INDUSTRIAL HYGIENE FOUNDATION OF AMERICA, Inc.

SEVENTH ANNUAL MEETING OF MEMBERS

PITTSBURGH, PENNSYLVANIA
NOVEMBER 10-11, 1942

... Manpower Commission, delivering the opening

PROCEEDINGS
OF SEVENTH ANNUAL MEETING
OF
INDUSTRIAL HYGIENE FOUNDATION OF AMERICA, INC.
NOVEMBER 10-11, 1942

INDUSTRIAL HYGIENE FOUNDATION

An Association of Industries
for the
Advancement of Healthful Working Conditions

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PROCEEDINGS OF SEVENTH ANNUAL MEETING OF INDUSTRIAL HYGIENE FOUNDATION OF AMERICA, INC.

NOVEMBER 10-11, 1942

Tuesday Session
November 10, 1942

THE FOUNDATION IN WARTIME

ANDREW FLETCHER*

It is certainly a pleasure to welcome you to this our second annual ı ing of the Industrial Hygiene Foundation. In reality it is the seventh aı meeting of our group, which was formed, as you probably will recall, a Air Hygiene Foundation. We changed the name in order that our name might better convey the purposes of our organization.

It is with very deep regret that I have to announce to you the res tion of Dr. Meller, because of illness. I am happy, however, to say th will be able to benefit by his views and thoughts relative to the proble industrial hygiene, as he will still be with us as a consultant.

I am also happy to say that Mr. McMahon, who you will remembe been with us for a number of years, will carry on in the work. Mr. McM in a few minutes will submit a short report to you of our activities. I, ever, would like to say just a few words.

There are probably few associations in this country who have representative members, and I do not think there are any associations have as heads of their committees such capable men as ours. In this co tion I think that you should realize that these gentlemen have cont year after year, to aid us, and in turn industry, by serving withou compensation other than the satisfaction of realizing that the help th giving to industry is lessening the problems of industrial health.

We are also very fortunate in this Foundation in being so closely ciated with Mellon Institute, and in that connection I feel that you realize that Mellon Institute extends to us housing and this audit and at no financial profit whatsoever—absolutely none. For a numl years many people thought that Mellon Institute was making mone of the Foundation, but instead of making money, in the first years we started, actually made very big financial contributions. What receive from us is possibly a little good will through our activities.

I am also happy to say to you that your Foundation is not in del in fact that our financial condition today is better than it ever was.

* Vice President, St. Joseph Lead Company, Chairman, Foundation Bo Trustees.

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sonally would like to see us try to raise, through special solicitation, a fund of possibly $25,000 or $50,000. I think that many of our members are enjoying satisfactory earnings now, and they could probably include in their current operating costs any contribution to the Foundation. If we were able to secure a fund of say $25,000 or $50,000, we would have definite assurances that we could carry on during the lean years which are before us. But more important still, with a fund of this kind we could increase our research activities. I hope that the Foundation will never become purely an organization to gather statistics. Let it rather be a place where industry can come and we in turn can aid them in lessening the hazards of occupational diseases, and thereby do our part in increasing the production of our country, which is so sorely needed, today, and which in my estimation will be just as much needed in the peace which is to follow.

In closing, I would like to say a few words as to the Foundation's obligation during this war time. All of us today are facing a situation wherein democracy and personal freedom are fighting to survive in competition with a way of life in which the rights of the individual are being completely disregarded. Under such circumstances it seems to me that the obligation of the Foundation and the obligation of each one of us is to subordinate our interests to the national interest. And I think our national interest can be very easily described as winning the war.

A few weeks ago I was asked a question: Do you not think that it is industry's obligation to improve the working and living conditions of its employees? I replied that I consider it no obligation, but rather a privilege, and an excellent investment from a dollar and cents angle.

Your investment in the Foundation is an excellent investment if you will use it, and I certainly hope that you will.

ANNUAL REPORT OF THE MANAGING DIRECTOR

JOHN F. McMAHON

Lost Workdays

Precious workdays lost in war industries through absenteeism, in face of manpower shortages, constitute the gravest problem of the yea the field of industrial health.

The main causes of absenteeism are sickness, accidents, and volunt unavailibility. Sickness is by far the greatest single cause, claiming estimated eight workdays per worker yearly. With more than 17 mil men and women war workers, war industries are losing manpower at rate of 136 million workdays per year, or an average of more than million workdays weekly, through illness alone.

Because of absenteeism of all kinds, a substantial portion of whic certainly preventable, tons of coal are unmined and tons of steel are produced. Planes fail to fly, ships to sail, and guns to fire on the al war fronts.

One encouraging sign can be reported: The problem is beginnin receive serious attention. There is a lessening of the "nothing can be about it" attitude. More and more companies are keeping account of ab ces. Adequate records reveal the causes of absences and an understan of causes helps toward solution.

