms per cubic meter for insoluble compounds. In reviewing the entire situation from a medical experience standpoint correlated with the environmental samples, there is no indication to go along with the data very extensively from animals to indicate that 50 micrograms is much too severe.

The new additions are also listed and we don't have time to discuss them individually. I would urge that the group adopt these values.

SECRETARY HOSEY: Excuse me. There is one suggested change, which the Executive Committee made on the bottom part. They asked that the atmospheric concentration be not above that 200 parts per million. I think that is what you meant, wasn't it?

DR. STOKINGER: That is right.

CHAIRMAN DUGUID: Is there any other discussion? Is there any question?

MEMBER: I have a question. What about some of the materials, Herb, that have been on the tentative list - carbon monoxide, for example? Are these now promoted to the recommended values?

DR. STOKINGER: Yes. In conformity with our general procedure, tentative values remain on the list for two years and then they are moved to the recommended list provided there has been no new information to the contrary. As you may know, investigations by industry to controvert the choice of 50 parts per million for carbon monoxide left the industry a little red-faced. They could not find 50 parts per million in most of their operations, so they didn't have much to stand on to support the 100 parts per million level formerly in existence.

MEMBER: Do you have a listing of the materials that have been moved up?

DR. STOKINGER: I don't have them with me, but you can check them over in the TLV book. They are all asterisked.

MEMBER: Those recommended in 1965 are now on the recommended list.

MEMBER: I was going to say fibrous glass is the only one that is stated.

DR. STOKINGER: That is right. The reason is that the fiberglass industry is having a large and extensive survey made of the health of these workers and it would be premature to move the tentative value until their findings have been reported.

CHAIRMAN DUGUID: Is there any other comment?

MEMBER: It will be listed under the intended values and that will also include additions as did the old tentative value. I would suggest we add the words "And Additions" to "Notice of Intended Changes." It is just a matter of terminology.

DR. STOKINGER: Well, the Committee interpreted changes as change from the prior year.

MEMBER: The first word, it is already in there, "The following additions, or changes."

SECRETARY HOSEY: Yes. I don't think you need to say that. You are changing it. It can be either additions or changes in value. The notice of intended change I think would take care of it.

CHAIRMAN DUGUID: Is there any further comment or question on it?

MEMBER: I would like to pose a question. I think you are doing a disservice to industry if you make a tentative limit a definite limit, unless you can back it up with factual information. By doing that sometimes it places a company in a position where they have real difficulty in maintaining the actual limit and when they try to find out they can't get a great deal of knowledge on the toxicological effect of the material at that level.

DR. STOKINGER: We tried to cover our position on that this way. We do not list any substance with a value, either tentative value or one that is proposed for change, until we have it documented sufficiently to be convinced.

SECRETARY HOSEY: They have two years, incidentally, to raise objections. If no objections are raised within that two year period, we assume it is an agreement level.

MEMBER: In some cases it has been difficult to find out why the level was set at that value within that two years.

DR. STOKINGER: Write to me and I will send you the documentation.

MR. BREYSSE: If there is compelling reason to put this on the intended list, this last statement "During this time, the corresponding 'Recommended Values' will remain in effect unless there are compelling reasons to the contrary," this doesn't seem to jibe with the intent of the list. In other words, if there are compelling reasons to change it, why don't we use the changed value?

DR. STOKINGER: In between the time it is placed on the list and two years elapse something may come up in the meantime.

MR. BREYSSE: I assume you have enough information to indicate it should be changed, and if you do have this information, or information to the contrary, I doubt whether very many of these intended values have changed from the intended value. There are a few, admittedly. This does place a disservice on the survey type, for instance in garages at 100 parts per million of CO. You might as well not go into a garage because with or without ventilation you will be all right. You get down to 50 ppm and practically all of them are going to have to install controls. You go into a garage and use 100 ppm and next week it is 50 ppm and you are in trouble, man. It is the same with styrene in boat plants. At 100 ppm most of the boat plants get by without mechanical ventilation.

MEMBER: They are going to stay there to eliminate the blanks in the list, and you are going to know they are going to change because they are in the back of the book.

MEMBER: Let's use the changed value.

MEMBER: We can't because we are committed to two years in the back of the book, so this is one way to resolve that change dilemma.

MEMBER: You can use whatever one you want to.

MEMBER: But other people can't. The fact is you make a statement that you only put it on the intended list because you have compelling reasons, and you say use the larger number until we have compelling reasons. It doesn't make sense.

CHAIRMAN DUGUID: Is there any further discussion on this motion?

MR. MCCLURE: I would like to ask if you concede that the Threshold Limit Values can rightfully be used in codes and regulations. Your opening statement about this notice of intent was that it was to forestall premature adoption in codes and regulations.

DR. STOKINGER: We don't actually foster adoption in legal codes, but when they do we would like to insist that they be used and interpreted properly. There is nothing wrong with putting them in the legal codes. The incorrectness comes in in their misinterpretation by legal minds, and you get cases adjudicated incorrectly by the fact, according to the legal mind, if you exceed the limit for a period however short you are in trouble, and this is incorrect according to the preface we have.

MR. MCCLURE: But in the preface it states the Committee recommends against the use of the codes.

DR. STOKINGER: But it says if it does get used it should be used properly, the next sentence.

MEMBER: That seems inconsistent to me. It is almost like saying, "Don't use it, but if you do--."

DR. STOKINGER: We have no control over it, you see.

CHAIRMAN DUGUID: Is there any other discussion on the motion? Are we ready for the question now?

MEMBER: Will there be some mechanical indication to avoid this double standard when you have a proposed change and you are still using the recommended value? Will the value be italicized or put in parentheses?

SECRETARY HOSEY: We can do that, yes.

CHAIRMAN DUGUID: Is there any further discussion? If not, all in favor say "Aye." Opposed. The motion is carried. Thank you. (See Appendix C for supplemental documentations.)

REPORT OF COMMITTEE ON THRESHOLD LIMIT VALUES

The Plenary Committee held its usual, two-day meeting in Washington, D. C., November 15 and 16, 1966, when the Notice of Intent was developed, and on March 30-31, 1967, when the business of the November meeting was finalized.

At the March 1967 meeting six changes and 12 additions to the 1966 list were recommended. See list accompanying.

The following recommendations to the Executive Committee were made:

Insert tear-sheet order blank for the Documentation in the TLV booklet for 1967. It was also suggested that the Secretary of A.C.G.I.H. make a package deal of the Documentation and the TLV booklet, and advertise it by a flyer on the mailing list of the Air Pollution Control Association or other appropriate associations.

Insert announcements of documentation in such journals as the J.O.M., Archives of Environmental Health, T.A.P., etc. Secretary Wagner was appointed to handle this matter, as well as whatever advertising seems advisable.

A.I.H.A.-A.C.G.I.H. Preface. Baier and MacFarland were appointed to review the matter of disposition of the preface prepared by the Joint Committee of A.I.H.A.-A.C.G.I.H. No general sentiment was expressed for replacing this preface in its entirety with the one currently in the TLV booklet. Efforts of Baier and MacFarland will be to determine whether certain parts of the A.I.H.A. Preface have sufficient merit to replace sections of the present preface.

Changes in Format for Listing TLVs. The present "Tentative Values" will be replaced by "Notice of Intended Changes." The "Recommended Values" will still be retained, however, and the new values will also be listed under "Notice of Intended Changes." This dual entry, it is hoped, will prevent premature adoption of the proposed changes into legal codes and regulations. As usual, the proposed values will remain in this category for at least two years.

Identification of Basis for TLV Value. This proposal to affix beside each Threshold Limit Value in the TLV booklet an appropriate designation indicating the basis for this value was voted down by a good majority of the Committee, the reason being that the basis for the TLVs is spelled out for each substance in the Documentation.

Notice of Intent to A.P.C.A. A recommendation was made to send the Notice of Intent to the Air Pollution Control Association for distribution to its members as a reminder of the activities of the TLV Committee.

ADDITIONAL ACTIVITIES OF THE TLV COMMITTEE

Some most heartening meetings were held by the TLV Committee members with associations, foundations, and industrial representatives, that indicate broader interest in contributing to the work of the TLV Committee.

Industrial Medical Association Ad Hoc Committee. Two meetings were held during the year with Chairman Golz of an Ad Hoc Committee on Industrial Health for the I.M.A., the first of which culminated in a printed statement in the J.O.M. recommending certain changes in the operation of the TLV Committee.

A second meeting resulted in further delineation of ways in which the I.M.A. might stimulate the gathering of data from industry suitable to serve as a basis for Threshold Limit Values.

Industrial Hygiene Foundation Repository of Anonymous Data. At a second, annual, two-day meeting at the Industrial Hygiene Foundation with approximately 50 of its industrial sponsors, the TLV Committee Chairman presented the basis for the proposed changes in the 1966 list, emphasizing the desire of the TLV Committee to obtain data for the repository that is being established under the auspices of the Industrial Hygiene Foundation. It is hoped that the anonymous nature of the repository will induce industry to release data of use to the TLV Committee.

Meeting with Institute of Explosive Manufacturers. The TLV Committee Chairman and Baier met with representatives of the Institute to resolve what the representatives considered to be an inappropriate listing for ETHYLENE GLYCOL DINITRATE and NITRO-GLYCERIN. After discussing the industrial situation in the explosives industry and comparing it with the experience in those areas where intermittent exposures occur, a statement was developed that proved satisfactory to both the industry representatives and the TLV Committee, and was later unanimously adopted at the plenary meeting.

Meeting with Chromate Industry. The Chairman, with Dr. Zavon and Wagner met with representatives of the chromate industry for the purpose of learning whether the present TLV for chromic acid was protecting the workers. After a full day's discussion it was concluded that the present limit, although it protected against perforation of the nasal septum, had a very low (2-3-fold) factor of safety, and that the limit probably was sufficiently low to prevent the development of bronchogenic carcinoma although only one of the 4 manufacturers has had approximately sufficient experience to make such a determination. The Committee learned, however, that the physicians and industrial hygienists now in the industry were sincerely interested in complying with the Threshold Limits, and are taking active measurements to control the atmosphere and check the response in the workers.

New Air Pollution Limits and TLVs. Great concern was expressed at the last meeting of the Committee by some of the members that the newly proposed criteria and standards of air pollutants are so low and so poorly based that ultimately they will undermine the TLVs for industry. It is feared that labor leaders will make active objection to exposure of their workers at levels often many times greater than that permitted for the same substance for their families, thus eroding the work of the Committee. The Chair accordingly, recommended that Dr. Fredrick draw up immediately a draft of statements to this effect and present it to the Committee for bringing it to the attention of appropriate groups.

NOTICE OF INTENDED CHANGES FOR 1967

The following additions, or changes in former limits were recommended by the TLV Committee at its meeting on March 30, 31, 1967, for adoption by the A.C.G.I.H. When adopted, these changes will appear in the TLV booklet under the caption, "Notice of Intended Changes" and will replace the former caption, "Tentative Values." These changes will remain in this category for at least two years, before being placed among the "Recommended Values."

SUBSTANCE	INTENDED CHANGES
Camphor	2 ppm
Chlorine	1 ppm
Ethyleneglycol dinitrate and/or Nitroglycerin - skin	0.2 ppm*
Stoddard solvent	200. ppm
Styrene	50. ppm
Uranium, sol. & insol. compounds as U	200 µg/m ³
 <u>ADDITIONS</u>	
Abate	15 mg/m ³
Bromine pentafluoride	0.1 ppm
Boron tribromide	1.0 ppm
Diethylene triamine - Skin C	10. ppm
Diphenyl amine	10 mg/m ³

SUBSTANCE	ADDITIONS
Iron salts, soluble, as Fe	1 mg/m ³
Indium and compounds, as In	0.1 mg/m ³
Methyl silicate C	5 ppm
Propargyl alcohol - Skin	1 ppm
RDX - Skin	1.5 mg/m ³
Tungsten & compounds, as W	
Soluble	1 mg/m ³
Insoluble	5 mg/m ³
Cyanogen	10 ppm

* An atmospheric concentration of not more than 0.02 ppm, or personal protection may be necessary to avoid headache.

Respectfully submitted,
H. E. Stokinger, Ph.D., Chairman

SECRETARY HOSEY: Well, we just have a few more reports. The report of the Committee on the Trade Names Index was accepted and the Executive Committee agreed that the charge for the supplement should be \$2.00 whether purchased singly or with the revised edition of the Trade Names Index. James Oser was appointed to replace Richard Fulwiler, who is now employed by private industry. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

REPORT OF COMMITTEE ON TRADE NAMES INDEX

Committee Activities During the Year:

The last copy of the original order of 300 copies of the Trade Names Index 1964 (Revised Edition) has been sold. The Secretary-Treasurer has ordered another 100 copies. The net profit above the printing and mailing costs on the sale of the first 300 copies was approximately \$1,600. The Committee is very grateful for the response from the membership and those governmental agencies who have so cooperatively made this all possible.

The Committee sent a special report to the Executive Committee just prior to their meeting on October 17, 1966 at Pittsburgh, Pennsylvania. We asked for permission to publish Supplement No. 1 (1966) covering data on about 500 new trade name products submitted to the Committee subsequent to the 1964 Edition. Upon notice of approval from the Executive Committee for publishing the supplement, the Committee sent the material to the printer. It has been proofread and hopefully will be available by the annual meeting in Chicago, Illinois.

Based upon an estimated printing cost of \$2.00 for the supplement, we suggested a selling price of \$3.00. The Executive Committee amended our recommendation to the effect that previous purchasers of the 1964 Edition would pay \$3.00 for the supplement but future purchasers of the 1964 Edition would only pay \$20.00 for both the 1964 Edition and Supplement. In other words, the supplement would be free to

them. Our Committee is of the opinion this decision is inequitable to the original purchasers of the Index, half of which gave an indication they would purchase the Index even before it went to press.

The Committee has not been able to have a face-to-face meeting during the year but the members have exchanged their comments on the future of Trade Names Index, particularly with regard to the possibility of overcoming the confidential nature of our Index, as we realize that there is a great desire among industrial hygienists employed by industry to have our Index. We believe the Committee should query all manufacturers of trade name products for about which we have listings of their product. In this request to the manufacturer, we will outline the purpose of our Index and ask for complete up-to-date product data. We would plan to make the request for product data in such a manner that the manufacturer could provide us with only the approximate chemical composition percentage, that is in certain ranges. For example, the information could be submitted to the Committee by the individual manufacturer to indicate the following breakdown of percentage for each ingredient: Less than 1%; one - 4%; 5 - 9%; 10 - 30%; and greater than 30%. Of course, if exact percentages were given it would be that much more useful. Another purpose for this query to the manufacturer would be the possibility that sufficient quantity of product data might be given the Committee as "non-confidential." If so, we might be able to publish an Index that could be made available to all industrial hygienists or at best, have two issues, one available to members only and one that anyone may purchase.

Recommendations for Executive Committee Action:

The Committee requests authority to make inquiry by appropriately worded letter to all manufacturers of trade name products now listed in the Index to obtain information needed not only for updating product data but hopefully such data can be obtained without a requirement for it being considered as confidential in nature.

The Committee requests that the decision for the selling price of Supplement No. 1 Issue made at the October 17, 1966 meeting be reconsidered. Our Committee recommends in view of the good profit made on the first 300 copies sold, that one of the following be approved with regard to selling the supplement:

1. Supplement No. 1 to be provided at a nominal cost not to exceed \$1.50 to cover postage and handling costs to all previous purchasers of the 1964 Edition. Further, future purchasers of the 1964 Edition would pay a total cost of \$21.50 and receive both the 1964 Edition and Supplement No. 1.
2. The purchase price of the Supplement No. 1 to be \$3.00 to everyone eligible to buy it.

Committee Membership Recommendations:

The only change recommended in the Committee membership is a replacement for Mr. Richard Fulwiler, who has served the Committee so admirably. It is unfortunate for our Committee and for A.C.G.I.H. that Mr. Fulwiler is now an industrial hygienist with industry. We wish to nominate Mr. James Oser, Public Health Service, as a replacement for Mr. Fulwiler. The present Chairman is willing to continue in this capacity.

Respectfully submitted,
E. Elbridge Morrill, Jr., Chairman

SECRETARY HOSEY: The following are reports of Ad Hoc Committees. The Executive Committee agreed to disband the Ad Hoc Committee on Epidemiology of Occupational Diseases but to reactivate it when sufficient interest is manifest in this subject. I move the adoption of this report.

...The motion was seconded.

CHAIRMAN DUGUID: Any discussion? If not, all in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: The report of the Committee on Hyperbaric Environments was approved and it was agreed that the Committee should continue the activities for at least another year with the same membership. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion? If not, all in favor say "Aye." Opposed. The motion carries.

REPORT OF AD HOC COMMITTEE ON HYPERBARIC ENVIRONMENTS

Four of the six Committee members were able to meet and discuss the problem of working under hyperbaric conditions during the last A.I.H.A.-A.C.G.I.H. Convention held in Pittsburgh. The result of this meeting was that we should as a group converge on what is probably the most important problem currently facing compressed air workers...the issue of an adequate decompression schedule.

To this end, it was agreed that the Committee should publish an interim standard concerned with this matter. The standard should be based upon the Washington State Code, which was felt to be the most acceptable decompression schedule currently in existence. Comments, views, and opinions from specialists in the field would be solicited on the proposed interim standard. After careful consideration of all comments, a finalized version of the standard would be drafted and sent to the Executive Committee of the A.C.G.I.H. for action.

To date the standard has not been even initially drawn up and we do not have much to offer in the way of an excuse for this. To get this project under way immediately is currently the goal of our group.

Publication of air quality standards is a second concern of our Committee and more emphasis will be placed upon this matter after the more important problem of standardized and adequate decompression schedules have been established.

In view of the above, I request that the Executive Committee allow us another year of operation as an Ad Hoc Committee. I will be happy to continue as Chairman for this extended period along with the members already designated and presently serving.

Respectfully submitted,
Fred Hertlein, III, Chairman

SECRETARY HOSEY: The report of the Committee on Industrial Hygiene Aspects of Mining was accepted and it was agreed to continue this as an Ad Hoc Committee for another year with the same membership. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion?

MEMBER: Wasn't there a point raised to add an M.D. to that Committee, a physician?

SECRETARY HOSEY: If there was, I forgot it. We can do it now.

MEMBER: I so move, --

SECRETARY HOSEY: -- that a physician be added.

CHAIRMAN DUGUID: We can take it as an amendment and vote on the motion with the amendment. Can we have a second on the amendment? You have made a motion amending the original motion.

...The motion was seconded.

Is there any discussion. All in favor say "Aye." Opposed. The motion is carried.

REPORT OF THE AD HOC COMMITTEE ON THE INDUSTRIAL HYGIENE ASPECTS OF MINING

I. Activities

During the past year this Committee met once, during the annual conference in Pittsburgh. At this meeting, after considerable discussion, an outline was agreed upon for written assignments relative to the Committee. Subjects were reassigned and it was further agreed that these assignments would be rewritten and submitted prior to October 1966; at which time another meeting would be held to review the subjects.

This meeting was not held in October as only two assignments were resubmitted, although one member advised the Committee that studies relative to his assignment were approximately 50% completed and that an interim report would be submitted as soon as studies were completed. It is possible that other Committee members have similarly been gathering further information relative to their assignments, but that the proposed October meeting did not give them sufficient time for completing these assignments.

One of our most active members, Mr. Donald Kingery, of the U. S. Bureau of Mines was assigned to Europe early last fall, and has been serving there ever since. Although he asked to be removed from the Committee and suggested a replacement, it was felt that as his assignment was only temporary, it would serve the best interests of the Committee if he were left on as a member, and that his suggested replacement act in his stead until his return. This procedure was followed.

During the past year Mr. Bardswich and Mr. Duncan Holaday both became a part of the Committee, permission for their serving having been officially obtained from their agencies, the Ontario Mines Safety Association and the U. S. Public Health Service, respectively.

Members of the Committee will be meeting during the Annual Conference to review the assignments submitted and to reassign subjects which have had no work done on them.

II. Proposed Material for Publication

It is not proposed to publish any material during the forthcoming year.

III. Recommendations by the Committee

It is the intention of the Committee to continue working toward the completion of the project presently under way, of having information relative to the industrial hygiene hazards of the mining industry collected, and presented in such a manner that it will be a working tool for personnel of the industry. Also, to determine whether some of the conditions encountered recently, due to changes in working procedures are, or are not, a hazard to personnel working in the industry.

It would be appreciated if this Committee may have permission to select another member with considerable knowledge of industrial medicine to work with the Committee toward assessing the relationship between environmental conditions and physiological effects. As soon as the Committee has chosen such an individual, permission to have him act on our Committee will be requested from the Executive Committee.

IV. Suggested List of Committee Members

It is suggested that the present Committee remain unchanged for the forthcoming year, and that I remain as Chairman provided that this is not in contravention to the wishes of the Executive Committee.