Collaborating with the U. S. Public Health Service, Industrial Hyg Foundation and a group of its member companies are conducting a s to help reduce sick absenteeism in the industries. Statistics are now c plete for 14 of the participating companies for the year of 1941, cove absences of 8 days or over. An individual analysis of each company's perience, prepared by W. M. Gafafer, Senior Statistician, Divisior Industrial Hygiene, U. S. Public Health Service, has recently been tr mitted to participating companies.

In the mining industry, where the problem has been acute, both and in England, District 2 of the United Mine Workers and the Ce Pennsylvania Coal Producers' Association are working together for "m mum production and maximum efficiency." They seek to "encourage r lar work on behalf of the miners and maximum efficiency on the par management. . . . ."

Women in Industry

Chairman Paul V. McNutt of the War Manpower Commissions re that "Of the 50 million women, age 14 and over, listed in the 1940 ce nearly 15 million are already at work." The swift influx of women industries, many of them filling jobs previously regarded as "men's w has been another major development of the year in the field of occupati hygiene. The successful employment of women imposes new responsibil on management respecting health and safeguards.

The campaign to promote proper nutrition for war workers, with phasis on "pack a lunch that packs a punch," has been stressed as before and promises to accomplish lasting good.

PLAINTIFF'S EXHIBIT

New Members

During 1942, 11 more companies and associations affiliated with Industrial Hygiene Foundation in the organization's efforts to promote healthful working conditions, namely:

General Motors Corporation	Koppers Company
Flintkote Company	General Refractories Company
Owens-Corning Fiberglas Corp.	Domore Chair Company
Employers Mutual Liability Insurance Co.	Strathmore Paper Company
Dresser Manufacturing Company	Davison Chemical Company
Pacific Coast Association Pulp and Paper Manufacturers	

There are now 246 company and association members in the Foundation. These organizations, practically all of them directly engaged in war production, emplo between 2 and 3 million war workers.

Plant Hygiene Surveys

The introduction of unfamiliar and new chemicals in manufacturing processes, some with little known toxic effects, is demanding even greater attention to plant hygiene measures. Meanwhile the dermatoses continue to be the most common of all occupational diseases.

The Foundation has conducted more plant hygiene surveys than in any previous year. These investigations, supervised by Frank R. Holden, check on the possible existence of health hazards in the workplaces. If hazards are detected, effectual measures are devised for their correction. Besides fostering healthful working conditions, the Foundation's plant surveys are proving to be an increasing factor in advancing harmonious labor relations, helping to eliminate working conditions which are often sources of discontent, such as nuisance dusts and fumes.

The Foundation collaborates actively with governmental agencies, both state and federal, which are interested in industrial health. One evidence of this cooperation is the subscription classification started early in the year whereby governmental agencies can secure all Foundation publications at less than cost. Since this arrangement was initiated 12 months ago, 4 federal agencies including Army and Navy, 22 states, and 5 cities have subscribed for Foundation literature. Meanwhile, 3 universities and 4 private specialists have also availed themselves of this material.

Research

The Foundation has continued to support medical and engineering research in industrial health with grants to The Saranac Laboratory, University of Pennsylvania and Harvard School of Public Health. Findings from these studies have been published. Then, too, an important study in toxicology is under way for a member company at Mellon Institute.

Publications

Two medical and two engineering bulletins have been issued to members during the year. These publications, giving the results of research, are as follows:

1. Comparison of Stereoscopic Miniature Chest Films, Single Roentgenograms on Paper, and Single Roentgenograms on Large Films.

2. Effects of Exposure to Welding Fumes and Gases upon Normal and Tuberculous Animals.
3. Air Flow Measurement by the Dilution Method.
4. Measuring Air Flow in Industrial Ventilation.

In addition to these contributions, the Foundation has publishe proceedings of the 1941 meeting, two educational bulletins, two special cles, and its monthly *Industrial Hygiene Digest*. More than 1,000 abst of articles, legal decisions, and news items relating to industrial health been carried during the year in that periodical.

As a wartime measure, the Foundation's Board of Trustees has au ized the extension of the services to non-member companies on a cost basis. This aid includes plant hygiene surveys which the Foundati making in increasing numbers in all types of manufacturing.

The value of Foundation membership is, in a large measure, what member makes it. Companies can utilize their membership or negle benefits. Call upon the Foundation more frequently in 1943! Your bership can help you keep your workers well.

DR. EDWARD R. WEIDLEIN (Director, Mellon Institute): Mr. C man, Members of the Industrial Hygiene Foundation of America, it is al a pleasure to welcome you to Mellon Institute. When I look back ove years of association that we have had with this organization, it has b very satisfying one. When we realize that we started out seven year with a small group to try to bring about a better cooperation and an u standing between labor and industry and management, through this I trial Hygiene Foundation, in improving health conditions of the work think we can all be gratified with the progress that has been made. We not only had splendid support from labor and industry in working on a mon basis for general improvement of working conditions, but we have had splendid cooperation from every scientific and research organizati the country, which is demonstrated in the report that Mr. McMahon just given you.

These advances have led to constant improvement in health condi in industry and to a better understanding of our problems. And the today is going to prove more valuable than it ever has in the past, whe realize the importance of the conservation of the health of the working especially while we are so short of labor, while we have to conserve in way possible.

I don't know of a better tribute that is being paid the Foundation than to have the Honorable Paul V. McNutt come from Washington, an extremely busy office, as you know the problems he is facing, and to the time to address this gathering. I think it gives us one of the supports and encouragements that we have ever had in the Foundation

I take great pleasure in introducing the Honorable Paul V. McNu

MANPOWER CONSERVATION

HON. PAUL V. McNUTT*

"What is the shape of total war?" asks Stuart Chase in his new book, "Goals for America."

"It is a condition," he says, "where every man, woman and child has specific duties to perform on behalf of his country."

That definition, mark you, anchors our hope for survival in human life and human effort—not in materials and machines.

We need to hold that concept, because the incredible changes in American industry over the past two years present a vision of physical accomplishment so dazzling that the motivating force of it all—the manpower and the womanpower—is obscured.

Here is a plant where the time for making an antiaircraft gun has been cut by four months. Over there is new equipment which beats the old in making machine guns by 20 to 80 hours.

Welding and the use of light metals has revolutionized shipbuilding and aircraft construction.

Our new plastics industry has become a Paul Bunyan overnight. Raw materials deposits are being newly put to use. New processes—new ways to do are introduced with miraculous speed.

One industrial plant alone has expanded to the tune of more than nine billion dollars. We have also more electric power, more machine tools, iron and steel mills, metal refineries, and chemical works than ever before.

Yes, we have the physical resources. But to send the ships down the ways, to roll the tanks and bombers off the assembly line, we must put every man and woman to work—and we must keep them on the job.

This conference then gains deep significance to our nation's drive to victory because you are here to consider how to keep workers on the job—and what you can do to aid in that herculean task.

You know far better than I do how costly the rapid changes in industry may be. A new material or process carelessly introduced in a plant may suddenly result in illness or injuries which keep men off the job. And you know how to deal with these problems—as your excellent program indicates.

The responsibility of the employer and the industrial hygienist for disability clearly occupational in origin is well defined. You and I must now consider other factors, both inside and outside the plant, which affect the health and efficiency of the worker. For if total war teaches us our duty to our country, it likewise teaches government its duty to every citizen; and it teaches each of us our duty one to another.

Frankly, our situation in war production today is such that we cannot afford to discard the services of one single man or woman who can be considered a potential worker. We cannot afford to lose one single day of work that can possibly be saved. The totals of armament to be produced in 1943 may be measured by the President's call for 10 million tons of shipping; 125,000 planes; and 75,000 tanks.

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* Chairman, War Manpower Commission.

If we were dealing with mere figures, we could safely predict t[h]
shall have enough manpower to do the job. But this is more than a
tical exercise.

The feat of actually getting the right people, in the required nu[mbers]
into the right jobs at the right time—the feat of supplying manpow[er]
one of the greatest problems of personnel management the world ha[s]
seen.

And it is not one national problem. It is a network of local pro[blems.]
It is a vast complex of individual towns and individual plants that
special challenges to meet, special difficulties to solve.

Within the impressive totals of workers needed are plants which
workers at less than top skill and thus create for themselves artificial
shortages. Within them are other plants which waste the vigor an[d pro]ductiveness of good workers because they do not follow sound advi[ce on]
health and safety.

Within the totals, too, are towns like New York, where there ar[e]
tens of thousands of unemployed. There are towns like Baltimore
there are few unemployed and less housing and where more than
additional workers must be found in the next twelve months from
employers did not consider or accept a year ago when they talked
"labor supply."

Nevertheless, the totals are impressive evidence of the gigantic
lenge which faces us.

By the close of the year, our total labor force will number more
59 million. Over 5½ million will be in the armed forces. About 18 n
men and women will be in war production jobs—more than twice as
as were in war work at the time of Pearl Harbor. In another year's
if the war continues, about 30 million people will be in the war indu
This means that we shall have fewer unemployed; fewer people in ag
ture; and fewer to man the essential non-war services and industries.

One of the most notable changes in industry is the increase in w
workers. Of the 50 million women, age 14 and over, listed in the
census, near 15 million are already at work. The remaining 35 millio
the nation's principal remaining labor reserve. But not more than 13 n
of them will actually be available to industry. Age limitations, the
for farm labor, maintenance of homes, and the military and voluntary
vices restrict somewhat the use of this potential supply. Youths
draft age, over-age men, and physically handicapped workers mu
counted to supply the remaining needs both in war industry and ess
non-war work.

How do these vast shifts in the composition of the labor force affe
conservation of manpower?

Women are going into occupations where only men were for[merly]
employed. The proportion of women employed in such industries as avi
munitions, tool and die, and manufacture of precision instrument
already increased by leaps and bounds. Employers are facing new prol
with respect to the health and efficiency of women workers.