Respectfully submitted,
John D. McKichan, Chairman

SECRETARY HOSEY: Mr. Henry Doyle gave a verbal report on the Ad Hoc Committee on Liaison with Other Countries. At his recommendation the Executive Committee agreed to make this a standing Committee, but to change the name of the Committee to Foreign Relations. The members of the Ad Hoc Committee were reappointed to the standing Committee with Mr. Doyle as Chairman.

The Executive Committee further agreed that the Secretary-Treasurer and the Chairman of this Committee be given authority to appoint to any of our standing Committees those individuals in foreign countries who expressed an interest to serve in such capacities. A bill of particulars for this Committee will be developed at a later date.

I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Any discussion? All in favor, say "Aye." Opposed. The motion is carried.

We had a hand raised right at the vote.

MEMBER: I personally do not like the term Foreign Relations and I would like to suggest substituting something like International Liaison or something like that for that last Committee. Foreign relations, you know, this is a technical group, a professional group. I think International Liaison would be a little more formal. I think it would give the Committee a little more prestige.

MR. DOYLE: That is acceptable.

MEMBER: I move that it be changed.

SECRETARY HOSEY: It has been moved that the name of the Committee be changed.

CHAIRMAN DUGUID: The prior motion has been passed.

MEMBER: I move we change the name of the Committee from Foreign Relations to International Liaison Committee.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Any discussion on this? All in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: No report was received from the Ad Hoc Committee on Occupational Health Nursing. The Executive Committee agreed to disband this Committee and Mr. Doyle will discuss with Miss Mary Louise Brown future plans for nurses. I move the adoption of this recommendation.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion on this? If not, all in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: The report of the Ad Hoc Committee on Physical Agents was accepted and it was agreed to abolish the Ad Hoc Committee and establish a standing Committee on Physical Agents. Mr. Herbert Jones was appointed Chairman and Messrs. Wilkinson, Palmisano, Davis, and Ottoboni, and Major Bell and Lt. Sliney and Drs. Mastromatteo and Powell were appointed to the Committee.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Any discussion? All in favor say "Aye." Opposed. The motion is carried.

REPORT OF THE AD HOC COMMITTEE ON PHYSICAL AGENTS

At the annual meeting last year this Committee was formed with the appointment of a Chairman and other members to be appointed at a later date. The Bill of Particulars for this Committee was as follows: To collect and evaluate existing and proposed standards and criteria involving industrial exposure to physical agents.

The Executive Committee appointed additional members to this Committee and an organizational meeting was held in Pittsburgh, Pennsylvania in October 1966. Committee assignments were made and the literature, standards, and criteria for a number of physical agents were reviewed. Based on this review of information available it is recommended that a standing committee be appointed to study the available data and make recommendations to the Conference on exposure limits for physical agents. The exposure limits should be reviewed annually. It is believed that there is information available on which tentative limits can be established for noise, lasers, microwaves, and heat stress. Other agents which the Committee tried to evaluate but are undecided on are ultraviolet and infrared, vibration and magnetic fields.

If it is the decision of the Executive Committee to establish a standing committee it is recommended that the ad hoc committee be abolished.

Respectfully submitted,
Herbert H. Jones, Chairman

SECRETARY HOSEY: No report was received from the Ad Hoc Committee on Truck and Air Transport. I talked to Mr. Ed Lowe, Chairman of the Committee, on the 'phone, and this conversation was reported to the Executive Committee. It was agreed to continue this as an ad hoc committee for at least another year. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded...

Is there any discussion? All in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: The report of the Ad Hoc Committee on State Occupational Health Programs was presented by Mr. Doyle. This provocative report received considerable discussion and the Executive Committee agreed to accept the report with thanks. The Committee was authorized to continue and to spend funds necessary to prepare a manual on "Recommended Programs in Occupational Health for State and Local Agencies." It was further agreed that Mr. Doyle would prepare a shorter version of this report for inclusion in the 1967 Transactions. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded...

Any discussion? All in favor say "Aye." Opposed. The motion is carried.

REPORT OF AD HOC COMMITTEE ON OCCUPATIONAL HEALTH PROGRAMS

THE FUTURE ROLE OF THE AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

I. Purpose of Present Report

At its meetings in May and November 1966, the Executive Committee of A.C.G.I.H. considered the matter of its growing financial resources and the effect this may ultimately have on the organization's nonprofit status. The suggestion was made that A.C.G.I.H. might use surplus funds to study the effectiveness of State programs and the factors which contribute to their successes and failures. Chairman Robert Duguid appointed Henry Doyle as Chairman of an Ad Hoc Committee to look into this matter and report to the Executive Committee at its next meeting. At Mr. Doyle's request the following members of the Ad Hoc Committee were appointed: Dr. Morris Kleinfeld, Dr. Jan Lieben, and Mr. John Soet. This Committee met in Washington on February 2, 1967, to consider the charge of the Executive Committee.

Very quickly the Committee concluded that there was a critical need to strengthen State occupational health programs and that such a project was, in theory, a commendable one for A.C.G.I.H. to undertake. However, under present circumstance the Committee questioned the success of an A.C.G.I.H. project directed at strengthening official agency programs until other mitigating factors had been overcome. The decline of official agency programs in occupational health has been the result of many factors including the lack of action and leadership on the part of the A.C.G.I.H.

It was therefore concluded that this report would be directed toward the decline of occupational health as a major public health program and the total effort which A.C.G.I.H. might contribute to the rebuilding and restructuring of occupational health as a major resource for this great industrial nation.

II. The Problem

The Committee acknowledges the great contributions that the health profession has made during the past half century to the improvement of the health status of the American worker. With the exception of pneumoconiosis, the classical occupational diseases are no longer a major component of the morbidity and mortality pattern of employed persons. Indeed, certain occupational diseases common to the past generations are becoming clinical rarities. The industrial worker now has a life expectancy slightly in excess of the general population. Giant steps have been taken to provide the employed population with adequate medical care through collective bargaining and by voluntary management sponsored insurance programs. Pneumoconiosis remains the largest identifiable occupational disease problem in terms of morbidity and compensation costs, although we have the tools and procedures to control this problem.

Certainly a brief self-analysis would immediately bring to light some of our shortcomings as a professional group. No study is needed to demonstrate our lack of professional activity in such areas as medical care, compensation medicine, the relationship of the environment to chronic diseases, human engineering and agricultural health. Our inactivity has permitted several specialties to develop which should have been an integral part of our profession such as radiological health, space, aviation, and submarine health. Further quiescence may lead to the splintering of the profession into specialty groups in agricultural health and human engineering.

Some of our major health problems are in the agricultural industry and in many ways these problems may be related to those in the mining and manufacturing industries of half a century ago. Solutions lie both in the social and technical fields. Maybe our reluctance to deal with social values accounts for our lack of progress in planning programs in agricultural health. Likewise our European associates have far outdistanced us in the human engineering field.

As a professional group we also have had an aversion to dealing with problems of professional education. There is a critical shortage of students for our existing professional schools. Consequently, each year fewer people are entering into the field with post graduate training in occupational health. The universities have doubtlessly produced graduates of high technical quality. However, questions may be raised on the adequacy of training in terms of modern day problems and the development of administrative leadership. On the other hand, the professional organizations have been delinquent in working with the universities to modernize their curriculum and supply meaningful manpower estimates. Few reports of manpower estimates have dealt with the problem in a realistic manner. A common fault has been to express manpower needs on a theoretical or ideal projection without relating this need to the average growth of the profession and our competitive position with training and demand in the basic sciences. A field which may be stagnate in concepts and growth potential will have great difficulty in attracting new and capable manpower. The profession has always attempted to maintain high educational standards by stressing the need for personnel with graduate and post graduate degrees. In view of the continuing shortage of manpower, and with no end of this shortage in sight, it may be more realistic to analyze our functions and isolate those which can be performed by technicians. Precedents in such matters have certainly been set by other professional groups.

Occupational health, as a State program, has tended to focus strongly on the industrial hygiene concept. In most States occupational diseases constitute only a small part of the total cost of workmen's compensation. Many individuals maintain that a large reservoir of occupational diseases remain unreported. If this be true then means must be found to expose this reservoir. Legislative bodies cannot be expected to appropriate funds for problems which cannot be documented. With growing emphasis on education, urbanization, and the control of community environmental problems, it can be anticipated that competition for tax funds will continue to increase. However, an analysis of the total industrial health problem of a State would serve to highlight many areas which are high cost factors but for which the official occupational health agency has expressed no concern. Such problems relate to medical care of the injured worker, medical and vocational rehabilitation, the cardiac problem in industry, mental health, the provision of emergency medical services, and the provision of consultation services to the compensation agency. In at least one State, industrial cardiac cases are compensable and their compensation cost dwarfs that of occupational diseases.

This discussion is presented not to depreciate the importance of industrial hygiene,, for it is the essential block of a preventive program, but to point out that (1) industrial health is a many faceted activity, (2) many of these problems are being neglected or not coordinated and (3) if the occupational health agency does not assume this responsibility then it will be given to a non health agency and these problems will then be dealt with in an administrative manner rather than from a preventive viewpoint.

Our final point, and we hasten to say that this is not intended to be an exhaustive analysis but one to highlight major problem areas, is to express our concern about the widening chasm between industrial health and safety. We are by no means advocating an amalgamation of these two activities, but we do see the fields coming closer together both technically and administratively. Certainly the two fields share a common goal and the total mission cannot be accomplished until procedures of both fields have been brought to bear on the problem. As an example, health agencies have much to contribute in applying the principles of epidemiology to accidents and this may well be the next breakthrough in industrial accident prevention. On the other hand, the industrial safety organization could well be the intelligence service of occupational health. The two activities should share a common interest in the provision of first aid and emergency medical care services, in the medical rehabilitation of the ill and injured worker, and in human engineering.

State Programs in Occupational Health

State occupational health programs had their impetus with the advent of federal grant funds in 1937, and a second thrust during World War II when funds and staff became available. The golden era of official agency programs was the period 1946-1950 when all but a few States had some type of a program. In 1950 there were 415 persons employed by State and local agencies in occupational health. In 1950, with the withdrawal of earmarked federal funds and the expansion of industrial programs, the process of rigor mortis began to take over in many State programs. Another blow to an already faltering program was dealt when federal funds became available in radiological health and air pollution. Many States simply shifted emphasis to these activities although retaining the name occupational health or industrial hygiene.

Presently, 42 States and 38 local agencies have administratively identifiable programs employing a total of 694 persons.* A significant proportion of these, however,

* The low water mark was 1957 when 360 persons were employed in State and local units. The growth since 1957 has been almost entirely in local health agencies.

are engaged almost wholly in air pollution or radiological health. The picture becomes a bit more discouraging when it is realized that 36% of the total personnel are employed by three States (New York, California, and Pennsylvania) and 46% by five States (New Jersey and Michigan). These figures exclude the federal agencies where occupational health has been a constantly growing program in terms of personnel.

The Committee attempted to place in perspective some of the reasons why State occupational health programs have not prospered. These are largely based on the experience and observations of the Committee members and are offered in the context of analyzing those factors which must be overcome if occupational health is to assume its proper place in the public health structure of the nation.

1. We accept the fact that the withdrawal of earmarked federal funds has had an adverse effect on the quality of State programs. However, we are loathe to accept the concept that for occupational health to survive and prosper there must be federal earmarked monies. The general health grant which the States receive is composed of a number of categorical items, including occupational health. In fact, the \$1,000,000 in earmarked occupational health funds were transferred in 1948 to the general grant which has been increased almost every year. It would therefore appear that either State health officers have not chosen to use a part of these funds for occupational health or that the occupational health administrators have not presented imaginative programs.
2. Conceptually, occupational health has not been a dynamic program in many States. Historically, programs have been based on the concept of providing a consulting service. In doing so the fact that the people, and especially the workers, are the primary recipients of the program has been overlooked. In general, where responsibility of occupational health has been in the health agency there has been a reluctance to sponsor legislation directed at the control of the industrial environment. It appears to this Committee that this is an abrogation of modern day responsibility. Such customs have placed the occupational health agency in a vulnerable position and frequently without a budgetary base. Other States have depended upon the labor agency to implement and apply rules and regulations. Such arrangements generally have not been successful, since split authority is not a satisfactory system to either agency. Most responsible industries would prefer a system of reasonable rules and regulations rather than be at the mercy of imprecise legal interpretations and administrative procedures.
3. Programs have been too technically oriented and frequently directed at the training or interest of the administrator. Such programs ultimately reach an imbalance and do not meet the total needs of the State. A balanced occupational health activity covers a wide range of activities and those that are directed to one facet have only a slight chance of survival. In reviewing those States which have active and strong programs, the common element among these has been aggressive leadership.
4. Program administrators have had a tendency to emphasize technical training for their staff at the expense of administrative training. Although the Committee supports the concept of technical training and the keeping abreast of new problems, it also recognizes the equal if not greater need, particularly in view of present day trends, to maintain and improve the skills of the administrator and his immediate staff. Inadequate administration has also led to inadequate public relations and a frequent comment that occupational health agencies are management oriented. Regardless of the merits of such statements they serve to detract from the image of the organization and result in inadequate support from either the public or labor groups. Traditionally, management organizations have

not openly supported those elements of the State government which exercise any degree of police power over industry. Thus, basic support for an occupational health agency must come from either the public or worker groups.

5. A final reason for the lack of prosperity of State occupational health agencies, and maybe the major shortcoming, has been the lack of a national cognizance of the problem. Programs result from public interest and demand. This has been demonstrated dramatically to our profession in the cases of radiological health, water and air pollution. However, in designing a national publicity program care must be taken to present the public with real issues and matters on which it can take action. Occupational health or industrial hygiene as a professional group owes a tremendous debt of gratitude to the crusading of Dr. Alice Hamilton and the effect of the National Conference on Silicosis held in 1935. If there are national issues presently at stake these should be identified for the benefit of the public and legislative groups.

The Committee is vitally concerned about the present status of occupational health, especially as a responsibility of the various States. Unless certain actions are taken, we are apprehensive that State programs as a whole will continue to disintegrate. We are convinced that A.C.G.I.H., as the major professional organization representing professionals in occupational health employed by governmental agencies, can and should take certain corrective measures.

III. The Past Role of A.C.G.I.H.

The American Conference of Governmental Industrial Hygienists was organized in 1938 through the effort of the Division of Industrial Hygiene, Public Health Service. Mr. Jack Bloomfield, then Assistant Chief of that Division was the motivating force in the organization of the Conference and for many years acted as its Secretary-Treasurer. This relationship with the Public Health Service has never been completely severed although in recent years the strength of the Conference has been such that it could act independently. The only tie which now binds the Conference to the Public Health Service is the constitutional requirement that the Secretary-Treasurer be an employee of the Occupational Health Program, Public Health Service. The original concept of the Conference was to aid in the development and strengthening of State programs in occupational health; to provide a vehicle for State administrators to exchange experiences; and to keep the Public Health Service advised of problems and its part in the solution of these problems. The original organization was chartered as the Conference of Governmental Industrial Hygienists. However, about 1950 the word American was added to indicate a western hemisphere influence.

That the Conference is and has been an effective force in the occupational health movement is unchallenged. It is due many accolades for its accomplishments, particularly for the development of Threshold Limit Values, standardization of chemical and physical methods of analysis, and the publication of manuals and reports of technical committees. These efforts have attained national and international recognition for the Conference. The influence of its TLVs are felt in almost every industrialized nation of the world and the Manual of Industrial Ventilation has been used as a text throughout the world. The Committee sees an even stronger role for the Conference in the future with respect to technical matters and the basis for this role should be improved with the growth of our membership in the European and Asiatic countries. The membership of the Conference has grown rapidly from the 30 original members to over 900 at present. However, of this number only 37% are members of State and local occupational health agencies.

The Conference traditionally has avoided involvement in matters of administrative procedures and efforts, other than technical, which would strengthen the role of

occupational health agencies. In certain areas it has depended on the American Industrial Hygiene Association, the Industrial Medical Association, and the Public Health Service for leadership. The voice of the Conference has never been heard on matters of national concern, although other comparable organizations such as the Conference of State Sanitary Engineers and Conference of State Laboratory Directors have taken stands on national matters within their purview.

The Committee, however, is concerned that the concepts of the Conference are not keeping fully abreast of modern day concepts and practices in occupational health. The day is past when our problems can be totally embraced in the concept of industrial hygiene; this is the day of space and submarine health, of agricultural health and human engineering; the era of changing social values and emphasis and massive hostile environments. This is the electronic era where knowledge developed today is out of date tomorrow. Yet a look at our Committee structure reveals emphasis on problems of the past. There are no Committees to direct attention to the major industrial health problems of medical care of the ill and injured, medical care insurance, the cardio-respiratory diseases, mental health and alcoholism, or the chronic diseases.

Even beyond this, however, the Committee is concerned that the Conference has no structure to support official agency programs. Although it has advised States on how to analyze for chemical contaminants, the Conference has never developed criteria for State programs or recommendations for program content.

IV. The Responsibility of A.C.G.I.H. in View of Present and Future Needs

If an organization is to remain dynamic it must, from time to time, re-examine its goals and its program to meet these goals. To our knowledge, this has not been done since the Conference was founded almost 30 years ago. To do this also means a relook at the organization of the Conference and its method of attaining its goals.

1. The most urgent problem presently facing the A.C.G.I.H. is the restoration of State programs. The Committee feels strongly that the Conference should take action on this recommendation immediately since it is of vital importance. This recommendation could also be considered separate and apart from the context of this report. Although only 37 percent of the membership of the Conference is composed of personnel from official agencies, this group is the hard core of the organization. Without strong support from official agency personnel, it is doubtful that A.C.G.I.H. could survive in its present form. Also, the basic goal of the Conference is the support of official agency programs. The preceding recommendations represent a long range program and most would have only an indirect effect on official agency programs. It is recommended that the Conference appoint a committee to gather and analyze data from a selected group of States to develop a "Manual on Recommended Programs in Occupational Health for State and Official Agencies." The study and report could have the following general outline.

- A. Historical background
- B. The development of official agency programs
- C. How to estimate the problem
- D. Factors that influence the success of State programs
- E. Factors that influence the failure of State programs
- F. Changing concepts in occupational health

(continued on following page)

- G. A recommended program
 - (1) large industrial states
 - (2) medium industrial states
 - (3) small industrial states
- H. Staffing plans
- I. Laboratory and other support

Such a report or manual should be of great assistance to State health officers, labor agency heads, and administrators in evaluating program effectiveness and establishing new programs; to legislative groups in evaluating legislation and budgets; to Federal agencies in program planning and, finally, to all professionals in the field to aid in molding occupational health into a dynamic forward looking profession dedicated to solution of health problems of the employed population.

To accomplish its mission, the Committee would have to be assured of sufficient funds to cover travel and subsistence cost, typing and other clerical assistance, and publication cost. A budget of \$3,000-\$5,000 would be required.

In addition to the above recommendations, the Committee wishes to take this opportunity to point out some changes in concept and principle which in its opinion need to be implemented.

2. The Conference should consider and work toward an Executive Secretary-Treasurer. We believe that the time has come for a complete administrative separation from the Public Health Service. Such a step would give the Conference greater flexibility and would relieve the Public Health Service of any embarrassment that might result from action taken in the public interest, would also permit the Public Health Service to use the Conference in an advisory capacity. However, additional sources of long range financing would have to be found before this action could be taken and it is the desire of this Committee to see this accomplished without a significant increase in membership dues. At least one member of the Committee feels that the term of the officers of the Conference should be increased from one to two years in order to provide continuity of leadership and the opportunity to implement new program concepts.
3. The Conference needs to take a stronger role in matters of national importance as they relate to occupational health. A deterrent to this kind of action in the past has been the fact that our members are employed by official agencies and action by the Conference may be misconstrued as lobbying. On certain questions, however, the Conference has the expertise that is needed and probably the best technical talent in the country. To present factual data to Federal agencies, Congressional committees and national advisory groups is generally not considered to be lobbying and such action is frequently welcomed.
4. Once recommendation number 1 has been accomplished the Conference could take a stronger position on influencing the national program in occupational health. The recommendations of other comparable organizations, particularly in air and water pollution and sanitary engineering, have had a significant influence on the national program in these areas.
5. To attain maximum utilization of talent and to emphasize new program areas, the Conference should have three administrative arms each headed by a competent person to embrace a much wider span of interest. These three arms should relate to technical, administrative and social (political) areas.