In my opinion, the conservation of womanpower should offer no
of a problem than the conservation of manpower. If we give the w
healthful working conditions, adequate training in safe practices, and
medical service, we can expect as good results in reducing the tim

due to industrial disabilities among these new employees as we know can be obtained among men. High sickness rates recorded for a few thousand office workers who grab a soda for lunch should not be a criterion for refusing employment to women in plants where industrial health has been given an A-1 priority.

True, we must make sure that untrained workers—the teen-age boy on his first job—and older workers who have lost their former skill are given more protection than the average man has been given in the past. And we must make sure that they are carefully trained in good work habits. But we must forget our peace-time fears that the young and the old and the physically handicapped will send up our insurance and compensation rates. The order of the day is manpower first.

I might add that, even though there is a differential as compared to the luxury physical standards some employers have enforced, they must still use women—they must still use the handicapped—they must still use the aged, and the untrained. In total war we use all our people. We must not disqualify them for their limitations. We use them for what they can do.

I hope that this war will outlaw the term "pre-employment" in favor of "pre-placement" examination. The old idea that an industrial worker must have the physical requirements of a 1-A or 1-B selectee must be thrown overboard. Management and labor can no longer regard the pre-placement examination as a means for rejecting the physically handicapped or any other worker from employment.

Your job is to make the health appraisal an effective tool for placing all workers in jobs which they can do safely and efficiently.

Men and women with minor and major defects can be given an opportunity to make a substantial contribution to the war effort. The Federal Government and many private industries are doing so today. The deaf and hard-of-hearing are being trained as card-punch operators for the Civil Service Commission. There are seven million physically handicapped men in the United States. The vast majority of them could go to work tomorrow, without any special restorative help. Another million men need rehabilitation, but with careful placement could be used in a wide variety of jobs.

Contrary to the belief of some men in public life, most of our war workers—new and old—are on the job longer and harder than they have ever been in their lives. They are working longer and harder than any group in Washington.

Fatigue is the most effective saboteur in the war effort. The military services regard fatigue as a major hazard to successful combat. A tired man or woman on the production line is a potential danger to himself and to his fellow workers. Making planes, tanks, and munitions demands skillful and precise work with precious materials we cannot afford to waste. You will find a high percentage of wasted effort and spoiled materials at a tired worker's bench. And no one will be more puzzled than he as to why he fumbles the job.

A short time ago, eight Federal agencies jointly subscribed to the policy that for continuous, efficient production, the 8-hour day in a 48-hour week is the best basic schedule for war work. These agencies included the War and Navy Departments, the War Manpower Commission, the War Production Board, the Maritime Commission, the Department of Commerce, the Department of Labor, and the Public Health Service. This agreement is in

line with a statement issued by the Surgeon General of the Public Heal[th] Service seven months ago, in which he pointed out that industries operati[ng] on a 24-hour basis must now take steps to minimize the effects of fatig[ue], night work, and the rotating shift.

The day of reckoning will come. The contractor who thinks he c[an] beat the timetable and top the quota by ignoring health and safety requi[re]ments is due for a shock. Before long, he will not be able to replace eve[ry] sick or injured worker. Army and Navy "E" pennants won at the expen[se] of high accident rates will have to be lowered to half-mast.

Every war plant can and should be a safe and healthful work pla[ce]. But what about the home and community?

There are 300 or more "boom" areas flung across the country. I[n] these places some 5 million new inhabitants have moved—to work in w[ar] plants or around military cantonments.

The health and medical care problems of these people are acute. U[n]bearable and even dangerous living conditions are common. Basic sani[ta]tion is inadequate to the new demands. Hospitals are insufficient. A[nd] there are not enough doctors, dentists and nurses.

That picture is black enough to plunge this conference of life-save[rs] into stygian gloom. But I do not despair. The old saw holds good—it[']s darkest before the dawn.

Slowly—I hope not too slowly—public housing, emergency constructi[on] and the resources of the Public Health Service will bring about impro[ve]ment of the environment.

As I see it, manpower conservation is not a problem of "know-ho[w]" but rather "Get on with the job."

Management and labor need a great deal more information about [the] causes of absenteeism and the ways to conserve manpower. Manageme[nt-]labor committees exist today which can translate that knowledge i[nto] action. The story must be understood and accepted by the workers w[ho] must put it into effect. It must be understood and accepted by even [the] most tradition-bound board of directors.

Few employers see the relation between their production "headach[es]" and conditions both in and outside the plant, which directly affect the wo[rk]ers' health and welfare.

Recent reports show that lack of decent housing and transportat[ion] tangles are high in the causes of labor turnover. Poor working condition[s—] exclusive of low wages—are given by many workers as a reason for quitt[ing] a job. You know better than any other group how frequently "poor wo[rk]ing conditions" mean crowding; excessive noise, tension and strain, medi[cal] sanitation—and even exposure to dangerous substances. Not long ago [a] war contractor was much surprised to learn that his 25 percent labor t[urn]over was largely due to the uncontrolled fumes of a poisonous solvent.

We have come far in the control of occupational hazards. The new plants will speed this advance, because they are being constructed to h[ouse] men and women as well as machines. But even today, all too many cont[rac]tors are grossly negligent of the most elementary practices for manpo[wer] conservation. As simple a thing as cleanliness in the workshop is too o[ften] neglected. Repair and maintenance of machines and safety equipmen[t are] forgotten as the call goes out for speed—more speed.

Many communities that had unenviable health records in the past learning that they must correct their errors for the benefit of war workers and old residents as well. More of the American ingenuity which gave us the bombsight and mass production of ships is needed on the home front.

Every community must look about for new ways to use every available resource for health protection.

Tens of thousands of doctors and nurses, and countless other professionals needed for the conservation of manpower, are with the armed forces. More will go.

The problem that faces us now is a two-headed beast. First, where and when to take the doctors needed by the Army and Navy. Second, how best to use our remaining medical strength.

With all the power that has been given it the War Manpower Commission will endeavor to allocate the skills and strength of the nation more equitably than has been done up to now. This would apply to our medical, engineering, and technical manpower as well as to the labor force.

The Procurement and Assignment Service, with the technical aid of the Public Health Service, is continuing its efforts to determine civilian needs in war areas and to find the needed doctors.

Most of the States have met their quotas for military doctors. Recruitment will continue in New York, Massachusetts, Illinois, Ohio, Pennsylvania, and California. Conferences with the Surgeons General of the Army, Navy, and the Public Health Service are being held continually to decide the best way to withdraw physicians.

The Procurement and Assignment Service reports that, to date, some 218 physicians have transferred to other communities, either within their states or out-of-state, for civilian practice.

More dislocations are sure to follow, if we are to maintain minimum medical service both in critical areas and non-war communities where the drain has been heavy.

To say that we can spare tens of thousands of doctors to the military and still have enough to take care of the civilian population on the comfortable margin of one physician to 1,500 people is just juggling figures.

Our doctors have never been parceled out evenly. And today the parceling seems to have taken little account of human needs or limitations. There are many towns where there is not one doctor per three thousand, or even four thousand or more. There are boom towns where the nearest adequate medical service is 25 to 50 miles away.

We must now begin to ask the question: "Is this essential to the war effort?" in our use of professional skills. This requires not only voluntary acceptance of demands but a method for rationing the skills just as we are rationing supplies. We must do it for all the rest of our manpower—and no profession is any exception.

The problem of getting doctors into hard-pressed war communities is a manpower problem. The Procurement and Assignment Service of the War Manpower Commission is responsible for the equitable allocation of medical manpower, so far as is legally possible, and the United States Public Health Service is responsible for its equitable use in civilian areas.

Rationing of medical services may be needed. The stamp-book method would not work because you cannot ration sickness. Misfortune hits unevenly. Some people need a doctor many times in a year; others, only occa-

sionally. But no one can predict "how much" or "how often." The l
way to meet the emergency would seem to be to exercise some control c
the movement of physicians both into and out of civilian practice, plus m
"pooling" of medical services, hospital facilities, and nurses in the c-
munity.

The lack of medical facilities in the critical areas is a war probl
Therefore, the Federal Government has a responsibility to help in solv
it. If the war workers and their families are left without medical c
their health problems will increasingly impede the war effort.

How the needs are to be met is the constant concern of the authorit
Plans are being made and tried in different areas. The same plan will
work everywhere. We must keep on trying, and meet situations as t
arise.

The shortage of nurses can be met. We have increased the ye
enrollment of student nurses by twenty thousand since 1940. By shorter
the period of academic training, we can take on as many as sixty-five th
and student nurses in 1943.

But to supply the armed forces and to stretch the remaining nurs
skill for civilians, we will have to use nurses' aides more often and in n
places. Hospitals, health departments, clinics, and industrial dispensa
have scarcely begun to tap this potential source of help.

We must all face this fact. Every profession is losing both recr
and practicing members to the armed forces.

In any event, "non-professionals" are going to have to take on a lo
jobs which only the initiated formerly did.

I wonder if the industrial hygienists have explored the possibility
inducting non-professionals into some of your specific skills? The s
health departments and the Public Health Service have 500 former sa
men, teachers, and other "laymen" out tracing the infectious contact
venereal disease patients. This job was once delegated to nurses and doct

If an industrial hygiene service has not enough doctors or engineer
cover a large number of war plants, is it economical—is it necessary
professionals to do all the legwork making contacts? Does it take a do
or chemist to tell, on a first visit, that a plant needs a thorough going ov
Could laymen be trained to do that specific door-opening job?

The British have made medical care and cafeteria service compul
in every war plant of 200 or more workers. In this country, the nutri
program has brought about great progress without compulsion, but m
more remains to be done.