6. The international interest in the affairs of the Conference has been most gratifying and through the effort of the Ad Hoc Committee on Relations with Other Countries has brought 20 new members from countries outside the western hemisphere during the past year. To maintain this interest and take advantage of the experience and knowledge of our counterparts from other countries, this should be made a standing committee. This committee should also maintain an active liaison with selected international organizations such as ILO, WHO, the European Coal and Steel Community, the European Economic Community, the Council of Europe and the Permanent Commission on International Health and certain national groups such as the British Occupational Hygiene Association. An active role awaits the Conference in developing international TLVs especially for the pneumoconioses.
7. We have spoken previously of our concern about the widening chasm between health and safety and the need to coordinate these concepts. At this time we have no formula to offer to accomplish this. However, A.C.G.I.H. could be the effective organization to breach these differences. Each group has functions it can perform best and the dividing line between safety and health hazards becomes progressively more vague. The trend in industry is to consider health and safety as one problem, especially from the administrative viewpoint. The Committee, however, suggests a closer liaison with other organizations which share a common interest with us although their major interest may be related to industrial safety such as the International Association of Accident Boards and Commissions, the National Safety Council, the American Society of Safety Engineers, and the United States Standards Institute.
8. In view of recent Congressional action funds may become available for post-Bachelor training in occupational health, A.C.G.I.H. could make a real contribution in developing realistic estimates of manpower requirements, assisting in the recruiting of personnel for training, and in developing curriculum suggestions for the universities. Suggestions could be offered to Federal agencies, universities and others on the needs and content of short training courses. In fact, some organizations have found it desirable to sponsor short courses especially those which improve management skills in its area of interest.
9. Industrial hygiene had its impetus through certain National Conferences and incidents that occurred in the 1930's. Among these were the National Silicosis Conference and the Surgeons General Conference on Tetraethyl Lead. The writings of Drs. Alice Hamilton and Emery R. Hayhurst had no small part in arousing a public consciousness about health conditions in industry. In recent years there have been no similar occurrences which would tend to focus public attention on occupational health. Every two years there is a President's Conference on Industrial Safety in which occupational health receives only minor consideration. In 1960 the National Health Forum devoted its annual conference to occupational health, but for various reasons this had little impact. Although present day work conditions are vastly different from the 1930's, there are national issues which need to be placed in perspective. The Conference could well take the leadership or sponsorship for a National Conference on Industrial Health.

Respectfully submitted,
Henry N. Doyle, Chairman

SECRETARY HOSEY: The report of the American Board of Industrial Hygiene was accepted and we were in error when we agreed to nominate Dr. Curtis McCammon to replace Allan Coleman because I was in conversation this morning with Dr. Henry Smyth who said that members of the Board do not represent organizations, and until Mr. Coleman resigns his term will continue. That will have to be amended as I have indicated. I move the adoption of this report as amended.

...The motion was seconded...

CHAIRMAN DUGUID: Is there any discussion? All in favor say "Aye." Opposed. The motion is carried.

REPORT OF AMERICAN BOARD OF INDUSTRIAL HYGIENE

1. The Board met during the A.I.H.A.-A.C.G.I.H. Conference in Pittsburgh and again in October in New York City.
2. The Board announced certification of 23 industrial hygienists in 1966.
3. The 1967 spring examinations will be held at the Pick-Congress Hotel in Chicago, Saturday and Sunday, April 29 and 30, preceding the Industrial Health Conferences.
4. The time and place of the fall examinations have not been determined. These will probably be in the fall somewhere along the west coast.
5. At the 7th Annual Meeting of the Board which was held in New York City in October, new officers were elected for two terms. I assumed the duties of Secretary-Treasurer on February 1, 1967 and was re-elected to the Board for a six-year term.
6. The American Academy of Industrial Hygiene has become a functioning organization with duly elected officers.
7. Finances of the Board are sufficient for conducting its work. I see no reason to request funds from A.C.G.I.H. to continue activities on the Board.

Respectfully submitted,
E. Lynn Schall, Chairman

SECRETARY HOSEY: No report was received from the Committee on Direct Reading Gas Detecting Tube Systems. Mr. Keenan will be asked to report to the Executive Committee in October on the current status of their activities. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded...

Is there any discussion? All in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: The report of the Committee on Respiratory Protective Devices was accepted. Messrs. Hyatt and Schutz were reappointed and Messrs. Luxon, Ackerman and Dr. Waters were appointed to represent A.C.G.I.H. Messrs. Castro, Held, and Dr. Powell were deleted from the Committee. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded...

Is there any discussion? All in favor say "Aye." Opposed. The motion is carried.

REPORT OF JOINT A.I.H.A.-A.C.G.I.H. COMMITTEE ON
RESPIRATORY PROTECTIVE DEVICES

Meetings

The A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee held meetings on the following dates during the 1966-1967 period.

16 May 1966 - Pittsburgh, Pennsylvania (during the 1966 American Industrial Hygiene Conference)

19 October 1966 - Pittsburgh, Pennsylvania (during the 1966 meeting of the Industrial Hygiene Foundation)

The Committee will hold a meeting on 1 May 1967 in Chicago, Illinois, during the 1967 American Industrial Hygiene Foundation.

Support of Activities of U. S. Bureau of Mines in Field of Respiratory Protection

The A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee received information during the spring and summer of 1966 which indicated that organizational changes in U. S. Bureau of Mines' establishment at Pittsburgh, Pennsylvania would result in a substantial decrease in the activities of the U. S. Bureau of Mines in testing and approving respiratory protective devices, carrying out research in the field of respiratory protective devices, and educating users of respiratory protective devices. A draft of a resolution urging an increase in the activities of the U. S. Bureau of Mines in the field of respiratory protection was written and submitted to the Board of Directors of A.I.H.A. and the Executive Committee of A.C.G.I.H. The Committee recommended that both A.I.H.A. and A.C.G.I.H. approve the resolution and that both A.I.H.A. and A.C.G.I.H. officially contact the U. S. Bureau of Mines and urge the U. S. Bureau of Mines to increase its activities in the field of respiratory protection.

A.C.G.I.H. sent official letters to both the Secretary of the U. S. Department of the Interior and the Director of the U. S. Bureau of Mines which urged that the U. S. Bureau of Mines increase its activities in the field of respiratory protection. A.C.G.I.H. received official replies from the Deputy Assistant Secretary of the U. S. Department of the Interior and the Director of the U. S. Bureau of Mines which stated that organizational changes in the U. S. Bureau of Mines would result in improving the activities of the U. S. Bureau of Mines in the field of respiratory protection.

A.I.H.A. decided to establish an Ad Hoc Committee which would investigate the activities of the U. S. Bureau of Mines in the field of respiratory protective devices and which would report directly to the Board of Directors of A.I.H.A. The Ad Hoc Committee was formed, it carried out an investigation, and it gave a report to the Board of Directors of A.I.H.A. The Ad Hoc Committee recommended that the Board of Directors of A.I.H.A. permit the Ad Hoc Committee to send a letter to the Director of the U. S. Bureau of Mines which urges the U. S. Bureau of Mines to increase its activities in the field of respiratory protection, recommends the establishment of specific new test and approval schedules for respiratory protective devices, and

asks specific questions concerning possible future research concerning respiratory protection. The Board of Directors discussed the recommendation of the Ad Hoc Committee and also investigated the matter. This investigation caused the Board of Directors of A.I.H.A. to decide to postpone action on the matter for a six month period (decision made in January 1967).

The A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee contacted I.S.E.A. (Industrial Safety Equipment Association - an organization of manufacturers of industrial safety equipment) and informed said organization of the information received which indicated that the U. S. Bureau of Mines may reduce its activities in the field of respiratory protection. I.S.E.A. replied to the Committee that it had investigated the matter and its investigation indicated that the U. S. Bureau of Mines actually intended to increase its activities in the field of respiratory protection instead of curtailing it.

Recently (March 1967), the A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee received information which indicated that it would be advisable that A.I.H.A., A.C.G.I.H., and I.S.E.A. officially write to the Director of the Health and Safety Research and Testing Center of the U. S. Bureau of Mines to urge the U. S. Bureau of Mines to develop a test and approval schedule for non-emergency type respirators (chemical cartridge respirators) for protection of personnel against low concentrations (not immediately dangerous to life) of acidic and alkaline gases. The Committee recommended to the Board of Directors of A.I.H.A., the Executive Committee of A.C.G.I.H., and the Board of Directors of I.S.E.A. that they write to the mentioned Director at the U. S. Bureau of Mines and urge the development of the mentioned test and approval schedule. The Committee also brought this matter to the attention of the A.I.H.A. Ad Hoc Committee.

AID TO A.I.H.A. HYGIENIC GUIDES COMMITTEE

Drafts of Hygienic Guides for the following materials were reviewed by the A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee and recommendations with regard to the selection of respiratory protective devices for protection of personnel against these materials in the form of air contaminants were made to the A.I.H.A. Hygienic Guides Committee.

Oxygen Difluoride
Ethyl Acrylate
Toluene Diisocyanate
Acetylene

Propylene Dichloride
Turpentine
Bisphenol A
Naphthalene
Phthalic Anhydride

TECHNICAL SESSION AT 1967 AMERICAN INDUSTRIAL HYGIENE CONFERENCE

The A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee will sponsor a technical session pertaining to respiratory protection at the 1967 American Industrial Hygiene Conference in Chicago, Illinois. The technical session is scheduled for the morning of 5 May 1967. The Session Arranger is Mr. W. A. Burgess of the Harvard School of Public Health. Co-Chairmen for the session are Mr. F. E. Adley of the Hanford Occupational Health Foundation and Mr. B. J. Held of Atomics International. Seven papers will be presented at the session.

SUPPLEMENT TO RESPIRATORY PROTECTIVE DEVICES MANUAL

The A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee has started to work on the writing of a Supplement to the Respiratory Protective Devices Manual.

The Supplement will have six chapters: I - New Developments; II - New Testing and Approval Methods; III - Protection Guide for Fumigants; IV - U. S. Bureau of Mines Approved Devices; V - U. S. Department of Agriculture Recommended Devices; VI - New Methods of Cleaning and Disinfecting. Assignments for writing the chapters have been made. It is hoped that the work on the Supplement will be completed before the end of 1967.

LIST OF SPEAKERS IN FIELD OF RESPIRATORY PROTECTION

A list of volunteer speakers from the A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee was sent to various technical associations by Mr. R. H. Schutz of the U. S. Bureau of Mines.

REVIEW OF CHAPTER 36 FOR 6TH EDITION OF NATIONAL SAFETY COUNCIL'S ACCIDENT PREVENTION MANUAL

Two members of the A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee, Mr. E. C. Hyatt of the Los Alamos Scientific Laboratory and Mr. W. H. Revoir of the American Optical Company were asked to review Chapter 36, Personal Protective Equipment, for the 6th Edition of the National Safety Council's Accident Prevention Manual. Both Mr. Hyatt and Mr. Revoir reviewed only the section of the chapter that concerned respiratory protective devices. Mr. Hyatt and Mr. Revoir both informed the National Safety Council that the mentioned section was poorly written, contained many errors, omitted many important devices, and thus should be completely rewritten.

REVIEW OF DRAFT OF BRITISH STANDARD RECOMMENDATIONS ON SELECTION, USE, AND MAINTENANCE OF RESPIRATORY PROTECTIVE EQUIPMENT

Copies of Document No. 66/29936 entitled, "Draft of British Standard Recommendations on the Selection, Use, and Maintenance of Respiratory Protective Equipment," written by Sub-Committee PSM/14/1 - Respirators for Protection Against Toxic Chemicals of Technical Committee PSM/14 - Protection Against Toxic Chemicals of the British Standards Institution were sent to members of the A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee for comment. Many members of the Committee had reviewed the mentioned item for other technical organizations. Comments by three persons from the Committee were sent to Commander R. O. E. Caton, Secretary of Technical Committee PSM/14.

REVIEW OF NETHERLANDS MEMORANDUM CONCERNING AEROSOL PARTICULATE FILTERING TYPE RESPIRATORS

Copies of a Netherlands memorandum which discusses possible requirements for aerosol particulate filtering type respirators were sent to members of the A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee for comment. All members of the Committee have not written their comments as yet. Comments from members of the Committee will be forwarded to De Weledelgestrengte Heer Ir. C. H. Buschmann, Directoraat Generaal van de Arbeid, Netherlands.

MISCELLANEOUS

Mr. B. I. Ferber of the Health and Safety Research and Testing Center of the U. S. Bureau of Mines has requested that the A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee discuss the use of a polydisperse DOP aerosol for testing the particulate filtering efficiency of aerosol particulate filtering type respirators designed for protection of personnel against highly toxic airborne particulate and

advise the U. S. Bureau of Mines with regard to this matter. Information concerning the polydisperse DOP aerosol is to be sent to members of the Committee and the members will discuss the matter at the meeting on 1 May 1967.

The A.I.H.A.-A.C.G.I.H. Respiratory Protective Devices Committee plans to sponsor a technical session concerning respiratory protection at the 1968 American Industrial Hygiene Conference. Mr. E. C. Hyatt of the Los Alamos Scientific Laboratory has been appointed the Session Arranger for this technical session.

Respectfully submitted,
W. H. Revoir, Chairman

SECRETARY HOSEY: The report of the Committee on Uniform Methods for Dust Counting was approved. Messrs. Harris, Ayer, Baier, and Davis and Dr. Roach were reappointed to represent A.C.G.I.H. I move the adoption of this report.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded...

Any discussion? All in favor say "Aye." Opposed. The motion is carried.

REPORT OF JOINT A.I.H.A.-A.C.G.I.H. COMMITTEE ON
UNIFORM METHODS FOR DUST COUNTING

1. Activity during the year.

This is an Ad Hoc Committee with the following Bill of Particulars:

"To define the method for optical microscopic counting of impinger dust samples for the evaluation of exposures in terms of the A.C.G.I.H. Threshold Limit Values."

The intent of the Committee was to complete its work during this year with a report to the A.C.G.I.H. and the A.I.H.A. proposing a uniform counting method. This goal has not been accomplished. The Committee met in Pittsburgh, Pennsylvania, on October 20, 1966. Agreement was reached on a number of provisions for a draft of a counting procedure which has been under development since the preceding year. Essential elements of the procedure are specification of microscopic optics, illumination, sampling and dilution medium, and settling time. Except for observer differences, these are believed to be major variables in the present standard method for counting.

A counting experiment was conducted to test the procedure. About 150 counts were made on three samples sent to eight laboratories. Results of the experiment showed substantial variation from the lowest to the highest counts. More work remains to be done before the Committee can report.

Howard Ayer and David Anderson attended the Gordon Research Conference on Metals and Minerals in the Work Environment and reported to the Committee.

2. The Committee has not yet produced material for review or publication.

3. The Committee should continue in its effort to develop a uniform method. It is hoped that it can report to the A.C.G.I.H. and A.I.H.A. before the forthcoming year is out. The Committee proposes to meet at least one more time to criti-

cally review its activity to date, to attempt agreement on some points which remain unresolved, and to develop main elements of its final report.

4. Present Committee membership should continue. In a telephone poll (except to Dr. Roach, who is being asked by letter) all members agreed to continue to serve in the Committee until it can complete its work in the next year. It is recommended that all present members be continued on the Committee. If it pleases the Executive Committees, the present Chairman will agree to serve until the Committee makes its report.

Respectfully submitted,
Robert L. Harris, Jr., Chairman

SECRETARY HOSEY: One more. The Executive Committee approved the report of the Joint Ad Hoc Committee To Develop a Statement on the Use of Threshold Limit Values as the report appeared in the 1966 Transactions. The Secretary-Treasurer was instructed to inform the Board of Directors of A.I.H.A. that it has the permission of this Conference to publish this statement in any suitable medium, preferably the A.I.H.A. Journal. Furthermore, this statement will be considered by the A.C.G.I.H. T.L.V. Committee, who will be instructed to use any or all of the statement they so desire. The Executive Committee of A.C.G.I.H. abolishes this Ad Hoc Committee with thanks. I move the adoption of this report.

...The motion was seconded...

CHAIRMAN DUGUID: There is a second. Any discussion? All in favor say "Aye." Opposed. The motion is carried.

SECRETARY HOSEY: The Executive Committee received reports from representatives on several committees, and since these are not printed in the Transactions I do not think there is any action necessary and these are just for informational purposes.

Mr. Chairman, that concludes the committee reports.

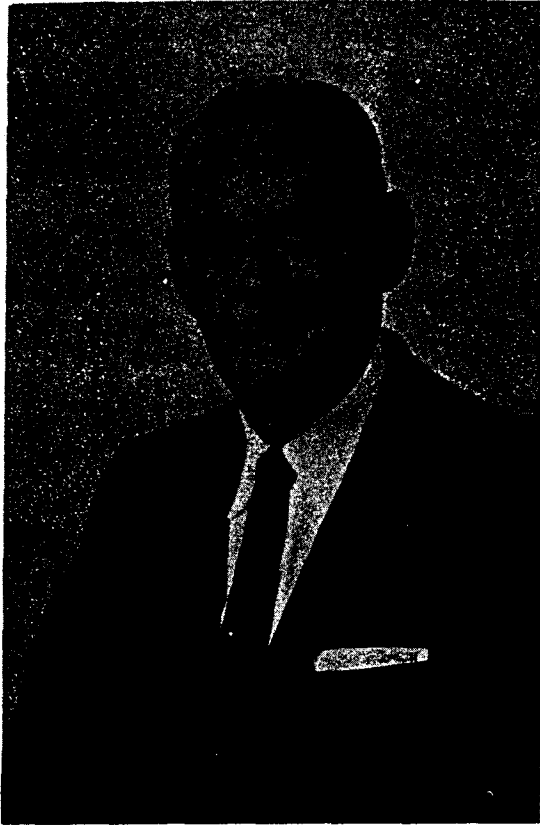
CHAIRMAN DUGUID: Thank you very much, Andy. It was a good job.

At this Business Meeting we normally have the report of the Awards Committee. The Chairman of this Committee, Mr. Lynn Schall, has informed me that there is no Meritorious Achievement Award this year. At this time he would like to make a comment. Lynn.

MR. SCHALL: Mr. Chairman, ladies and gentlemen. The members of the Award for Meritorious Achievement Committee are Miss Victoria Trasko, Miss Elizabeth Neubert, who recently passed away, Dr. Herv Elkins, Dr. Carl Nau, and myself. We planned a meeting in Paris, France to choose a recipient for the award, but too few of our members were able to get away. We didn't bother asking Andy for necessary funds. We then reported that there would be no award this year, but for obvious reasons this was not true and we do have a recipient.

Some accomplishments by their nature are spectacular -- a new discovery, a brilliantly conceived study. But the achievements that contribute most consistently and solidly to the march of scientific and professional progress are those involving a high level of inconspicuous but dedicated, competent performance.

The person we honor today is one of these unsung heroes. In his characteristic fashion of quiet, excellent performance, he has left his mark in areas of activity



that have been milestones in the progress of occupational health, contributing not only to new knowledge but also to the training of new generations of investigators.

Today we pay particular tribute to him for the additional responsibility which he has carried during the past six years in furthering the pursuit of excellence through organized activity. He has worked cheerfully and tirelessly, refusing to let his enthusiasm or energy be diminished, even under the trying circumstances of eye operations and other health problems. Under his leadership, the organization now has grown to a membership of nearly 1,000 and has broadened the scope of its activities. It has truly assumed a new dimension in professional responsiveness and has gained increased stature as a leading organization in the field of occupational health.

The powerhouse behind this development also tempers efficiency with great understanding and tolerance for the problems of his colleagues. So this award today is given in a spirit of both well-earned admiration and affection.

The organization which has benefited so tremendously from the efforts of this individual is, needless to say, the American Conference of Governmental Industrial Hygienists. And, at this point, it is even more gratuitous to say that the recipient of this year's award is our beloved Andy Hosey. (Standing Ovation)

SECRETARY HOSEY: This is really a complete surprise, I assure you. I am really at a loss for words and I don't know how in the world the Committee did all this because I get the mats for all of these plaques. Gosh, I surely do appreciate this and, as you know, no individual can make all of these accomplishments that Lynn enumerated without the assistance of many, many other people, and I do sincerely appreciate all of the help that I have had during this past six years. Thank you. (Applause)

CHAIRMAN DUGUID: Finally, Mr. Normal Schell would like to make an announcement.

MR. SCHELL: Thank you. This announcement is specifically for the administrators of either State or local industrial hygiene agencies. Those of you who attended the seminar in Norman, Oklahoma will remember that it was the expressed desire of that group to meet sometime during this meeting to consider whether or not they would be interested in forming an association of administrators.

Following that meeting I discussed this matter briefly with Mr. Howard Kusnetz as to whether or not we could obtain time and space at this Conference for a brief meeting. Howard, however, has been transferred to another activity and in the

meantime we sort of lost view of this intent, but at a late date we were able to obtain the cooperation of the hotel here who have promised us the use of the Washington Room this evening from 7:00 to 8:00 p.m. Now, any of you who are interested in furthering this particular group can meet at this time and discuss your interest. Thank you.

CHAIRMAN DUGUID: There being no other business, this meeting is adjourned until 11:00 o'clock tomorrow.

...Adjourned at 12:30 p.m....

SECOND BUSINESS SESSION - May 2, 1967

The second business session was called to order at 11:00 a.m.

CHAIRMAN DUGUID: Ladies and gentlemen, I would like to ask you to take your seats so we can start the second business session. We are already behind time so we should get going quickly.

I would like to call this meeting to order. The first order of business is the presentation of resumes of round table discussions. The first will be by Mr. Robert Keenan, who will report on the Chemists' Round Table. Robert.

MR. KEENAN: Thank you, Mr. Chairman. This year we had a pretty small turnout of chemists for the round table discussion, and coupled with that situation, those who did appear at 9:00 a.m. for the opening of the Round Table decided that there were quite a number of topics on the agenda for the Engineering Round Table that they were vitally interested in because they related to their work, so we joined with the engineers for the morning session. I feel that we got a lot out of it as chemists. I hope that the little contributions we were able to make were useful to the engineers.

I am personally a great one for the engineers and the chemists getting together more often than they have in the past. I like it in connection with our training, and I have always been an advocate of it in field work because I think both disciplines can benefit from a mutual exchange of information.

I would like to suggest at this point that further consideration be given to this in scheduling the Round Tables for next year where at least perhaps part of the day be spent as a group. I don't know how the engineers feel about this, but I would like to get this opinion expressed, at least, that we consider it for the future.

During the afternoon the chemists met separately and we discussed a number of topics that had been submitted by our colleagues in the field. We discussed in considerable depth such things as the present status of atomic absorption. I think there was general agreement among the group that the Perkin-Elmer Instrument is still the preferred instrument, by at least the people present at the session, because of its double beam design and the relative stability imparted to that instrumentation by that double beam principle.

We discussed numerous applications of atomic absorption that are now being used in support of our industrial health studies, and the great speed and the relative freedom from interference of quite a few otherwise difficult chemical determinations, cases in point being that it is now very simple to have a selenium or tellurium determination as contrasted with the old chemical methods which have diverse chemical interferences and we ran into many hours and sometimes days of chemical manipulations before a final result could be obtained.

We discussed the Orion fluoride electrode which some of us are using to considerable advantage for the direct determination of a fluoride ion in either solubilized air samples or in diluted urine samples. Other electrodes are coming on the market for direct analysis. One other example of this is one for calcium which, of course, speeds up that determination rather considerably.

We got into a discussion of ozone analysis for a while. One of our participants mentioned that by using deionized water rather than just strictly glass distilled sources of water, he had been able to reduce his reagent blank for ozone in his analytical work.

There was quite a lengthy discussion of the ability, analytically speaking, to distinguish between ammonia and monoethanolamine. A number of suggested techniques were offered although nobody present had had any direct experience with this. It was pointed out that there is now commercially available a column material for the gas chromatographic separation of these substances that have been reported in the commercial literature and this might be well worth looking into.

We got into our annual discussion of gas detecting tube devices and the apparent improvement in some areas of at least, shall we say, the literature that is being disseminated by the suppliers nowadays to give the user a little better idea of acknowledgement of interferences, and also the provision by some of correction factors for flow characteristics of the devices that are now being used. It has been often agreed that a lot of work needs to be done in this area, and we feel that considerable testing and evaluation should be instituted along this line in order to improve the general situation. Thank you, Mr. Chairman.

CHAIRMAN DUGUID: Thank you, Mr. Keenan. The presentation of the Engineers Round Table will be given by Mr. Paul Brandford of the California State Health Department. Mr. Brandford.

MR. BRANDFORD: The Engineering Round Table started off at 9:00 o'clock in the morning together with the chemists, as was mentioned earlier. It started off with about 17 and grew to around 30 or 35 by the time we closed for the morning. The afternoon attendance was fairly well the same thing.

We started off with a number of topics. We discussed the question of ozone, the use of ozonators in walk-in meat boxes. We were questioning the value of them related to the potential hazard involved. It was mentioned that Detroit is controlling some of their problems with ozonators by the use of a fumigation ordinance.

We had some other discussions on ultraviolet light and the problems of noise and ultraviolet light in teenage night clubs and discotheques and the use of black light and the psychedelic effects for hippie joints. As an aside, this always amuses me that it seems like we always have another term in California for something which everyone else has a common term for. The hippie joint is a very fully accepted term in California. In Philadelphia they reported noise levels which they had taken in discotheques and they found them within allowable limits.

There was some discussion of possible problems of ozone with electrostatic copiers, and some problems of analysis of ozone at the one-tenth part per million level. The Drager tubes were discussed and described to be adequate, but there were some problems in reading them.

We discussed the problems of applying the ceiling TLV on formaldehyde where the problem usually occurs in peaks of concentrations and our sampling procedures are only able to give us the averages. Where we find conditions where we have problems with our average we are not able to get above 3 parts per million in many cases. Also there was the question of the appropriateness of the TLV at the 5 parts per million level. Also, there were other problems that people did have of reacting to formaldehyde below the TLV. Also the question of the relationship between the TLV concentration and the humidity in the air was brought out.

We migrated toward the question of irritating dust and the use of durable press garments. We then discussed the problem of oil mist where oil mist occurs together with the vapor. It was agreed that the TLV on oil mist is only covering the particulate material and not the vapor, and that perhaps the use of the applicability of the TLV is questionable in all situations.

Questions were raised about the carcinogenicity of nickel dust and we had some discussion on nickel oxide. Later there were questions of simultaneous exposures to oxides of nitrogen and cadmium fume where both produced a delayed response, which is somewhat similar. The question of separating out which is which was raised. Someone brought up several cases of edema and one death that were attributable directly to oxides of nitrogen. We also discussed some of the aspects of cadmium poisoning deaths as reported in California.

Later in the afternoon we talked about carbon monoxide and the use of continuous recording equipment. We agreed that more data on the nature of carbon monoxide exposure in garages and related exposures should be obtained. We can then increase our knowledge with some of this recording equipment. Mr. Buckwalder of Alberta discussed the study that they were doing in his area where they were measuring the blood CO in about approximately 400 men, service station operators, and they were doing this because in Alberta where it is considerably colder the garages were quite tightly closed and carbon monoxide was a problem. The survey shows that most garage workers were within acceptable limits, although perhaps 5 per cent were at blood saturation levels of 15 per cent oxyhemoglobin. This level might represent a problem.

Questions of lasers were brought up and whether or not lasers were properly the responsibility of the industrial hygiene staff or the physics staff. Naturally we all rallied and insisted that it was the problem of the industrial hygienists partially because of their background and the fact that industrial hygienists were there and filling this gap. Also, the fact that lasers are often used with chemicals and other materials which are of interest to the industrial hygienist, or within his range of responsibility.

Questions were brought up on calibration of radio frequency meters, and there was an agreement that there is a need for some conformity on the calibration of these meters.

Mr. Baier presented a discussion on free silica analysis in mixed dust which will appear in the Transactions (see Appendix B). The summary of his discussion is that of 16 labs that produced acceptable analyses, 12 use wet chemical methods and 4 use x-ray methods. The two methods agreed fairly well in mean silica concentrations, but the ranges were greater for the chemical method. When the TLV formulas applied to low silica dust, that is those below, less than 5 per cent quartz, the TLV in the million particles per cubic foot range takes quite a jump and may differ by as much as ten million particles of silica at the extremes of the range.

We closed with a discussion of changing the time for the Round Tables and although we had no consensus, the majority expressed opinions seeming to favor a time change; for example, Monday evening. There was a suggestion that we recontact the officers of the Conference to express our opinion and ask for a change.

CHAIRMAN DUGUID: Thank you very much, Mr. Brandford.

The resume of the Inter-Disciplinary Round Table will be given by Dr. Marcus Key.

DR. KEY: Mr. Chairman, the Inter-Disciplinary Round Table, consisting of five physicians and one nurse, met in morning and afternoon sessions. Discussed topics included occupational health programs for hospitals and airports, pulmonary irritation from hydroscopic borate and calginate dusts, and the need for specific Threshold Limit Values for these dusts, and the advantages and disadvantages of replacing workmen's compensation by comprehensive medical coverage. Thank you.

CHAIRMAN DUGUID: Thank you, Dr. Key.

At this point I would like to ask if there is any old business that anyone desires to bring up at this point. Mr. Berghout.

MR. BERGHOUT: I wonder if it is possible to consider having these round tables integrated with A.I.H.A. They have a similar group of discussions which the people like to make. I wonder why they couldn't be incorporated with A.I.H.A. Is this the place to bring it up, or under new business?

CHAIRMAN DUGUID: Well, this might be a suggestion that could be turned over to the Round Table group.

SECRETARY HOSEY: The Program Chairman, Mr. Baier.

MEMBER: Mr. Chairman, Mr. Keenan mentioned yesterday, and I would like to also make the point, that these are not closed meetings by any means and any member of A.I.H.A. who can attend is perfectly welcome to attend and to contribute, whether or not he is a member of A.C.G.I.H.

CHAIRMAN DUGUID: In other words, in effect you are saying it is already open to them.

MEMBER: Yes. Of course the time period is such that only a few A.I.H.A. members are at the Conference when the Round Tables are held.

MR. BERGHOUT: Monday night wouldn't be good for them because they would be coming in.

CHAIRMAN DUGUID: Is there any other old business?

MR. BERGHOUT: There is quite a lot of duplication in these committees. I suggest there might be a possibility of combining the Codes and Regulations Committee with Legislation and perhaps one other to take care of all business of that type.

CHAIRMAN DUGUID: Andy tells me that the Legislation Committee has been disbanded.

MR. BERGHOUT: Well, items that come within that purview. You would not have to make it Codes and Regulations; you could make it some other.

Also I notice you have a group working on Nonionizing and Ionizing Radiation. We wrote a Laser Guide. Why didn't we write that one?

CHAIRMAN DUGUID: I am sure that we will never achieve the point where we will not be writing guides. Do you desire to make a motion on this at all, or is this just a comment?

MR. BERGHOUT: I make a motion that consideration be given to the possibility of combining those disciplines or whatever you want to call them into a single one so that we won't have so many.

CHAIRMAN DUGUID: Is there a second? I guess there was no second.

Is there any other old business?

Is there any new business? If not, although Andy mentioned this yesterday, I would like in my capacity as Chairman and on behalf of the entire organization to extend

to both Mr. Bernard Bloomfield and Dr. Jan Lieben, who served three years on the Executive Committee, who are leaving the Executive Committee this year, our gratitude for the important contributions that both of them have made during the three years of their service. Thanks to both of you, if you happen to be here.

I skipped one. I would like to ask for the report of the Committee on Resolutions. The Chairman is Mr. Lynn Schall.

MR. SCHALL: Mr. Chairman, the Committee, consisting of Miss Victoria Trasko, Dr. Curtis P. McCammon and myself have the following two Resolutions:

Resolution Number 1. In Memoriam.

The Conference has suffered the loss through the death of three of its members during the past year, Miss Elizabeth Neubert, formerly with the Tennessee Department of Public Health; Mr. James B. Wynn of the Middletown Department of Health in Connecticut; and Mr. Floyd A. Robillard, of the New York State Department of Labor. Each will be remembered through her or his individual professional contributions and through the heritage of her or his association with fellow members.

Be it Resolved, that the Conference express this sense of loss and sympathy by the inclusion of this in memoriam statement in the minutes of the Twenty-ninth Annual Meeting of the Conference and by sending a letter expressing this loss to the families.

Resolution Number 2.

Whereas, the success of our Conference depends upon proper planning and indeterminate coordination and the smooth execution by many individuals;

Be It Resolved, that the membership of the American Conference of Governmental Industrial Hygienists express its appreciation to the General Conference Committee for its high achievement in making the 1967 Conference outstanding and successful.

I move the adoption of these two Resolutions.

CHAIRMAN DUGUID: Is there a second?

...The motion was seconded.

Is there any discussion? All in favor say "Aye." Opposed. The motion is carried.

Yesterday Andy also told us that Mr. Edward Baier is the Chairman-Elect for the coming year and in that capacity he will serve as the Chairman of the Program Committee.

Now before turning the meeting over to the new Chairman, Mr. Henry Doyle, I would like to express my appreciation to everyone who has contributed to making the past year a successful one for A.C.G.I.H. It has indeed been a privilege to serve as your Chairman. It has been an enlightening experience. Thank you all very much.

Henry, I would like now to turn the Chair over to you. (Applause)

CHAIRMAN DOYLE: Thank you, Bob. I really appreciate the confidence that you have placed in me by electing me as your Chairman for the coming year. This is the 25th meeting of the A.C.G.I.H. that I have had the privilege of attending. The first one was in St. Louis in 1942.

It has been disappointing in some respects to see the number of people attending the A.C.G.I.H. meetings go down, and I look around and I see a few faces that attended that meeting some twenty five years ago with me. On the other hand, it has been very gratifying to see the progress that has been made in A.C.G.I.H. We have grown from a very small organization in 1938 to a very sizable one. I think the membership is now over 900 people. It is also gratifying to see the tremendous amount of work that this organization has done over this quarter century, and it is gratifying to see at our annual sessions such a large number of people attending. I think our meetings are attended by many more people from outside A.C.G.I.H. than inside it. I think this bespeaks the quality of programs that we have been able to put on over the history of the organization. Frankly, I think our programs have been much more interesting in many respects than our competitor, if you wish to call it that, the American Industrial Hygiene Association. Certainly they have covered, I think, a much broader range of interest.

In the forthcoming year there are three things that I hope I shall be able to start:

One. There has been, and this has been commented on very frequently, a gradual decline in our State programs. I hope that I can interest A.C.G.I.H. in a program of strengthening our State and local health departments and labor departments in the field of occupational health.

Secondly, I hope that I can start a program of reexamining our goals and our missions in A.C.G.I.H. We have been in business some thirty years. With the changing times that we are facing, I wonder if it is not time to sit down and look at our goals and missions as they apply to the present day situation.

Thirdly, at this Conference there has been a great deal of comment on the need for a National Conference on Occupational Health. I hope by working with the Executive Committee and the organization that we can play some part in helping to get a National Conference on Occupational Health.

Finally, it is a great pleasure of the incoming Chairman to express the appreciation of the organization to the outgoing Chairman. I have worked with Bob Duguid over the past year. I know the great deal of effort that he has put into the job of serving as your Chairman. I know he has done this with a great deal of devotion, a loss of time to his own organization as well as to his personal recreation, and it is my pleasure, Bob, at this time to present to you on behalf of the American Conference of Governmental Industrial Hygienists this plaque which goes from the organization to you with a great deal of respect and a great tribute for the efforts that you have put in during the last year. My congratulations. (Applause)

DR. DUGUID: Thank you, Henry, very much.

CHAIRMAN DOYLE: The Chair will entertain a motion for adjournment.

MEMBER: So moved.

MEMBER: I second it.

CHAIRMAN DOYLE: We stand adjourned.

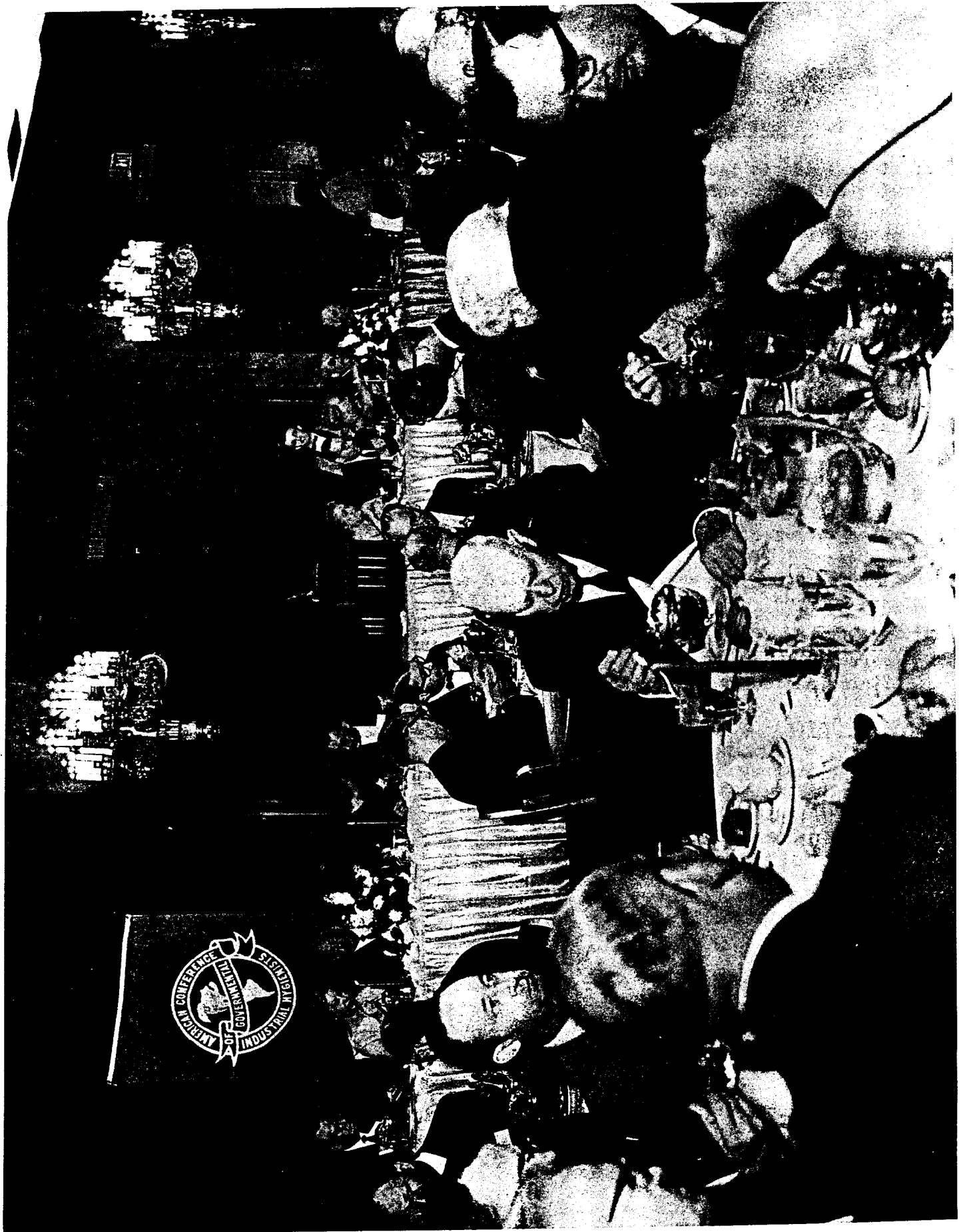
...Adjourned at 11:45 a.m...



Mr. Henry Doyle (right), Chairman, presents plaque to Dr. Robert Duguid, Past-Chairman, in appreciation for his numerous contributions while serving as Chairman of the Conference during 1966-67.



Dr. Sven Forssman, Director, National Institute of Occupational Health, Stockholm, Sweden, was guest speaker at the annual ACGIH banquet. Over 100 members and guests were present.



APPENDIX A

PROPOSED GUIDE FOR UNIFORM INDUSTRIAL HYGIENE CODES
OR REGULATIONS FOR LASER INSTALLATIONS*

SECTION 1. Scope and Purpose

- a. This guide is intended to identify certain dangers common to all types of lasers (or optical masers) and to protect the safety and health of workers using them as well as to provide for the safety and health of other persons likely to be exposed to their radiations and associated hazards.
- b. This guide does not limit the intentional exposure to laser radiation for the purpose of performing medical, surgical, and dental procedures.
- c. For the purpose of this guide the word laser shall include coherent light sources emitting visible, infrared, and/or ultraviolet light. Although very high power or energy densities have been known to produce ionization in the air and other materials, laser radiation should not be confused with ionizing radiation (i.e., x-rays and gamma rays).

SECTION 2. Definitions and Abbreviations

- a. Angstrom (Å) - a unit measure of wavelength equal to 10^{-10} meter or 0.1 millimicrons.
- b. Beam divergence - angle of beam spread measured in milliradians (1 milliradian = 3.4 minutes of arc).
- c. Closed installation - any location where lasers are used which will be closed to personnel when a laser is operating. Useful adjuncts thereto are remote control firing and television monitoring of the target area.
- d. c.w. laser - a continuous wave laser, as distinguished from pulsed lasers.
- e. Decibel (dB) - a unit used to express a beam intensity ratio. The decibel is equal to ten times the logarithm of the beam intensity ratio expressed by the following equation:

$$n(\text{dB}) = 10 \log_{10} \frac{(P_1)}{(P_2)}$$

where P_1 and P_2 designate two amounts of power density or energy density and n the number of decibels corresponding to their ratio.

- f. Energy Density - the intensity of electromagnetic radiation per unit area per pulse expressed as joules per square centimeter (j/cm^2).
- g. Gas laser - a type of laser in which the laser action takes place in a gas medium, usually a c.w. laser.

*NOTE: If no comments from members of A.C.G.I.H. are received by December 1, 1967, this proposed guide will be submitted for approval as a guide.