Industrial medical service also must be extended. But if that is t
accomplished, medical departments must take a wider view of their res
sibilities.

The shortage of physicians will make it harder for plants to keep t
full medical staffs. New departments will not find it easy to obtain doc

Too few industrial establishments had full-time medical service be
the war. A larger number had a doctor in a few hours a week to
care of accident cases. In fact, all but a handful of industrial me
departments concerned themselves with nothing but compensable injur

I submit that in today's war emergency such unrestricted concep
manpower conservation does not justify exempting the industrial physi
from induction into the armed forces.

Industrial medical departments should draw upon local physicians wherever possible. But under any circumstance, in-plant medical care should treat non-compensable illness on the job. Preventive services should be provided.

And in boom towns where there are not enough doctors, industrial physicians and nurses should give home care both to the workers and their families.

I will go further. Where location permits, industrial medical service should be spread to cover the employees of more than one plant. In one new shipbuilding town there are three plants. Only one has been able to get doctors and nurses. The lucky contractor cannot meet his schedules unless the other two meet theirs. Preventable time-loss from sickness in the doctorless plants is holding up the war effort. Now why cannot all three get together and make some medical care available for all the workers and their families?

The Public Health Service has been taking care of the United States Coast Guard families for several years.

You in industry and medicine have a bigger task than saving that small amount of time lost to preventable diseases and accidents. Your assignment is total conservation of manpower.

Like military medicine, your task means "prevention and restoration." Prevention has the high objective of throwing around the soldier every known health protection to keep him in action. If he does succumb to sickness, accident, or enemy attack, the duty is to restore him to action as quickly as science, skill, and nature permit.

Your task is to do the same for the men and women in our war industries—our industrial army without whom the United Nations cannot win.

LT. COL. A. J. LANZA, M. C.: In accordance with the spirit of the times, the comments of your chairman will be strictly rationed.

Mr. McNutt referred to hours of work. Three or four days ago the Washington Post, on the front page, had two headlines. One headline stated that one very eminent gentleman, one of the leaders of our government, wished to increase hours of work. The other heading was to the effect that another extremely eminent gentleman in our government did not wish to increase hours of work. In that situation lies the crux of the matter of industrial fatigue, and without any more ado I am going to introduce Dr. Selby, who will lead a discussion on hours of work and the rotation of shifts.

FATIGUE IN WARTIME INDUSTRY
(Hours of Work and Rotation of Shifts)

A Panel Discussion with the following participants:

C. D. SELBY, M. D., Medical Consultant, General Motors Corp., Presid
W. A. SAWYER, M. D., Medical Director, Eastman Kodak Company
NATHANIEL KLEITMAN, Ph. D., University of Chicago
WILLIAM H. FORBES, Ph. D., Harvard Fatigue Laboratory

DR. SELBY: The panel consists of Dr. W. A. Sawyer, Prof. Nathan Kleitman, and Dr. William H. Forbes. They are prepared to respond questions from the audience. The discussion will be unrehearsed and sp taneous, I hope. I wish it were possible to offer you a reward of a memb ship in the Foundation for the question which will stump the experts. can offer you, however, a competent answer.

I would like to have the panel of experts define fatigue in a war ind try. Perhaps Dr. Forbes can answer that.

DR. FORBES: I don't think that fatigue in industry is one single ent It should be divided for purposes of discussion, in my opinion, into at le three categories: first, physical fatigue; second, mental fatigue; and th what I should like to call nervous fatigue.

Of these the last is by far the most important. In modern indus physical fatigue has become relatively unimportant by the introduction very large number of labor saving devices and the use of electric po Even when physical fatigue does occur it is of far less importance than vous fatigue, partly because it is so easily remedied. If it is clear th man is out of breath all day from the work he is doing, something is d commonly, to make the work lighter.

Mental fatigue I would like to skip over. It is a type that I thin relatively unimportant, coming only from long hours of application to tal tasks, without particular nervous strain. I would like to invite attention to nervous fatigue, that which makes a man say at the end of day, "I'm tired." In the great majority of cases that is the reason.

It comes in mild degrees, as is natural. It comes in major deg however, from working under conditions of too great strain, emot strain among others, and in uncongenial surroundings.

I think that is about all I can do in the way of defining fatigue.

DR. SELBY: It is quite evident from what the Doctor says that fatigue with which we are concerned is that which results from emot conditions, or conditions causing emotional disturbances. I think that a very good question, by the way.

DR. L. D. BRISTOL (American Telephone & Telegraph Company a meeting last night in New York a question was asked me which I co answer. I wish this meeting had come first. The question is, how do measure fatigue, nervous fatigue, short of decreased production? Do have to wait for decreased output, decreased production for eviden fatigue? What is the best measurement of it?