- h. Joule (j) - a unit of energy used in describing a single pulsed output of a laser, it is equal to one watt-second or 0.239 calories.
- i. Joule/cm² (j/cm²) - a unit of energy density used in measuring the amount of energy per area of absorbing surface, or per area of a laser beam. It is a unit for predicting damage potential of a laser beam.
- j. Laser - Light Amplification by Stimulated Emission of Radiation, sometimes referred to as an optical maser.
- k. Maser - Microwave Amplification by Stimulated Emission of Radiation. When used in the term optical maser, it is often interpreted as molecular amplification by stimulated emission of radiation.
- l. Maximum Permissible Power- or Energy-Density - the intensity (power density or energy density) of laser radiation that, in the light of present medical knowledge, is not expected to cause detectable bodily injury to a person at any time during his lifetime. The maximum permissible levels for occupational exposures are listed in Table II, page 111.
- m. mm.Hg. - millimeters of mercury, a unit of gas or air pressure (e.g. one atmosphere = 760 mm. Hg., or 29.92 in. Hg.).
- n. Open installation - any location where lasers are used which will be open to operating personnel during laser operation and may or may not specifically restrict entry to casuals.
- o. Optical density (O.D.) - a logarithmic expression of the attenuation afforded by a filter.
- p. Optically pumped lasers - a type of laser that derives energy from a non-coherent light source such as a xenon flash lamp as a general rule (coherent light sources have also been used). These lasers are usually pulsed and are commonly called solid-state lasers.
- q. Output power and output energy - power is used primarily to rate c.w. lasers since the energy delivered per unit time remains relatively constant (output measured in watts) in contrast, pulsed lasers deliver their energy impulses in pulses and their effects may best be categorized by energy output per pulse. [The power output level of c.w. lasers is usually expressed in milliwatts (mW = 1/1000 watt) or watt range, pulsed lasers in the kilowatt range (kW = 1000 watts), and q-switched pulsed lasers in the megawatt (MW = million watts) or gigawatt range (GW = billion watts)] . Pulsed energy output is usually expressed in joules per pulse.
- r. pO₂ - partial pressure of oxygen. [At sea level oxygen exerts a partial pressure of 159 mm. Hg. This equals 760 (mm. Hg. air pressure) x 0.2096 (the O₂ content of the air)] .
- s. Power density - the intensity of electromagnetic radiation per unit area expressed as watts/cm².
- t. Pulsed laser - a laser that delivers its energy in short pulses, as distinguished from a c.w. laser.
- u. Pulse length - duration of a pulsed laser flash, it may be measured in terms of millisecond (msec. = 10⁻³sec.), microsecond (μsec. = 10⁻⁶sec.), or nanosecond (nsec. = 10⁻⁹sec.)

- v. P.R.F. laser - a pulsed recurrence frequency laser which is a pulsed-type laser with properties similar to a c.w. laser if the frequency is very high.
- w. Q-switched laser - also known as Q-spoiled - is a laser capable of extremely high peak powers for very short durations (pulse length of several nanoseconds).
- x. Semi-conductor or junction laser - a class of lasers which at present produce relatively low c.w. power outputs. This class of lasers may be "tuned" in wave lengths and are most efficient. (It is anticipated that higher power outputs will be made available through future developments.)
- y. Solid-State laser - a type of laser which utilizes a solid crystal such as ruby, or glass. This type is most commonly used in pulsed lasers.
- z. Watt (W) - a unit of power used in describing a c.w. laser output.
 - a.a. Watt/cm² - a unit of power density used in measuring the amount of power per area of absorbing surface, or per area of a c.w. laser beam.

SECTION 3. General Requirements for Safety

- a. The exposure of personnel to the direct beam of conventional pulsed lasers shall be expressly forbidden if the levels exceed those in Table II. The hazard from these lasers is present only when the capacitor bank is being charged and the laser fired, the type of hazard for pulsed, single-shot operation is similar for lasers at all wavelengths in the ultraviolet, visible, and infrared regions.
- b. Continuous lasers and high pulsed recurrence frequency lasers have common problems in the prevention of persons from entering a hazardous area and in the location of personnel in these areas. The problem is particularly acute with lasers operating in the ultraviolet and infrared, or visible, portions of the spectrum. Under these circumstances, the laser area must be considered hazardous at all times - in a similar manner to radioactivity hazardous areas.
- c. Exposure to the eye is to be avoided at all installations. The thresholds for biologic damage at the retina of the eye, derived from experimental work on animals, are given in Table I. Exposure to low powered lasers shall not be permitted when levels at the cornea of the eye exceed the values in Table II.

Table I

<u>Type</u>	<u>Wave-Length</u>	<u>Pulse Duration</u>	<u>Level</u>
Non-Q-switched	6943 ⁰ _A	200 μ sec	0.42 j/cm ²
Q-switched	6943 ⁰ _A	30 nsec	0.035 j/cm ²
c.w.	White Light	-	1.33 W/cm ²

TABLE II

Maximum Permissible Exposure Levels for Laser Radiation at the Cornea for
Direct Illumination or Specular Reflection at Wavelength = 6943 Å

	<u>Q-SWITCHED PULSE (j/cm²)</u>	<u>NON-Q-SWITCHED PULSE (j/cm²)</u>	<u>CONTINUOUS WAVE LASER (W/cm²)</u>
Daylight 3 mm pupil	5.0 x 10 ⁻⁸	5.0 x 10 ⁻⁷	5.0 x 10 ⁻⁶
Laboratory 5 mm pupil	2.0 x 10 ⁻⁸	2.0 x 10 ⁻⁷	2.0 x 10 ⁻⁶
Night 7 mm pupil	1.0 x 10 ⁻⁸	1.0 x 10 ⁻⁷	1.0 x 10 ⁻⁶

These levels can be adjusted for other wavelengths by using the graph of energy transmitted to, and absorbed at, the retina (Figures 1a and b), and by normalizing the curve (Figure 1b) at $\lambda = 6943\text{\AA}$. Figure 1a should be used for pulsed lasers and Figure 1b for c.w. lasers. However, under no circumstances should the adjusted levels exceed the corresponding levels in Table II by a factor greater than ten. Maximum permissible exposure levels for the skin should not exceed the daylight levels for the eye (Table II) by a factor of more than 10⁶ except for types producing ultraviolet. The latter may require careful control of reflected radiation to limit exposure to ultraviolet radiation. Effects are additive and tolerance levels are therefore hard to determine since previous exposures would have to be taken into account.

- d. Control of occupational hazards incidental to the use of lasers shall be aimed at maintaining exposures to less than the limits specified in Table II. Potential occupational hazards include damage to the eyes, skin and other human organs; burns from contact with liquid nitrogen, helium, or other substances used as coolants; electrical shock; exposure to gases such as bromine, carbon dioxide, carbon monoxide, hydrogen cyanide, chlorine, and ozone as well as the vapors of lead and mercury that may tend to accumulate as the result of laser operation; and explosions at capacitor banks, optical pump systems, and target areas. The toxicology of the gases, vapors, and other materials to be used in any laser system should be investigated prior to their use as a laser media.
- e. Hazardous materials shall be properly identified, labeled, and kept in adequate containers.
- f. Only properly indoctrinated persons shall be placed in charge of laser installations and projects. Control of laser hazards should be under the supervision of a safety director, safety committee, or both.
- g. A complete safety system shall be maintained for the protection of operating personnel and such other persons as may be required to be present at laser installations. Provision of a closed installation is desirable. However, the equivalent of a closed installation can be achieved by installing a laser in a light proof enclosure. The use of secondary precautionary barriers, in addition to room-entry interlock techniques, may be used in the form of white tape marking for c.w. lasers and P.R.F. lasers to limit accidental exposure. A monitoring technique similar to that used for radioactivity may also be employed with these lasers particularly those operating in the invisible portion of the

Figure 1a

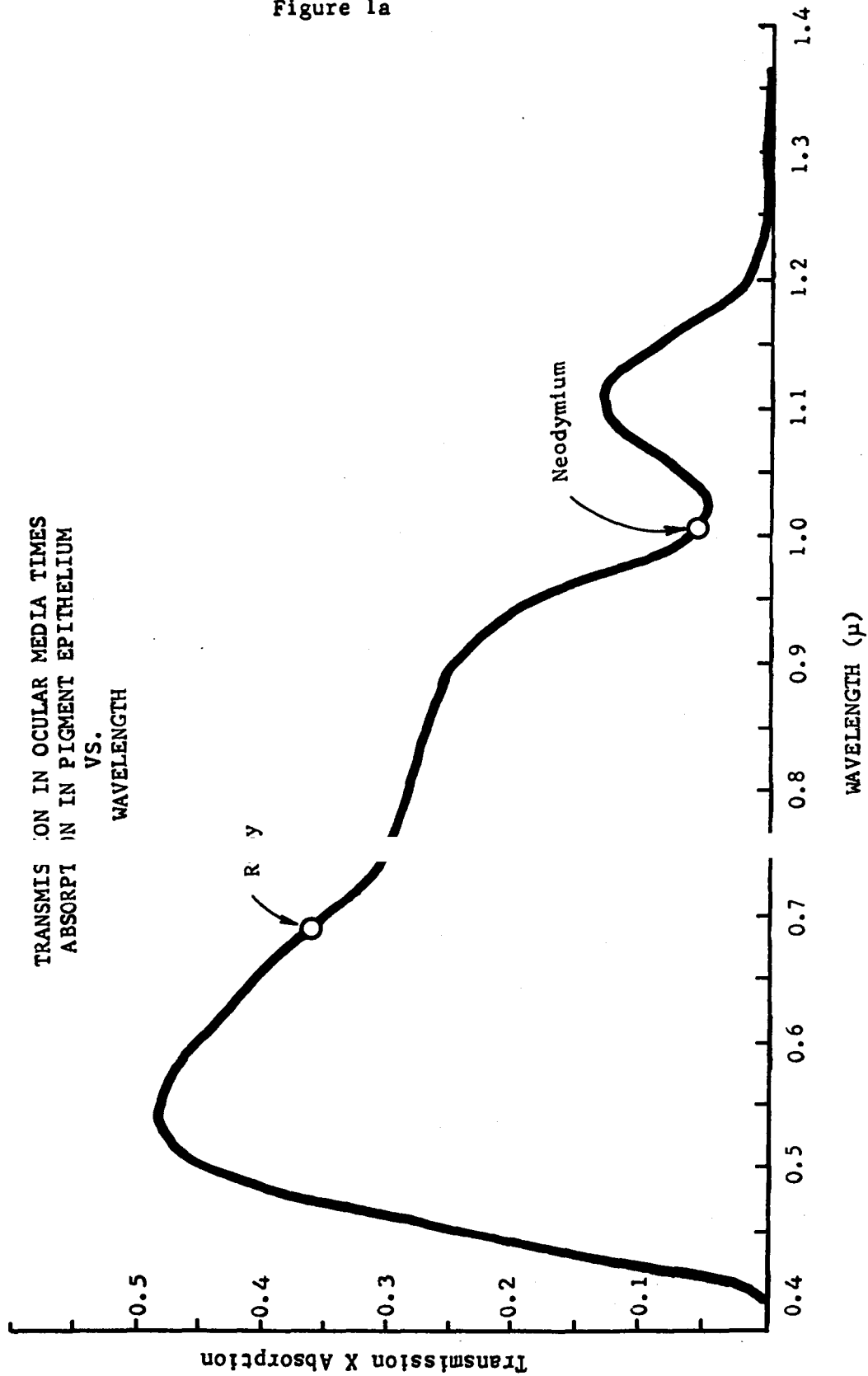
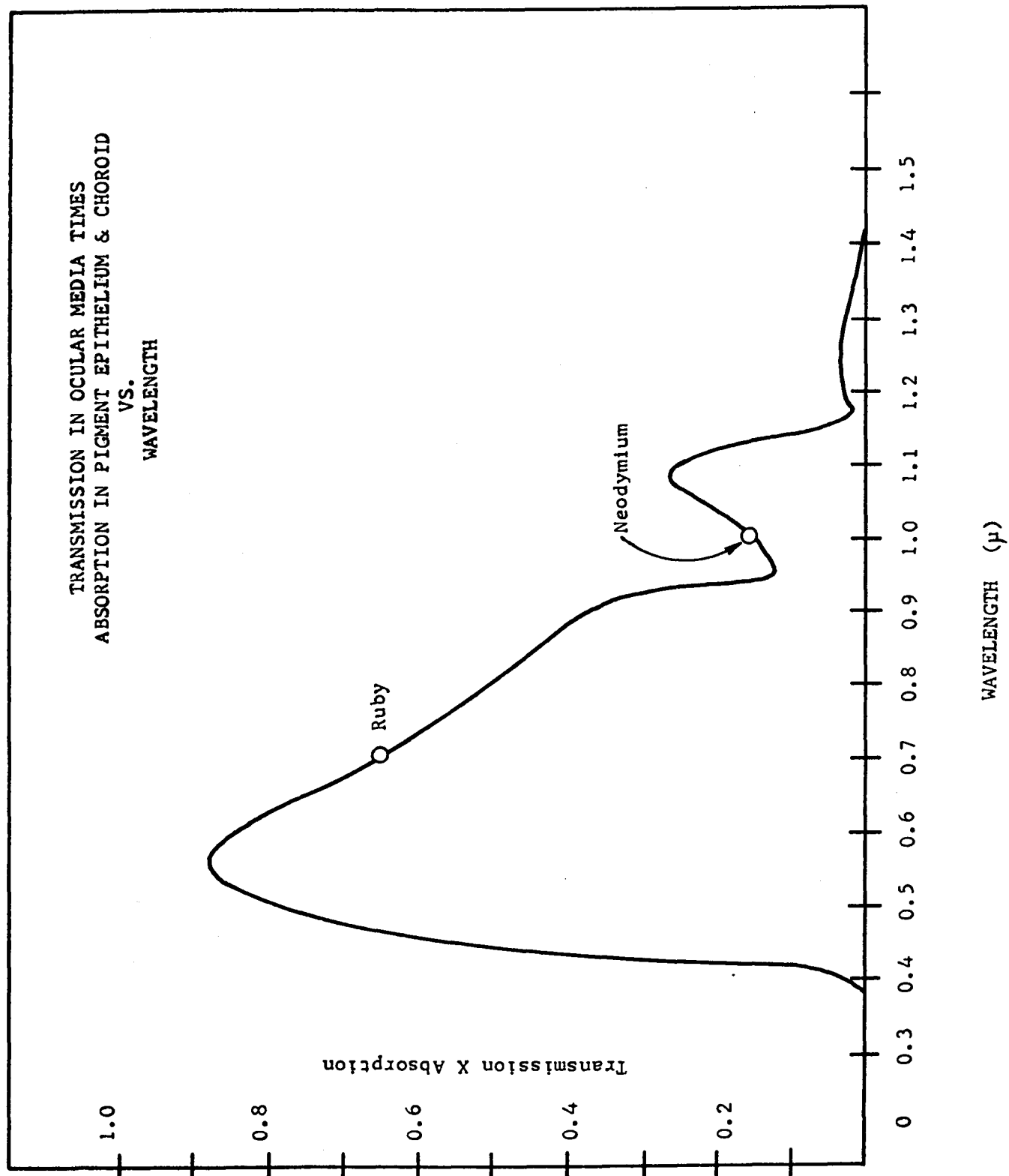


Figure 1b



spectrum. This technique may include use of area detectors and survey detectors. Thermocouples will readily detect mW/cm^2 and thermopiles microwatts per cm^2 . For CO_2 lasers, Thermofax paper changes color to brown at energy densities in the order of one j/cm^2 . In general the following precautions shall be observed:

(1) General Precautions (Common to Every Laser Installation)

- (a) Personnel should not look into the primary beam or at specular reflections of the beam when power or energy densities exceed the permissible exposure levels.
- (b) Avoid aiming the laser with the eye to prevent looking along the axis of the beam, which increases the hazard from reflections.
- (c) Work with lasers should be done in areas of high general illumination to keep pupils constricted and thus limit the energy which might inadvertently enter the eyes.
- (d) Safety eyewear designed to filter out the specific frequencies characteristic of the system affords partial protection. Safety glasses should be evaluated periodically to insure maintenance of adequate optical density at the desired laser wavelength. There should be assurance that laser goggles designed for protection from specific lasers are not mistakenly used with different wavelengths of laser radiation. Distinctively colored frames are recommended and the optical density should be shown on the filter. Laser safety glasses exposed to very intense energy or power density levels may lose effectiveness and should be discarded (see Section 4).
- (e) The laser beam shall be terminated by a target material that is non-reflective and is fire resistant; and an area shall be cleared of personnel for a reasonable distance on all sides of the anticipated path of the beam.
- (f) Avoid electrical shock from the potentially dangerous electrical sources of high and low voltage.
- (g) Special precautions should be taken if high voltage tube rectifiers (over 15 KV) are used because there is a possibility that x-rays will be generated.

(2) Specific Precautions (Applicable to High Powered Pulsed Lasers)

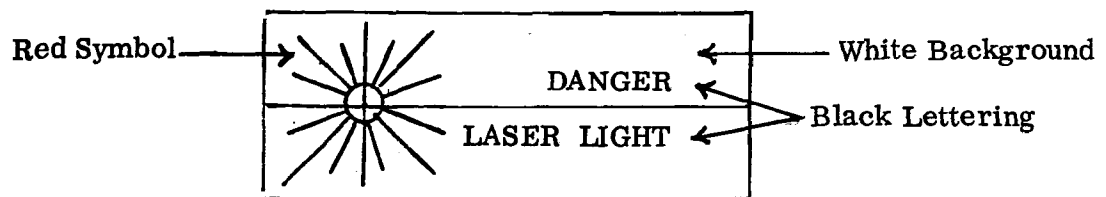
- (a) Safety interlocks at the entrance of the laser facility shall be so constructed that unauthorized or transient personnel shall be denied access to the facility while the laser power supply is charged and capable of firing.
- (b) Laser electronic-firing systems shall be so designed that accidental pulsing of a stored charge is avoided. The design shall incorporate a "fail-safe" system.
- (c) An alarm system including a muted sound, flashing lights (visible through laser safety eyewear) and a countdown procedure shall be used once the capacitor banks begin to charge.

- (d) Installations using liquid gas coolant shall be adequately ventilated. Water-cooled lasers are preferred. Refer to Section 5.
 - (e) Walls and ceilings shall be painted with nongloss paint to produce a diffuse surface. Diffuse black is preferred in the target area, and a light color in the surrounding area to maximize the lighting distribution from general lighting fixtures.
 - (f) Solid-state lasers should be operated by remote control firing with television monitoring, if feasible. This eliminates the need for personnel to be physically present in the same room. An alternative is to enclose the laser, the associated beam, and the target in a light-tight box.
- (3) Specific Precautions (Applicable to Low Powered c.w. Gas and Semi-Conductor Laser Systems)*
- (a) General precautions with reference to aiming and the avoidance of specular reflection shall be observed.
 - (b) The laser beam should be terminated by a target material that is a diffuse matte of such color or reflectivity to make positioning possible but should minimize the reflection.
 - (c) Reflective material should be eliminated from the beam area, and good housekeeping should be maintained.
 - (d) High power (watt range) CO₂ infrared (10 microns) lasers shall be operated with utmost precaution because the hot beam is invisible and because of the added fire hazard if this hot beam is directed toward a flammable target.
- (4) Carbon Dioxide - Nitrogen (CO₂-N₂) Gas Lasers.
- (a) The principal hazard associated with the CO₂-N₂ lasers is the fire hazard. A sufficient thickness of firebrick or asbestos should be provided as a backstop for the beam.
 - (b) The laser assembly should be constructed of a material opaque to ultraviolet light generated by the gas discharge. Quartz tubing transmits ultraviolet light, whereas certain heat-resistant glass tubing is reasonably opaque at this part of the spectrum.
 - (c) Reflections of the infrared laser beam should be attenuated by enclosure of the beam and target area or by eyewear constructed of a material, such as plexiglass, opaque to the CO₂ wavelength.
- (5) Specific Precautions for Outdoor Laser Installations
- (a) Personnel shall be excluded from the beam path at all points where the power or energy exceed the permissible limits. This shall be accomplished by the use of physical barriers, administrative controls, the use of interlocks and by limiting the beam traverse.

* High Powered Gas and Semi-Conductor Lasers are to be treated as Pulsed Lasers.

- (b) The tracking of non-target vehicular traffic or aircraft, whether intentional or inadvertent, shall be prohibited within the calculated hazardous areas.
- (c) Operation of laser systems while it is raining or snowing or when there is dust or fog in the air should be avoided.
- (d) The path covered by the beam shall be cleared of all objects capable of producing reflections that are potentially hazardous. Concentrated light intensities generated by some lasers can be delivered over considerable distances (miles). Although these effects can be used to good advantage, they are potentially dangerous and shall be given adequate consideration.
- (e) WARNING SIGNS. Placarding of potentially hazardous areas should be accomplished in accordance with local standard operating procedures. The following sign is an example:

FIGURE 2



A yellow background can also be used as well as fluorescent or "Day-Glo" red for the symbol.

SECTION 4. Personal Protection

- a. Personnel exposed to laser beams shall be furnished suitable safety goggles of optical density (O.D.) adequate for the energy involved. The following table lists the maximum power or energy density for which adequate protection is afforded by glasses of O.D. one through eight. This table is based on the maximum permissible exposure levels for dark adapted eyes:

(see following page for Table III)

TABLE III

Attenuation of Laser Safety Glass

O.D.	Attenuation (dB)	Attenuation Factor	Q-Switched Max. Energy Density (j/cm ²)	Non-Q-Switched Max. Energy Density (j/cm ²)	c.w. Max. Power Density (W/cm ²)
1	10	10	10 ⁻⁷	10 ⁻⁶	10 ⁻⁵
2	20	10 ²	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴
3	30	10 ³	10 ⁻⁵	10 ⁻⁴	10 ⁻³
4	40	10 ⁴	10 ⁻⁴	10 ⁻³	10 ⁻²
5	50	10 ⁵	10 ⁻³	10 ⁻²	10 ⁻¹
6	60	10 ⁶	10 ⁻²	10 ⁻¹	1
7	70	10 ⁷	10 ⁻¹	1	10
8	80	10 ⁸	1	10	100

- b. Protective gloves, clothing, and shields shall be used by personnel to prevent exposure to the skin. Generally the face can be turned from the target area for protection. Laser welding facilities shall have adequate shielding surrounding the article being welded.
- c. Impervious, quick-removal type gloves, face shields and safety glasses shall be provided as minimum protection for personnel who handle the liquefied gases used as coolants for high powered pulsed lasers. Liquefied gases shall be stored and handled in accordance with procedures promulgated by the Compressed Gas Association, Inc., and the National Safety Council.

SECTION 5. Ventilation

Laser installations should be well ventilated for the purpose of preventing the accumulation of hazardous gases where continuous-flow gas lasers are used, or to properly control cryogenic liquids and gases used to purge and cool lasers. Both liquid nitrogen and liquid helium have been used to cool solid-state and semiconductor laser units. Use of these cryogenic liquids may result in the formation of liquid oxygen. This can become an explosion hazard in the presence of organic matter. Continuous-flow gas lasers may be used in sealed systems, however, cracking of the system may lead to the release of enclosed gases and/or vapors including chlorine, bromine, lead, mercury, carbon monoxide, and hydrogen cyanide. Rates of ventilation should be adequate to maintain exposure levels at or below the current Threshold Limit Value (TLV) published by the American Conference of Governmental Industrial Hygienists (A.C.G.I.H.). Oxygen levels should be maintained to at least 18 percent (equivalent to a pO₂ of 135 mm Hg.). Ventilation standards in the parent guide to this one as well as Industrial Ventilation, published by A.C.G.I.H., should be followed in the design of ventilation systems.

SECTION 6. Electrical Hazards.

- a. Special precautions shall be used with high-energy systems to insure that cables between the power supply and laser head are properly selected and placed and that the capacitor discharge system is properly safeguarded. The placement of firing buttons shall be chosen to preclude accidental or inadvertent discharge of a laser. The placement of meters and oscilloscopes shall also be given consideration from the overall safety hazard involved.
- b. Cables, connectors, cabinets and switches shall be maintained in proper working order to prevent electrical shock and burns. Capacitors should be discharged before cleaning or repairing them or any connected equipment. Operators shall not be permitted to leave equipment until all voltage is removed from the capacitors as indicated by a zero reading on a volt meter. Interlocking covers shall be provided over high voltage circuits to prevent access to energized components, and a tagout or lockout system shall be provided to prevent connections from being made unless power supplies are disconnected. All noncurrent carrying metallic components shall be grounded. An interlock with a built-in manual override that automatically resets on closure is a type that can be used. Hazards from capacitor breakdown can be minimized by the use of distance and mechanical shielding between the operator and the bank.
- c. The choice of cables between power supply and laser head should be specified as corona-free and have an adequate dielectric strength for the laser with which it is to be used. Tests of dielectric strength and presence of corona should be made periodically. If a cable shows the presence of corona it should be replaced. Accidental contact with high current carrying cables should be eliminated by proper placement of the cables.
- d. Firing buttons should be located sufficiently remote from the charge and hold buttons to preclude accidental or inadvertent discharge of a laser. Charging preferably should be under manual control.
- e. Meters for measuring high voltages, and oscilloscopes required for use with lasers should be arranged and protected to minimize hazards to the operators. Operators should not be required to turn or face a laser beam during charging of the capacitor or firing of the laser.

SECTION 7. Medical Surveillance.

Individuals who may be occupationally exposed to laser radiation shall have pre-placement and periodic medical examinations. These examinations should include a thorough general eye examination before starting to work and periodically thereafter. The examination should include determination of near and distance visual acuity and a detailed ophthalmoscopic evaluation of the retina. A retinal fundus photograph of the foveal area is advisable. A slit lamp examination may be desirable for individuals exposed to lasers operating in the ultraviolet and infrared regions.

SECTION 8. Hazard Evaluation.

As the eye is the organ most sensitive to damage from the laser beam, hazard evaluation based on safe levels for the eye can be applied to the entire body.

- a. Hazard Evaluation of the Primary Beam (direct viewing). The worst possible situation would exist if the eye were focused at infinity and the beam

concentrated on the retina in a diffraction spot (smallest possible retina image size). Under these conditions, the levels in Table II would be applicable. The beam intensity at the point of interest may be calculated (refer to equation (1) in the Appendix).

b. Viewing the Reflected Beam.

- (1) Specular Reflection. Specular reflection requires a mirror-like surface. If the reflecting surface is flat, the characteristics of the reflected beam may be considered identical to those of the direct beam except that the range is the sum of the distances from the laser source to the reflector and from the reflector to the eye. If the surface is not flat the reflected light intensity arriving at the retina may be more or less than the original beam depending upon whether the surface is concave or convex, and may be readily calculated for a uniformly curved surface, if the curvature is known.
- (2) Diffuse Reflection. The reflection from a flat diffuse surface obeys Lambert's Law (refer to equation (3) in the Appendix) which relates the energy or power per solid angle to the surface brightness (i.e., essentially the "inverse square law"). A maximum brightness for the illumination of a diffuse material may be estimated* from the following table:

TABLE IV

Maximum Illuminance Permitted from a Diffuse Surface Reflection as Measured at the Reflecting Surface

Nature of Exposure	Daylight 3mm pupil	Environment	Night 7.5mm pupil
		Laboratory 5mm pupil	
Q-switched Pulse Joules/cm ²	.45	.15	.070
Non-Q-switched Pulse Joules/cm ²	5.5	2.0	.9
Continuous Wave Laser Watts/cm ²	13.5	6.0	2.5

Such a maximum brightness would be the same regardless of the distance of the viewer from the reflective surface or apparent size of the image, since the energy or power density at the retina remains the same. If the size of the illuminated spot subtends an angle less than θ_{min} (refer to equation (4) in the Appendix), the maximum allowable brightness may be greater than the values shown in Table IV. In this case, the level of reflected light arriving at the eye may again be calculated by Lambert's Law. The level reaching the retina may then be calculated in the same manner as for direct viewing.

* The actual illuminance from a diffuse surface may be calculated by multiplying the energy or power density of the beam impinging upon the surface by its reflectance (a property of the material).

c. Other Factors.

- (1) Atmospheric Effects. The effect of atmospheric attenuation may become a major factor in evaluating the energy or power density at distances greater than a few kilometers. This attenuation is the sum of three effects: (a) Mie (or large particle) scattering, where the particle size is greater than λ (wavelength of the light), and is normally the greatest contributor; (b) Rayleigh (or molecular) scattering (where particle size is much less than the wavelength) is reasonably constant for a given wavelength, and (c) absorption by gas molecules, which is relatively insignificant in comparison to scattering and may therefore be disregarded. Attenuation due to scattering* is much more pronounced at shorter wavelengths, thus red light from a ruby laser is scattered far less than wavelengths in the blue end of the visible spectrum. A clean atmosphere may therefore be expected to be quite transparent to the ruby wavelength. The atmospheric attenuation upon a non-diverging beam is expressed by:

$$I = I_0 e^{-\mu r}$$

Where: μ = attenuation (or extinction) coefficient which varies from 10^{-4} per cm in thick fog, to 10^{-7} per cm in air of very good visibility.

The effect of dust in even the clearest atmospheres usually raises the value at $6934\text{\AA}$ to at least 10^{-7} cm^{-1} .

At 10^{-7} per cm this leads to a value of the $e^{-\mu r}$ term as follows:

$$\text{at } 10 \text{ km-- } e^{-0.1} = .905$$

$$\text{at } 100 \text{ km-- } e^{-1.0} = .368$$

The effect of atmospheric turbulence affects the result, but assuming a very stable atmosphere, "worst possible case," this effect could be disregarded. The meteorological visibility, based upon the entire visible spectrum may not readily be utilized in arriving at the extinction coefficient at a given wavelength.

(2) Effect of Optical Viewing Instrument.

- (a) The effect on the retinal energy density of viewing a diffuse reflection (extended object) through a telescope is often to lower it slightly. This is due to the fact that, although the total light energy entering the eye is the ratio of the area of objective aperture to the area of the exit pupil aperture, the true value will be slightly less due to the absorption of some light in the optical system. The size of the image is increased by the magnification (or power) of the optical system, which results in an increase of image area, and therefore a reduction in the power density or energy density. The energy density or power density of a retinal image does not vary for subject-to-reflection distance as long as the image is not diffraction-limited.

* $4.8 \times 10^{-8} \text{ cm}^{-1}$ is the Rayleigh scattering coefficient for $6943\text{\AA}$

$1.8 \times 10^{-7} \text{ cm}^{-1}$ is the Rayleigh scattering coefficient for $5000\text{\AA}$

- (b) If, however, the laser is viewed directly or by specular reflection, the laser spot size is essentially a point source and is still diffraction-limited upon "magnification" by the optical system. The power then does not affect the energy density since the image size is still a retinal diffraction pattern thus allowing the optical device to increase the retinal energy density considerably. The problem may be further complicated by the situation of an image not quite being diffraction-limited. The effective magnification, P , of an optical system is also limited by diffraction phenomena, which may be derived by an equation (refer to equation (12) in the Appendix).

APPENDIX

1. MATHEMATICAL FORMULAS USED IN COMPUTATIONS OF SECTION 8.

a. The following symbols are used:

- E = level of radiation leaving the laser (output measured in milliwatts or watts; pulsed output measured in joules)
- r = range from the laser to the point of concern (cm)
- r_1 = range from the laser target to the point of concern (e.g. target)
- I = intensity of beam at range, r , measured in joules/cm² for pulsed lasers and watts/cm² for c.w. lasers
- a = diameter of emergent laser beam (cm)
- $\emptyset$ = emergent beam divergence measured in radians
- λ = wavelength of the radiation of concern (cm)
- e = base of natural logarithms
- μ = atmospheric attenuation coefficient (cm⁻¹)
- f = effective focal length of eye in air (1.7 cm)
- $\theta_{\min}$ = minimum angle subtended by the minimal spot size (radians)
- d_e = diameter of the pupil of the eye (varies from approximately 0.2 to 0.8 cm)
- D_e = diameter of the exit pupil of an optical system (cm)
- D_L = diameter of laser beam at range r (cm)
- D_o = diameter of objective of an optical system (cm)
- d_r = diameter of image on the retina (cm)
- $d_{\min}$ = diameter of minimal spot on retina (cm)
- M = magnification factor of energy density or power density from cornea to retina disregarding absorption of light in the ocular media

T = transmission of ocular media for a particular wavelength

R = reflectivity of a diffuse object

P = magnification or power of an optical system

L = ratio of retinal energy density or power density for optically aided eye to retinal energy density or power density for unaided eyes

b. Formulas used and Sample Calculations

- (1) Beam intensity at range r (direct circular beam):
(Refer to Figure 3 for illustration.)

$$I = \frac{E e^{-\mu r}}{\pi \left(\frac{a + r\phi}{2} \right)^2} \quad (\text{Eqn 1})$$

This formula is accurate only for small ϕ ; i.e., accuracy of ϕ better than 1 percent for angles below .17 milliradian (10°) and better than 5 percent for angles less than .37 radians (21°).

Example #1: To find the energy density at 1 Km (10^5 cm) of a 0.1 joule ruby laser which has a beam divergence of 1 milliradian (10^{-3} radians) and an emergent beam diameter of 0.7 cm:

$$\begin{aligned} I &= \frac{(0.1 \text{ j}) e^{-(.01)}}{3.14 \left(\frac{0.7 + (10^5)(10^{-3})}{2} \right)^2} = \frac{(0.1)(.99)}{3.4 \left(\frac{0.7 + 100}{2} \right)^2} \\ &= 1.25 \times 10^{-5} \text{ j/cm}^2 \end{aligned}$$

- (2) Minimum beam diameter at range r:

$$D_L = a + \phi r, \text{ for small } \phi \quad (\text{Eqn 2})$$

Example #2: To find the diameter of a laser beam at 1 kilometer where the emergent beam diameter is 10 cm and the beam divergence is 0.1 milliradian:

$$\begin{aligned} D_L &= 10 \text{ cm} + (10^5 \text{cm}) (10^{-4} \text{ milliradians}) = 10 + 10 \\ &= 20 \text{ cm} \end{aligned}$$

- (3) Maximum reflected energy density from diffuse reflector:

$$I = \frac{ER}{\pi r_1^2} \quad (\text{Eqn 3})$$

Example #3: To find the maximum reflected energy density from a diffuse matte of reflectivity 0.6 which would return a distance of 10 meters to the operator of a 0.1 joule laser:

$$I = \frac{(0.1j) (0.6)}{(3.14) (10^3 \text{cm})^2} = 1.91 \times 10^{-8} \text{ j/cm}^2$$

(4) Limiting angle for extended object:

$$\phi \text{ min} = \frac{d_{\text{min}}}{f} \quad (\text{Eqn 4})$$

$$= 0.6 \text{ milliradians for } d_{\text{min}} = 10 \text{ microns}$$

(5) Size of image on retina, diameter d_r :

(a) Extended diffuse object (when angle subtended by object is greater than $\phi \text{ min}$):

$$d_r = \frac{D_L f}{r} \quad (\text{Eqn 5})$$

(b) "Point" source - theoretical limit (Rayleigh's Criterion)

$$d_{\text{min}} = \frac{2.44 \lambda f}{d_e} \quad (\text{Eqn 6})$$

(Refer to Figure 4, following page, for a graph of Eqn 6 for $\lambda = 6943\text{\AA}$.)

Example #4: The diffraction-limited retinal spot size, D_{min} , which may be produced by ruby laser light ($\lambda = 6943\text{\AA}$) for a pupil size of 5mm is:

$$d_{\text{min}} = \frac{(2.44) (6.943 \times 10^{-5} \text{cm}) (1.7 \text{cm})}{(0.5 \text{cm})}$$

$$= 5.76 \times 10^{-4} \text{cm} = 5.76 \text{ microns}$$

(6) Ratio L of energy density or power density at the retina when viewing is aided by an optical system, as opposed to naked eye viewing:

(a) Direct viewing and specular reflection (or diffuse spot unresolved by eye and optical system):

$$L = \frac{D_o^2}{d_e^2} \quad \text{for } d_e \geq D_e \quad (\text{Eqn 7a})$$

and

$$L = \frac{D_o^2}{D_e^2} = p^2 \quad \text{for } d_e \leq D_e \quad (\text{Eqn 7b})$$

Figure 3

GRAPHICAL REPRESENTATION OF SYMBOLS USED

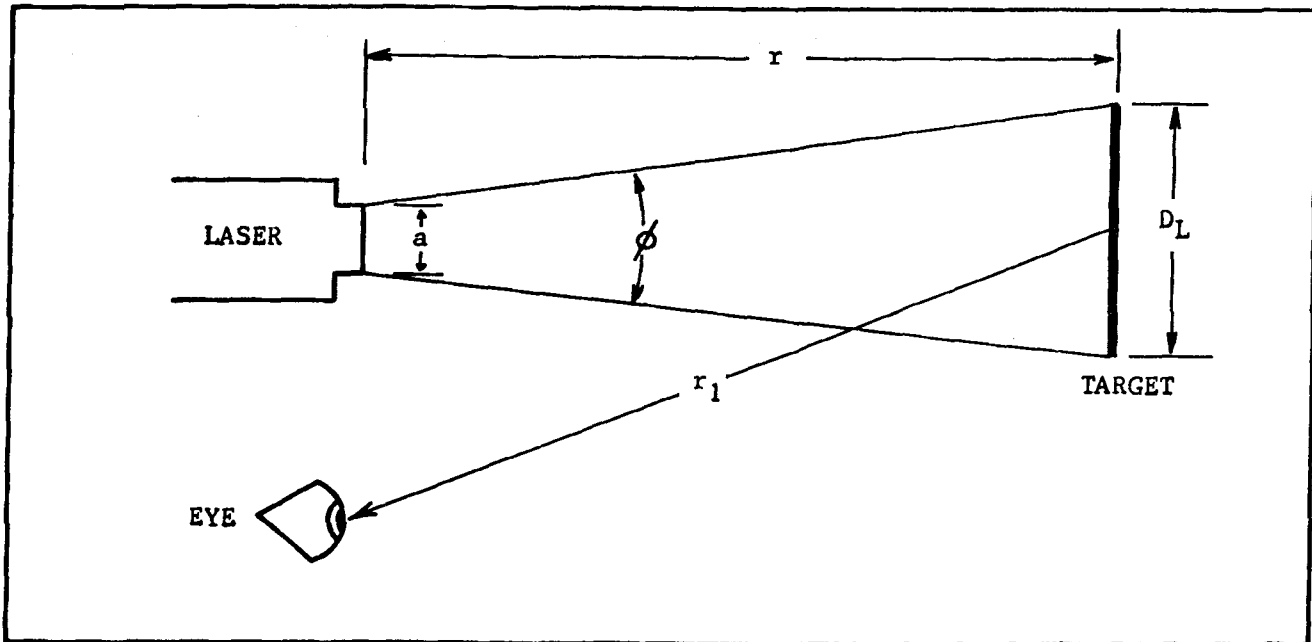
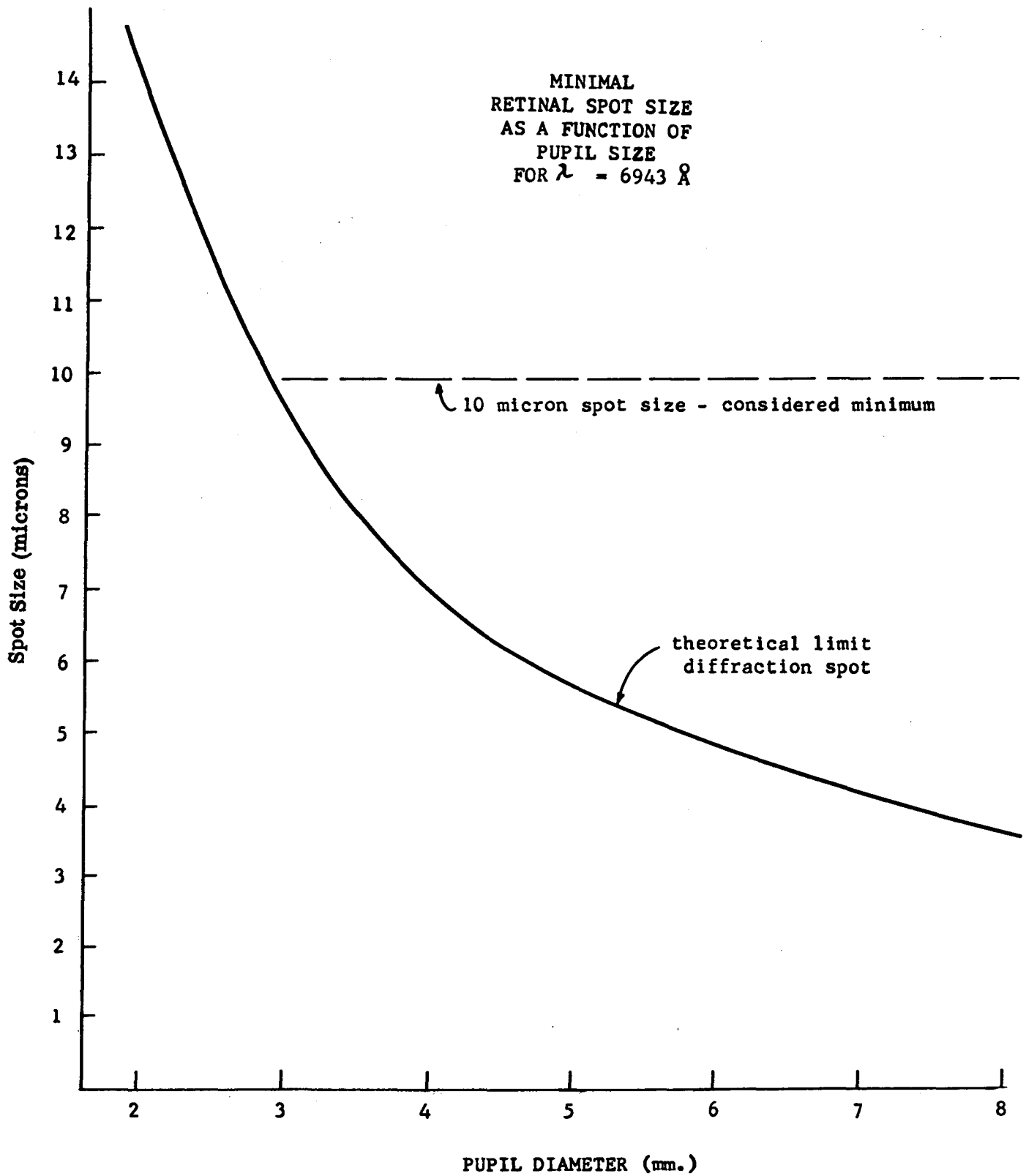


Figure 4



- (b) Indirect viewing of a diffuse reflection; extended objects only (i.e., object subtends angle greater than 0.5 milliradians when magnified):

$$L = \frac{D_o^2}{P^2 d_e^2} \quad \text{for } d_e \geq D_e \quad (\text{Eqn 8a})$$

and

$$L = \frac{D_o^2}{P^2 D_e^2} = 1 \quad \text{for } d_e \leq D_e \quad (\text{Eqn 8b})$$

Example #5: The laser operator of Example #3 desires to view the laser flash with a pair of 10x50 binoculars (i.e., $P = 10$ and $D_o = 50$ mm). Find the relative hazard to the man's eyes when the viewing is done in bright daylight. Because the exit pupil is not given, Eqn 8a will give a conservative if not exact answer:

$$L = \frac{(5\text{cm})^2}{(10)^2(0.3\text{cm})^2} = \frac{25}{(100)(.09)} = 2.78$$

The hazard is equivalent to a corneal irradiance on the naked eye of: $(2.78)(1.91 \times 10^{-8} \text{ j/cm}^2) = 5.3 \times 10^{-8} \text{ j/cm}^2$.