PROF. KLEITMAN: We can measure it by the number of mistakes the person makes, and also by the speed with which he works. Speed and accuracy are very good measures of fatigue. You don't have to be at the point of sheer exhaustion or complete failure. If speed decreases and accuracy decreases, then fatigue has set in. Actually, of course, sleepiness is a pretty good indication of incapacity for work. A person that is sleepy, yawns all the time, is definitely not in condition to work.

DR. SAWYER: May I put in a word from the practical point of view? It seems to me there are some other things we can think about. That is the question of the number of accidents the man has. The amount of time he loses on the jol may be related to the fatigue question, and his spoilage of work also.

DR. SELBY: When I get tired or fatigued, I get irritable. Is that something to be considered? The panel says "yes."

MR. JOSEPH PAPPALARDO (Hawley Products Company): How long do you think it is practical for a man to work on, say, the last shift, when fatigue becomes quite a factor?

PROF. KLEITMAN: I would put it the other way. There is more fatigue on the night shift to start with than later on. The worst trouble we have today is the rapid rotation of shifts. Most people are accustomed to sleep at night and work in the daytime. When they need to work at night they are sleepy at night and they cannot sleep in the daytime. A person who cannot sleep in the daytime will naturally be sleepy at night.

Mr. McNutt mentioned the statement by the Surgeon General of the United States Public Health Service about work around the clock. He definitely expressed himself as against rapid rotation of shifts. How many people here have heard about it or know about it? I don't think very many do. In other words, there has been no attempt to educate both labor and management to the danger of rapid rotation.

It takes weeks for any one, even the fastest, to adapt oneself to a new routine. If you put a worker on a shift for one week, he is no good. Next week he will be better.

So I would answer your question in reverse. The longer you have him on the shift, the less he is likely to be inefficient during his odd working hours. I am in favor of so-called steady shifts, unchanged shifts, but that seems to be impractical for a variety of reasons, and so to compromise, I advocate infrequent rotation of shifts. Not once a week or two weeks, but once in two or three or four months—as long on one shift as is possible under local conditions.

DR. ANNE BAETJER (Johns Hopkins): I would like to ask Professor Kleitman: how do you fit that with the experience of Great Britain in the last war, where they found that the output did not decrease at any time when they had an alternating shift, say, changing every two weeks, whereas if it was a continuous night shift they found that the output decreased, both for men and women?

PROF. KLEITMAN: That is news to me. I do know that they use two weeks rotation, but from experience in this country and elsewh is the steady worker at night that has fewer accidents than the one rotates very rapidly.

DR. BAETJER: I was quoting from Vernon's book and also fro Industrial Health Research book, both the one published in 1921, afte last war, and the recent one. He makes the definite statement that co tinuous night work the output was lower than it was if they rotated da night shifts.

PROF. KLEITMAN: There are other elements there, probably the of worker employed at night. I would say the important element i lack of community organization of leisure for the night worker. I treated more or less as a social outcast. And so rapid rotation has t its favor. It gives a man, under the present organization, some chan normal social life at two or three or four week intervals. But wit present situation, in boom areas entirely devoted to defense work, it tainly should be possible, and that is the job of Mr. McNutt, to org social life on the odd schedule to make it livable and acceptable, i exactly desirable.

DR. SELBY: Has the panel anything else to add to that? For exa does the type of work have anything to do with it?

DR. FORBES: It seems to me that the question originally asked c be answered without knowing the type of work involved, and that each of work has its own maximum hours, which is related to its difficulty to the variety to be found in the particular job. A farmer, for instance work very many hours, even probably on a night shift, in comparison pilot of an airplane, who is probably inefficient if he endeavors to work than something like 100 hours a month. I think that the kind of work be taken into consideration when any such question is asked.

DR. A. G. CRANCH (Union Carbide and Carbon Corp.): Just observations based on experience for some years with a concern tha general mechanical work on a day and night shift basis. They ado finally a four week interval of shift from day to night. It gave the an opportunity to enjoy day life every other month and work one full m on night shift. They adjusted to it very readily. They had a 24-hour i val on changes of shift. They adjusted very well, the men all liked it, did well on it, and we had no greater accident experience at night tha had on the day shift.

In another instance, the night shift was longer than the day shift, u their set-up. It was a 13-hour shift against a 10-hour day shift. That bad. That was machine work, and they had a number of very severe dents on the night shift as compared to the day shift. The men woul careless toward the end of the shift and overlook ordinary precau which the day men seldom overlooked.

Another thing was that those night shift men, to a large extent—it permanent, not shifting—did want to enjoy certain daytime activities.

time came out of their period for sleep. They were sleeping from four to five hours out of the 24, working 13 hours, and it was not good. I know that this did not work out well.

PROF. KLEITMAN: I would repeat that monthly rotation is better than weekly rotation. But as a matter of fact, when you change from one routine to another, it doesn't make any difference whether you are a worker or a non-worker, at first you will be sleepy during your regular sleeping hours. A sleepy worker naturally is a danger to himself and his machine. It takes time to adapt himself. There is absolutely no question about it. The fact that people will accept weekly rotation or bi-weekly rotation or monthly rotation because of the social element involved is absolutely true. They will pay for it, just as we pay for other things by making sacrifices. But it is not good, physiologically, to have a man rotate rapidly.