- (7) Ratio, $M \cdot T$ of corneal energy (power) density to retinal energy or power density:

(a) General: $M \cdot T = \frac{T d_e^2}{d_{\min}^2} \quad (\text{Eqn 9})$

- (b) ($d_{\min} = 10$ microns):

$$M \cdot T = T d_e^2 (\text{mm}^2) \times 10^4 \quad (\text{Eqn 10})$$

- (c) $d_{\min} = \text{Rayleigh's Criterion Spot Size}$:

$$M \cdot T = \frac{T d_e^4}{(2.44 \lambda f)^2} \quad (\text{Eqn 11})$$

(Figure 5, following page, presents equations (10) and (11) graphically for ruby laser light.)

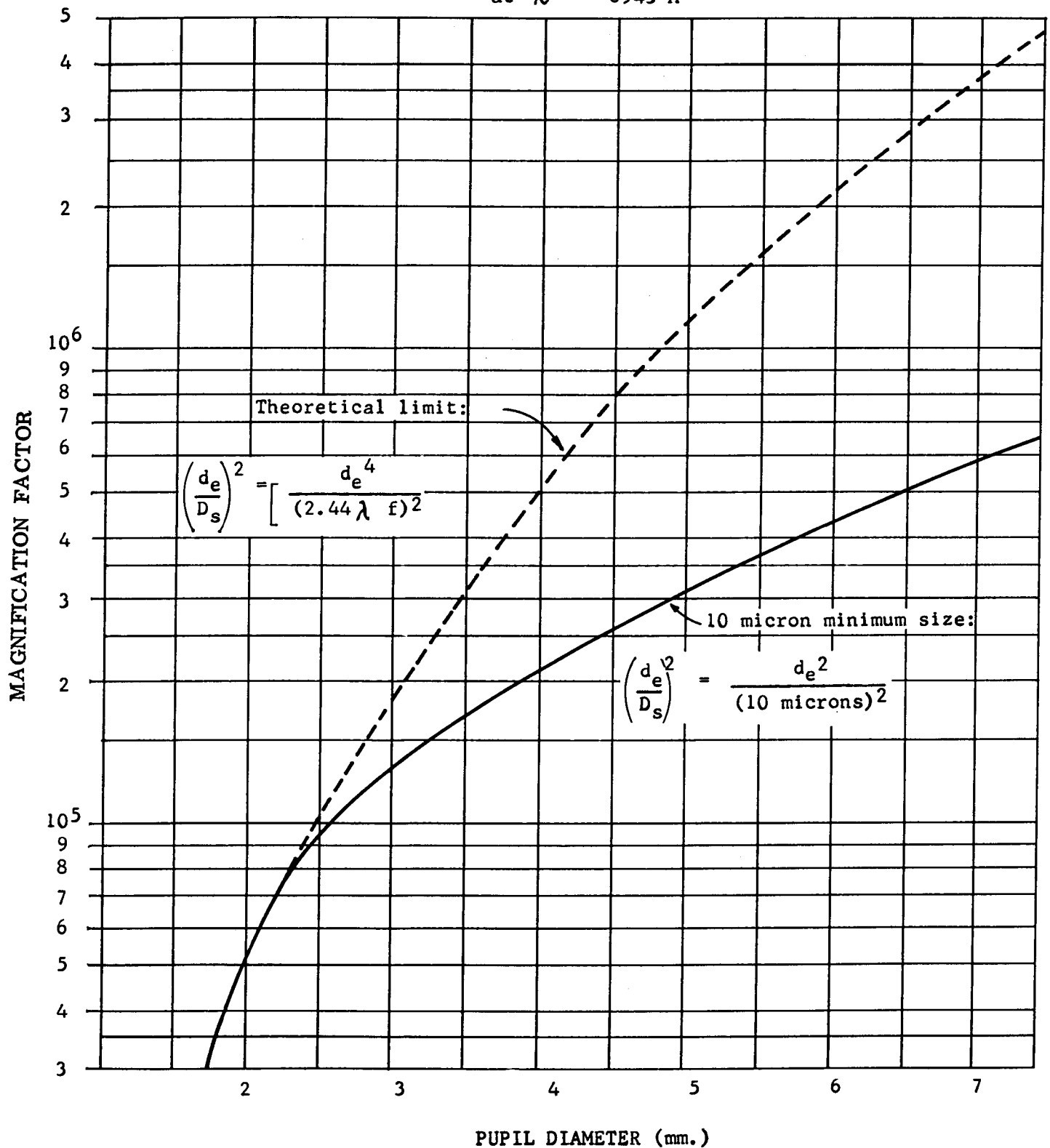
- (8) Diffraction limit (resolution) of an optical system - limiting angle:

$$\theta_{\min} = \frac{2.44}{D_o} \quad (\text{Eqn 12})$$

Prepared by the Committee on Industrial Hygiene Codes and Regulations (1967).

* * * * *

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 Figure 5
 MAGNIFICATION FACTOR
 for
 LIGHT ENERGY DENSITY
 from
 CORNEA TO RETINA
 at $\lambda = 6943 \text{ \AA}$



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APPENDIX B

Procedures for Free Silica Analysis of Mixed Dusts

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In 1962 the basis for the Threshold Limit Value (TLV) for mineral dust was changed from a range concept to one of a formula. When the formula, $TLV = \frac{250}{\% SiO_2 + 5}$

was adopted, the analytical precision for free silica (SiO_2) became a critical factor in assessing dust exposures in industry.

The American Conference of Governmental Industrial Hygienists through its Committee on Environmental Factors in the Pneumoconioses began a study to resolve the validity and precision of various methods of SiO_2 analysis. Although the basic SiO_2 analytical procedures are either microscopic, x-ray diffraction or chemical in nature, this Committee reported in 1966^(1,2) that there are several modifications of these techniques used by laboratories in the United States.

In the original project 20 governmental agencies agreed to participate in a special study to test their analytical precision. Samples of high percentage SiO_2 of varying particle size, but within respirable fraction, were sent to these agencies for analysis. The results showed that the variance between laboratories was about 10 percent with mean values less than 3 percent by different methods of analysis. The project pointed up the reliability of analyzing airborne dust for SiO_2 content when the sample contained a significant amount of free silica. The effects of airborne dusts containing lesser amounts of SiO_2 on analytical methods was not tested during the original study.

To determine the laboratories' capabilities for analyzing lower percentages of SiO_2 in mixed dusts, the project was repeated among those agencies which agreed to continue. In the second phase, coal which contained about 3 percent SiO_2 was used as the basic material. The coal was ground and blended in a Spex Industries Mixer Mill and passed through a 325 mesh sieve. Material left over from the original project, containing more than 90 percent SiO_2 , was processed in the same manner. The high quartz material was then added to the coal so that one mixture would contain about 6 percent SiO_2 and another would contain about one-third SiO_2 . These mixtures were then blended in the mixer mill and sieved. Samples of the coal and the two mixtures were then sent to 19 participating agencies.

As noted in the initial project, the majority of agencies used chemical methods of analysis. Of those who completed the analyses, 12 used chemical and 4 used x-ray technique. One participant reported results both by chemical method and by an optical microscope procedure. In several cases, the data reported were the average of four identical tests completed on the samples. Four agencies submitted results which were way out of line with those expected. When notified of this, these agencies asked that their data be withdrawn, pending further testing. No additional results were submitted, and the conclusions reported here do not include these data.

In general, the results obtained were in very good agreement (Table 1). The comparison between averages for chemical and x-ray diffraction methods were 3% vs 3%,

5% vs 6% and 33% vs 36%. There was slightly less deviation about the mean from samples analyzed by x-ray diffraction than by clinical methods, but the differences are not significant due to the small number of analyses by x-ray technique.

Using the range of quartz as a basis for TLV interpretation (Table 2), the x-ray diffraction method was far superior to chemical methods for estimating all ranges of quartz. As expected from the slope of the curve drawn from the formula, a slight change in SiO_2 content when very little quartz is present, results in a significant change in TLV. This was quite evident in the analysis of about 3% SiO_2 by chemical methods. Almost a 2 to 1 ratio in TLV was found between laboratories for this sample. As the quartz content increased, the differences were less significant.

Conclusions

Methods for analysis of quartz, especially by chemical procedures, lack precision when the quartz content is less than 10 percent. This is due to two factors. 1. The characteristics of the formula used for calculation of the quartz Threshold Limit Value is such that a small change of SiO_2 in this range results in a significant change of TLV. 2. Small errors or losses of SiO_2 from the sample during analysis result in a large shift from the "true" percentage of quartz present.

When factors, such as time-weighted average exposures to dust, are calculated, the errors inherent in quartz analyses are reduced. This is probably a saving feature, in general, but cannot excuse the real errors apparent from tests made during these studies. The projects point up that many agencies have the capability to precisely analyze low quartz containing materials. On the other hand, the projects also point up the need for refining technique for samples containing less than 10 percent quartz. This is an area for improvement, and analytical technique should be investigated and standards recalibrated for low silica without delay.

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Table 1

Comparison of Chemical and X-ray Diffraction Methods
for Analysis of Quartz of Varying Percentages

Percentage of Quartz Found

	Average	Median	Range
Chemical	3.16	2.82	1.60 - 5.55
	5.33	5.37	3.20 - 6.95
	32.79	32.8	30.03 - 35.99
X-ray Diffraction	3.2	3.0	2.6 - 4.0
	5.8	6.0	5.4 - 6.0
	36.3	35.0	34.0 - 40.0

* * * * *

Table 2

Comparison of Calculated TLV, in Millions of Particles
per Cubic Foot of Air, Range of Quartz Reported by
Chemical and X-ray Diffraction Methods

TLV

	Based on Mean Value	Based on Extremes of Range
Chemical	31	37 - 24
	24	31 - 21
	7	7 - 6
X-ray Diffraction	30	33 - 28
	23	24 - 23
	6	6 - 6

APPENDIX C

Supplemental Documentation of
Threshold Limit Values

ABATE

(O,O,O',O'-tetramethyl O,O'-thiodi-p-phenylene phosphorothioate)

15 mg/m³

Abate has been found to have an acute oral LD₅₀ of 4000 mg/kg or greater in rats and mice. All animal species tested tolerated 10 mg/kg without clinical effect, and 1 mg/kg without effect on cholinesterase activity. (1) Human volunteers tolerated an oral dosage of 256 mg/man/day for 5 days or 64 mg/man/day for four weeks without clinical symptoms or side effects attributable to Abate, and without detectable effect on red blood cell or plasma cholinesterase. (2) Experience in the field for a period of more than 1 year has confirmed that 1 mg/l in drinking water is without effect.

The acute oral LD₅₀ of malathion has been found to be 2100 mg/kg in rats or about one-half that of Abate. Men tolerated oral dosage with malathion at the rate of 16 mg/man/day without change in blood cholinesterase, but 24 mg/man/day for 56 days produced some reduction of the enzyme. On the basis of this comparison, a Threshold Limit Value of 15 mg/m³ has been assigned to Abate.

References:

1. Gaines, Thomas B., Kimbrough, Renate, and Laws, E. R.: Arch. Environ. Health, 14: 283, 1967.
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BORON TRIBROMIDE

1 ppm (Approximately 10 mg/m³)

Boron tribromide is a colorless, fuming liquid decomposed by water or alcohol. (1) Its acute local effects are considered to be high for irritation, ingestion, and inhalation. Reference to HBr is to be made for toxicity.

On decomposition, boron tribromide would be expected to produce three moles of HBr. By analogy, to prevent toxic injury and reduce the likelihood of irritation, the limit for BBr₃ should be equivalent to HBr, i.e., 1 ppm.

Reference:

1. The Merck Index: Merck & Co., Inc., N. J., 6th Ed., pp. 158 (1952).

BROMINE PENTAFLUORIDE

0.1 ppm (Approximately 0.7 mg/m³)

Bromine pentafluoride is a strong fluorinating agent, but it is not so reactive as free fluoride.⁽¹⁾ A threshold limit fully comparable to that for free fluorine, and also for chlorine trifluoride is recommended. It is believed that this concentration will not lead to excessive irritation of the respiratory passages.

Reference:

1. Chem. & Eng. News, 44, (40), 79 (1966).

CYANOGEN

10 ppm (Approximately 22 mg/m³)

Cyanogen, also referred to as oxalic nitrile, ethane dinitrile, or prussite, is a colorless, practically odorless, flammable, toxic, water-soluble gas at room temperature. It is sometimes described as having an almond-like odor. It hydrolyzes to yield one molecule of hydrogen cyanide (HCN) and one of cyanate. This is the basis for the supposition that cyanogen is comparable in toxicologic effect to hydrogen cyanide.

Although cyanogen is used primarily in organic synthesis, it is also used as a fuel gas for welding and cutting heat-resistant metals, as a rocket and missile propellant (with ozone or fluorine), and as a fumigant.

Cyanogen dissolves to the extent of 4 per cent in water, more readily in alcohol or acetic acid. The aqueous solution slowly decomposes to ammonium oxalate and formate, hydrogen cyanide, and urea. It burns with a peach-colored flame; with oxygen it gives the hottest flame known.

Odor and irritation threshold level detection tests on humans indicate no odor up to 250 ppm but immediate eye irritation shortly followed by nasal irritation occurred at 16 ppm. Irritations lasted several minutes after the mild exposure. Tests on rats have suggested that cyanogen is less toxic than hydrogen cyanide by a factor of 10.⁽¹⁾

By analogy with hydrogen cyanide, and to prevent irritation, as well as systemic effects, a TLV of 10 ppm is recommended.

Reference:

1. McNerney, J. M., Schrenk, H. H.: A.I.H.A. J., 21, 121 (1960).

DIBROM(R) (NALED)

5 mg/m³

Dibrom(R) has an acute oral LD₅₀ of 250 mg/kg for male rats.⁽¹⁾ The effects of acute exposure are similar to that of other cholinesterase inhibiting organo-phosphorus compounds. Feeding rats dietary concentrations of up to 30 ppm of Dibrom(R) for as long as 27 days did not result in any depression of plasma erythrocyte or brain cholinesterase.

Guinea pigs and rats exposed 6 hours/day, five days each week for five weeks to an aerosol of 65% Dibrom^(R), 25% xylene and 10% emulsifier-surfactant, showed an effect at concentrations of 42 mg/m³ and greater of Dibrom^(R). At these concentrations there was decreased cholinesterase activity, inactivity and obvious discomfort.⁽¹⁾

Human experience during manufacturing and use has not indicated any unusual human response.

The acute toxicity data, inhalation data, and experience to date indicate that this is not a highly dangerous material. Percutaneous absorption must be considered, however, in any calculations.

Dibrom^(R) is closely related to DDVP. Based on the data available and analogy to DDVP, a threshold limit of 5 mg/m³ appears to be a reasonable level.

Reference:

1. Industrial Hygiene Bulletin, Standard Oil Co. of California (with attachments) January 1964.

DIETHYLENETRIAMINE - Skin

C 10 ppm (Approximately 42 mg/m³)

Bourne, et. al.⁽¹⁾ found that diethylenetriamine caused respiratory tract irritation when exposure was to the hot vapor.

Patty⁽²⁾ cites a report by Grandjean⁽³⁾ where no concentrations of this curing agent were found in a plant in which dermatitis cases were occurring. It is capable of producing allergic sensitization of the respiratory tract leading to bronchial asthma in man similar to other ethyl amines.

By analogy with ethylamine, and to reduce the likelihood of allergic response, a TLV of 10 ppm is recommended.

References:

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DIPHENYLAMINE - Skin

10 mg/m³

Diphenylamine, also called phenyl aniline, is a colorless solid in the form of monoclinic leaflets. It is almost insoluble in water but soluble in organic solvents.

Hamblin⁽¹⁾ states that diphenylamine is much less toxic than aniline and is less readily absorbed through the skin and respiratory tract.

In comparing toxicity ratings of diphenylamine with aniline, Sax⁽²⁾ lists the acute and chronic systemic potentials as high for both compounds.

Fairhall⁽³⁾ notes that industrial poisoning has been encountered and is manifested clinically by bladder symptoms, tachycardia, hypertension, and skin trouble. French investigators reported definite changes in liver, spleen, and kidneys in animals exposed to diphenylamine dust. Dernehl⁽⁴⁾, from years of experience with diphenylamine, considers 10 mg/m³ a satisfactory limit.

A TLV of 10 mg/m³ is suggested for diphenylamine dust, based on industrial experience. It is known to be sufficiently low to prevent systemic poisoning.

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1. Hamblin, D. O., in Patty, F. A.: Industrial Hygiene and Toxicology, 2nd Ed. Vol. II, Toxicology, Intersci. Pub. N. Y., pp. 2143 (1963).
2. Sax, N. T.: Dangerous Properties of Industrial Materials, Reinhold Pub. Corp. N. Y., pp. 761 and pp. 300 (1957).
3. Fairhall, L. T.: Industrial Toxicology, Williams and Wilkins, Baltimore (1957).
4. Dernehl, C. U., Communication to Committee member, 1967.

HEPTANE

200 ppm (Approximately 800 mg/m³)
(See Documentation for Stoddard Solvent)

INDIUM AND ITS SALTS

0.1 mg/m³

Parenterally administered, soluble indium salts are highly toxic, fractions of a mg/kg being lethal to rabbits; rats are somewhat less susceptible.^(1,2) Orally, indium salts are far less toxic; the oxide requiring 10 g/kg to be lethal to mice.⁽³⁾ Rats absorb from the gastrointestinal tract only from 0.2 to 0.4% of the oral dose.⁽²⁾ The soluble salts are very irritating to the eyes.

The lungs of rats exposed daily to the sesquioxide (In₂O₃) at concentrations ranging from 24 to 97 mg/m³ for a total of 224 hours, showed evidence of widespread alveolar edema differing from the usual toxic edema fluid in being granular microscopically and containing a few alveolar phagocytes, polymorphonuclear cells and nuclear debris.⁽⁴⁾ The injury was further characterized by alteration of the alveolar walls by spindle-shaped and other type cells. The lesion showed little change either during exposure or after a 12-week post-exposure period, and no fibrosis resulted from

the healing process. Thus, In_2O_3 dust uniquely produces a widespread alveolar stasis resembling alveolar proteinosis in which alveolar clearance is reduced. Associated chronic respiratory insufficiency, recurrent acute pneumonitis, or complicating infections may result in fatal outcome.⁽⁵⁾

In the light of the character and severity of indium salts, particularly the pulmonary effects, a TLV of 0.1 mg/m^3 is recommended.

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1. McCord, C. P., Meek, S. F., Harrold, G. C., Heussner, C. E.: *J. Ind. Hyg. & Tox.* 24, 243 (1942).
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IRON SALTS (Soluble) as Fe

1 mg/m^3

Iron salts, especially the ferric salts, e.g., ferric chloride and sulfate, are highly and instantaneously toxic when injected into the bloodstream. The acute lethal dose of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ for the rabbit by injection is about 7.2 mg/kg.⁽¹⁾ Inhalation of iron salts as dusts and mists irritates the respiratory tract.⁽²⁾

The oral lethal dose in rats is about 900 mg/kg. Ingestion in humans causes marked gastrointestinal irritation,⁽³⁾ and the estimated fatal dose is 30 gms.⁽⁴⁾

It has been used as an astringent and styptic for skin disorders, causing contraction of the blood vessels,^(3,5) and is listed as a cutaneous irritant.⁽⁶⁾

In order to reduce the likelihood of respiratory tract irritation and skin effects from aerosols, a Threshold Limit Value of 1 mg/m^3 as iron is recommended.

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METHYL SILICATE (Tetramethoxy silane)

C 5 ppm (Approximately 30 mg/m³)

Methyl silicate finds use, among other things, in coating picture screens of television picture tubes whereby it presents both an inhalation and an eye exposure hazard.

Smyth et. al. (1) in range-finding toxicity tests rated undiluted methyl silicate as a very severe eye irritant in rabbits leading to marked edema and necrosis of the lid and to be lethal to rats at 250 ppm after a 4-hour exposure. Exposure of rabbits at 1000 ppm in dry air caused "delayed" eye burn; saturated vapor, (15,000 ppm at 25°C) for 5 minutes caused eye burn, but exposure for 4 minutes, none. (2) Saturated vapor at 100% relative humidity for 5 minutes resulted in a slight amount of necrosis. Intravenous, spaced doses totaling 1g during 3 months did not produce fibrosis of the liver of rabbits, indicating methyl silicate not to be productive of silicosis. Industrial handling experience both in the U.S.A. and in Europe, has been bad, ranging from eye pain to eye loss. When exposure is moderate, recovery is complete after 1 week, if treatment with cortisone and penicillin is given promptly. (3)

Efforts to estimate the air concentrations of methyl silicate relative to corneal damage in man revealed that in general, 200-300 ppm are required for 15 minutes to produce minimal lesions, 1000 ppm to produce injury requiring hospitalization. (3)

Supplementary animal toxicity data relative to developing a TLV showed that the highest concentrations that still produced no damage to the guinea pig eye, the most sensitive target site, were 135 ppm for 15 min., 90 ppm for 1 hr., 20 ppm for 8 periods of 1 hr. each and 20 ppm for 5 days of 8 periods of 1 hr. each. Brief exposures to high concentrations were productive of greater injury than lower concentrations for longer periods. The LC₅₀ values for guinea pigs for exposures of 1, 4, and 8 hours were respectively 300, 95, and 26 ppm. Lung function tests were always normal if corneal damage was absent. The latent period of ophthalmologic changes was 16 hours for serious involvement, up to 3 days for mild involvement. All corneal damage was reversible. (3)

In order to protect against eye injury and pain, a ceiling limit of 5 ppm is recommended for methyl silicate.

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OCTANE

200 ppm (Approximately 930 mg/m³)
(See Documentation for Stoddard Solvent)

PROPARGYL ALCOHOL (2-Propyn-1-ol)

1 ppm (Approximately 2 mg/m³)

Propargyl alcohol is a moderately volatile, light to straw-colored liquid with a mild geranium-like odor. The acute oral toxicity for albino rats is respectively LD₁₀₀, 0.1 ml/kg; LD₅₀, 0.07 ml/kg; LD₀, 0.05 ml. It was slightly more toxic by this route for guinea pigs (LD₅₀, 0.06 ml/kg). The alcohol is a primary skin irritant, but not a skin sensitizer.⁽¹⁾

By analogy with the structurally and toxicologically similar acrolein and allyl alcohol, which have respectively an oral LD₅₀ (rat) of 46 and 64 mg/kg body weight compared with 70 mg/kg for propargyl alcohol and which are similarly severe irritants, a TLV of 1 ppm is recommended.

References:

1. New Product Bulletin A-103, Antara Chemicals, 1952.

RDX (Cyclotrimethylene trinitramine)-Skin

1.5 mg/m³

RDX is a high explosive for which there was widespread exposure among workers handling it in World War II. Such exposure is continuing as shown by a report of 5 cases of illness in workers handling RDX in an explosives plant in 1962.⁽¹⁾ The clinical manifestations referable to the central nervous system of nausea, vomiting, convulsions and unconsciousness seen in the workers paralleled those previously reported in animals by von Oettingen⁽²⁾ and Sunderman.⁽³⁾ Animal studies show RDX not to be an acutely toxic substance. Human illness results from repeated exposures via the respiratory and gastrointestinal tracts and by skin absorption.⁽¹⁾

Limited, but good health experience has been reported⁽⁴⁾ from an AEC establishment when RDX dust control was maintained below 1.5 mg/m³ as analyzed polarographically. This limit, in turn, was based on a prior suggestion by von Oettingen, et. al.⁽²⁾ that the air tolerance for TNT be applied to RDX. A similar limit has been recommended for the chemically more closely related nitramine, tetryl. Oddly the chief complaints of tetryl, skin sensitization, are not those of RDX, which simulate the central nervous system effects of TNT.

Accordingly, a TLV of 1.5 mg/m³ is recommended for RDX by analogy with TNT and its demonstrated effectiveness in the prevention of injury from RDX exposures.

References:

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STODDARD SOLVENT

200 ppm (Approximately 1200 mg/m³)

Patty(1) states that pharmacologically and toxicologically stoddard solvent is qualitatively comparable to heptane and octane. Heptane exposures to 1,000 ppm for 6 minutes and 2,000 ppm for 4 minutes produces a slight vertigo in man.

Davis(2) et. al., noted that a majority of subjects exposed to unleaded gasoline reported itching or burning of the eyes at 500 ppm. Before and after photographs of the eyes were evaluated for injection of conjunctival vessels. The majority of subjects showed changes at 500 ppm.

The Threshold Limit Value is based on analogy with studies made with gasoline and its components. The limit of 200 ppm is set to avoid subjective symptoms of eye irritation and dizziness.

References:

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TUNGSTEN & COMPOUNDS

Soluble - 1 mg/m³
Insoluble - 5 mg/m³

There is considerable difference in the toxicity of soluble and insoluble compounds of tungsten; the soluble sodium tungstate (Na₂WO₄·2H₂O) resulted in an LD₅₀ when injected subcutaneously in adult rats at a dose between 140-160 mg/kg body weight as W. There was a considerable age factor in the toxic response; very young rats (30 days old) survived the dose that proved lethal to old rats.(1) Death is ascribable to generalized cellular asphyxiation as W is found generally distributed throughout the body organs following administration.(2) Karantassis(3) found that guinea pigs treated orally or intravenously with W or Na₂WO₄·2H₂O suffered from anorexia, colic, incoordination of movement, trembling and dyspnea. Animals suffered a weight loss before a delayed death.

Orally, in rats the toxicity of Na₂WO₄ (2% W) was highest, the oxide, WO₃, (3.96% W) was intermediate, and ammonium p-tungstate (NH₄)₆W₇O₂₄·6H₂O, (5%W) least.(4) Both Na₂WO₄ and WO₃ proved lethal to rats on a diet containing 0.5% as W; the ammonium salt was not lethal at this level, but resulted in slight weight loss (4-5%). A similar weight loss was produced by dietary levels of 0.1% of the oxide and the sodium salt. W has been shown(5) to act by antagonizing the action of the essential trace element, molybdenum.

Tungsten metal powder administered to animals was not altogether inert; fed to weanling rats of both sexes at levels of 2, 5, and 10% of the diet, a 15% reduction

in body weight gain occurred among the females, but not among the males in comparison with controls.⁽⁶⁾ Likewise, although Fredrick & Bradley⁽⁷⁾ found tungsten carbide inert, W metal powder was not so classified. It did not produce a distinct fibrosis, however. They reported an intraperitoneal LD₅₀ of 5 g/kg body weight for W metal powder in the rat, all fatalities occurring in 24 hours. Survivors sacrificed 45 days later showed minor gross changes in the liver and spleen. Rats similarly treated with tungsten carbide did not die, and when sacrificed 30 days later, showed a typically inert response, according to the Miller and Sayers classification. Delehant⁽⁸⁾ made intratracheal injections of tungsten metal and tungsten carbide dust into guinea pigs in three 50 mg doses spaced one week apart, and judged the dusts to be relatively inert. Schepers⁽⁹⁾ made microscopic examinations of these tissues and found those treated with tungsten metal showed moderate interstitial cellular proliferation. He concluded that the exposure to W metal dust would be relatively safe, but not wholly free from risk, and that the dust was relatively inert. Those tissues treated with tungsten carbide dust showed negligible reaction, and he concluded that tungsten carbide dust was less harmful to lung tissue than was tungsten metal. Similar conclusions were reached by Harding⁽¹⁰⁾ from intratracheal injection of the metal and the carbide. Soviet workers,⁽¹¹⁾ however, reported that 50 mg W dust introduced into the trachea of rats resulted in proliferation of the intra-alveolar septa, especially in those areas where dust had visibly accumulated. Dust chamber exposures of animals to W, WO₂ and WC produced only minor changes.⁽¹²⁾

Long industrial experience, however, has indicated no pneumoconiosis to develop among workers exposed solely to W or its insoluble compounds.⁽¹³⁾ Air concentrations of W were of the order of 5 mg/m³.

McDermott⁽¹⁴⁾ reports no difficulty in controlling atmospheric concentrations of tungsten and tungsten carbide at levels considerably below 5 mg/m³ based upon several years of surveillance of a large establishment manufacturing cemented tungsten carbide products.

Because of the unusually high density of tungsten, it is extremely difficult to maintain stable dust clouds containing particles above five microns diameter; aerosol particles in the 0.5 to 1 micron range are abundant around powder metallurgy operations which utilize tungsten metal and tungsten carbide. A TLV of 5 mg/m³ would approximate an airborne dust concentration of 20-50 million particles per cubic foot, and seems to be consistent with the reported physiologic activity of the sparingly soluble and insoluble compounds. In view of the degree of systemic toxicity of soluble compounds of W, however, a TLV of 1 mg/m³ as W is recommended.

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URANIUM & COMPOUNDS

0.2 mg/m³ as U

The Threshold Limit Values originally recommended for uranium of 0.05 mg/m³ for soluble compounds and 0.25 mg/m³ for insoluble compounds, were based on extensive toxicologic studies in animals.⁽¹⁾ Prior to 1950 when these limits were developed, exposures of workers were commonly 4 to 30 times the 0.05 mg/m³ limit.⁽²⁾ Exposures of the majority of the uranium plant workers were to dusts of uranium feed materials, to the intermediates, to uranium metal, and including the soluble and most toxic of the industrial uranium compounds, UF₆. During the period of high exposures, approximately 1943 to 1950, well over 1,000 workers were exposed. In one plant, with about 800 workers, 90% were exposed to multiples of the TLV until 1948, and 6% had an average exposure above the TLV between 1948 and 1956.^(Breslin, 2)

In a report of the health experience in one plant after 15 years (1958) in which exposure was to natural uranium and its compounds, but not UF₆,^(Mason, 2) no abnormal clinical findings were traced to uranium as a cause. Similar experience was had at other uranium processing plants to 1958. In the period from 1958 to 1967, during which time the experience was extended to a maximum of 25 years, no further evidence of uranium effects in these workers has come to light. The incidence of all diseases, whether or not they have been specifically linked to radiation exposure, has been no higher than that in the general working population. These findings were from a pilot study of the health records and uranium exposures of approximately 100 workers at each of three plants. The workers selected for study were those who had the greatest potential for uranium exposure, considering both length of employment and concentration. Exposures were to most of the common uranium compounds. In connection with worker follow-up since 1950, the major processing plant has weekly job assignment records on each worker permitting evaluation of individual exposure and correlation with health experience. Similarly, 7 accidental, brief exposures to soluble U compounds (UF₆, UO₂F₂) at levels 2- to 5-fold the TLV, well documented as to urinary excretion of U and clinical tests for response, failed to result in any physiologic damage.⁽³⁾ The authors further suggested that the limits should be reexamined.

As a consequence of the lack of evidence for 25 years linking exposure at levels well above 0.05 mg/m³ to both soluble and insoluble U compounds with injury either to the kidney or to the blood, it is recommended that the TLV, applying to both insoluble and soluble forms of natural U compounds, be 0.2 mg/m³ as U.

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APPENDIX D

THE OCCUPATIONAL HEALTH SPECIALIST OF THE FUTURE

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Our present methods of responding to the changing needs of the world are more closely characterized as a patchwork approach, rather than one of bold and inventive planning. With all the ingredients present to tell us what the world has in store, we are still adapting old methods and making minor revisions and emergency moves; we are still desperately trying to pour new wine into old bottles instead of recognizing that the new vintages may require quite different sorts of receptacles.

(Samuel B. Gould, Chancellor of the State University of New York, Albany¹)

Most views into the future, when rechecked in later decades, have all the solidarity of structure of gossamer musings. To bolster a forecast and build into it a self-supporting skeleton, one must have initiated action that will be innovative and creative, and will make the prediction of sterner and more time-resisting stuff. The review of tomorrow's occupational practitioner will be offered in light of practices which already, in part, have been inserted into the curriculum.

There is nothing so fragile as a crystal ball, and there is no gazing so myopic as that encountered on peering into such a sphere. Because of this tenuous grasp on the future, groundwork-laying statements will be made with care.

We are all aware of contemporary change - the unprecedented change which we face each day. We see the incongruous paring of such scientific expertise as trench-digging on the moon with such total social ineptitudes as war and poverty. In spite of these almost unbelievable bedfellows, can we picture the future so as to respond deeply to social and technologic trends, and prepare tomorrow's practitioner to use tomorrow's tools?

Curricular Change

Today, medical schools are re-designing their curricula; as a British observer has put it, (2) they are "sacrificing completeness of coverage in favor of stimulating the student's comprehension of the scientific approach to each different aspect of medicine, and showing students how to find out things for themselves." In parallel with this conversion, a work-conference of the educators in occupational medicine is meeting in July 1967 to scrutinize the residency programs and to provide leads for up-dating of the curricula which are now 20 years old, parts of which no longer have the pertinence of two decades ago.

It is anticipated that a comparable study will be conducted of the graduate education programs in industrial hygiene and radiological health, so that the university offerings can be re-patterned to meet most fittingly the needs of these specialties.

Who Will Be the Specialist?

In a scientific enterprise characterized by a broad interdisciplinary mix, the problem of captaincy usually presents itself for examination. Custom has usually designated the physician as the person of positional primacy, but there have been successful exceptions to this traditional format. Will the occupational health specialist of the future necessarily be a doctor of medicine? Or could, or should, he be an industrial hygienist? Or engineer? Or sanitarian? Or a lay administrator with appropriate occupational health insights?

It probably will not be too important who leads the group, for the specialist will have to be an environmentalist--a professional person concerned with the environment in all of its aspects: administrative, chemical, clinical, microbiologic, physical, psychologic, and social. Our present-day specialist--physician, hygienist, or engineer--falls short in one or another of these areas of involvement. For greatest contributive worth, then, the future occupational health expert must be knowing in nearly all of the environmental stress areas. If it is the germanely-educated physician who has this kind of knowledge, then it will be he who will provide sophisticated leadership. If it is a hygienist who secures his clinical support through joint activity with a physician, then it is he who can serve most effectively. The point remains moot, it is believed, until there can be a review of the products of the new curricula.

It is felt that there will be an insinuation into the medical curriculum of the years just ahead the subject designated environmental medicine, as suggested by others, and in the school of public health, the generic title of environmental health will be utilized. Subsumed under both of these program rubrics will be such subjects as occupational health, air pollution, accident prevention, industrial hygiene, radiologic health, sanitary sciences, and aerospace medicine, each appropriately tailored to fit either clinical medicine or public health.

The components of the environment encompassed in such a realignment, as can be judged by the fields just mentioned, would include the land, air, space, the sea (and the undersea), the water on the land, and the containers for living, such as homes, work places, and recreational facilities.

Ancillary Personnel

There will be great need for auxiliary workers, and as nursing has developed personnel of sub-professional level, so will occupational health. Eveline Burns⁽³⁾ expressed the concept well for medicine: "It means a willingness to abandon the performance of procedures and tasks that do not call for high levels of expertise and which could be performed effectively by less highly trained professional or auxiliary workers, alone or under medical supervision." In this instance it meant that physicians must pay greater attention to the importance of economy; comparably, workers in occupational health must pass downward some of the functions which they have held as singularly theirs for many years, so that the task can be completed.

The development implies the creation of industrial hygiene or environmental technicians; the occupational health nurse's becoming truly responsible for occupational health nursing practices, or giving up lower level activities to the licensed vocational nurse; and the training of more administrative aides for the organizational aspects of occupational health.

The Computer

Future personnel will require training in computer technology because of the many potential applications of computer science to occupational health. With electronic data processing, both clinical and environmental records can build a highly meaningful body of knowledge of employee morbidity and mortality. There can be an immediate correlation of clinical and environmental measurements, and life histories of workers can be produced which will point up the relationship of work and its exposures to the onset of chronic disease. The storage of personal habit data--smoking, drinking, use of medications, exposure to hobby-intoxicants--will be feasible for epidemiologic reviews. The worth and desirability of automated multitesting have been demonstrated by Collen,⁽⁴⁾ and the institution of comparable systems in industry is foreseen. Lastly--as an example, only, for there are innumerable other uses which can be envisioned--the computer can facilitate the establishment of occupational disease registries, beyond today's sparse beginnings, as part of highly workable data banks.

Telemetry

Placement of workers, today, is accomplished by hunch, hope, and happenstance. There is no bank on job demands as delineated by accurate physiologic monitoring or bio-instrumentation. Little exists on the true measure of functional capacity of a man either at rest or under emotional or environmental stress-loading. Knowledge is scanty regarding which elements are stressful to different workers, or to the same worker at different times. The wise use of telemetric systems will provide information directly from reality situations to give job placement scientific objectivity.

New systems of environmental and personnel monitoring will permit remote determination of air content and highly improved detection systems for personnel protection.⁽⁵⁾

Mental and Social Health

There will be a greater number of younger workers, and as is known both by tradition and documentation, they are the lowest producers. The aging and the aged will be obsoleted by newer technology. Negro workers will increase in number, so that there can be no room for feelings of racism.

The specialist of the future must be prepared to care for these groups, in addition to those with the known or identified emotional upheavals. The knowledge of psychotoxicology will increase, so that the perceptive specialist will recognize subtle clinical, and possibly, subclinical, behavioral changes produced by exposure to noxious workroom materials, before frank intoxication occurs.⁽⁶⁾

Epidemiology and Biostatistics

The future practitioner will have a total ability to apply these analytic techniques in the identification of otherwise undiscoverable correlations between hazardous environmental conditions and untoward human response. Few occupational health services will be without this capability, for it will serve another function, that of evaluation, in determining if the occupational health or environmental service is meeting the health needs of the particular population at risk.

Expansion of Service

It is mandatory that the specialist operate more widely in this arena, so that occupational health facilities--established singly, or more desirably, jointly, by management, labor, and public health--will be created as central installations in large

industrial parks or trading estates. This will provide trained personnel for both the large manufacturing complex and the small service firm, backed by appropriate laboratory and computing support systems. It is only in this configuration that occupational health services will ever become available to the majority of employed persons.

Social Responsibility of Industry

In the community of the future, industry will no longer be able to remain the relative isolate which it has in the past. As it has subsidized the health care of its employees through insurance schemes, and lightened the load of public welfare through corporate giving, it will have to lend its environmental health talents to the community by sharing the skills of its trained personnel in water and air pollution control, and in effective waste disposal methods. It seems only logical that the industrialist offer assistance to his neighbors in these areas of environmental blight, as does the United States in the many variations of foreign aid.

The Specialist Himself

He will have training in business management and public administration, and will be accustomed through a cross-disciplinary graduate education to work comfortably with the architect and urban planner, the sanitary engineer, and the voluntary citizens' group. As an example, has anyone, of any discipline, made any community environmental health plans for the introduction on a regularly scheduled basis of the supersonic transport?

Because of the lack of durability and the early obsolescence of today's education, the occupational health specialist will need sabbatical leaves for refreshing of his knowledge. Industry and public health agencies have, at no time, simulated the institutions of higher learning in granting these periods for reinjection and re honing of skills. To maintain capability, these returns to school will be mandatory.

Summary

In essence, the occupational health specialist of the future may come from any pertinent discipline. He must be skilled in understanding human behavior, using computer techniques, adopting telemetry to the work site, employing epidemiologic and biostatistical study methods, and must be willing to forego much clinical work or environmental measurement, passing this on to sub-professional personnel.

Above all, he must be willing to change "not for the sake of change itself but because world events and trends make such change essential."⁽¹⁾

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