The only difficulty, it seems, here, is what we call "rapidly." Some schedules require rotation three times in one week. That, of course, is too much. But two or three or four months, I would say, is probably the best compromise between steady shift and rapidly rotating shift.

MR. W. H. LIPMAN (Hewitt & Co.): I would like to ask the members of the panel to tell us their views about the possible influence of age on fatigue, whether it wouldn't be advisable to choose the younger employees. I imagine younger employees would not be fatigued as soon as the older ones, and yet the younger employees are more anxious for a social life than the older workers.

And may I ask another question while I am up? It has been my observation in certain localities that the provisions made for cafeteria and lunch room facilities at night are not as adequate as those provided for the day shifts, which of course are larger. I am wondering whether poorer lunches are not a factor in the production of fatigue.

PROF. KLEITMAN: I would like to say something on both questions. Dr. Lipman said younger people are more anxious for social life, which usually goes on in the evening. For this reason it has been found that older people are more willing to work at night and will do so especially if a little extra pay is offered. In many plants they have found that their older workers do very well on the so-called undesirable night hours.

The second item you mentioned is a very important one, not only as to cafeterias but health service. Nurses may not be on duty for first aid. If you work around the clock you have to organize all the services around the clock. That has definitely not been done. That is another reason why the night shift is undesirable.

DR. SAWYER: It seems to me that the older individual may suffer more fatigue, possibly, than the younger person on certain types of jobs. A proposal was expressed in Toronto the other day, which I thought was rather interesting, namely, that it might be well if we would take some of these older people that we are now taking into our organizations and keep their hours to perhaps half time. Let some of the women work four hours a day instead of eight, because many of these women coming out of homes are not accustomed to routine factory work. Couldn't we use a great deal of man-hours or woman-hours in that way?

DR. FORBES: We endeavored to make a laboratory study of the e of age upon capacity to continue work for long periods, but we used pl cal work, because physical fatigue is the only one that we have been to measure with any degree of accuracy. We were surprised by the that for long continued physical effort of low intensity the peak of effici seemed to be reached at a much older age than we had expected. Someti probably in the neighborhood of forty, rather than as we had expecte the twenties. That applies, of course, only to physical fatigue. I d know whether nervous fatigue follows the same pattern.

While it is certain that the very old get tired easily, I am not at convinced that the age group of forty to fifty is easily fatiguable unless rate of work is very hard. I think a young person, it is fairly clearly sho can work more rapidly for a long period. But if you step down the ra little, the older person will perhaps outstrip the very young. I don't th there is any advantage over people over twenty-five, but I think that man of 40 is often better than a man of 20.

MR. J. G. WRIGHT (Massachusetts Bonding and Insurance Co.): Forbes has mentioned something about emotional fatigue. I am wonder [illegible] [illegible] nistic and steady going. I wonder if that type of study isn't necessary.

DR. FORBES: The studies that Professor Roethlisberger carried and which are reported in his book, "Management and the Worker," indica on the whole that it was not the type of man so much as the way the n fitted into the particular group in which he was working which was imp tant in the alleviation of or the causation of fatigue. If he fitted in poor if he was ill adjusted to his group, if he didn't work with them as a team, got tired irrespective of almost any other factors. On the other hand, i man or woman felt that he was a necessary part of an organization in wh he took some pride, he could do more work, under almost any reasona conditions of environment, than he could in the best possible conditions environment if he did not fit into the group.

I was referring to this when I said that emotional strains were proba very important in the causation of what I called nervous fatigue.

MR. HARMON SWART (K and S Restaurants): I would like to as question on nutrition. What investigation has been made of the effect proper employee feeding in preventing fatigue, nervous as well as otherwis

DR. FORBES: I can merely say that various people have worked on Haggard and Greenburg published a book about three or four years ago diet and the worker. I believe the title is "Diet and Physical Efficienc Then Professor Roethlisberger's book that I just mentioned, "Manageme and the Worker," describes a series of experiments at the Hawthorne pl of Western Electric Company, in which they tried a large variety of fe ings. They gave workers two or three meals a day and then they stepp it up to six, and they analyzed the results. The differences with differe numbers of feedings do not seem to be closely related to the feedings, pr vided that the men get enough food at the meals they do take. Howev insufficient feeding is very productive of fatigue.

MR J. DEWEY DORSETT (Assn. Casualty & Surety Executives): What part does our present day thinking play in the matter of fatigue and short working days? I am told that the farmer works from sun to sun and certainly the boys in the vicinity of Guadalcanal Island and the Solomons stay on the job for several hours per day. Have we been coddled in this country a little too much in the past several years?

PROF. KLEITMAN: I don't think you can compare a farmer with a factory worker. He very often works for himself. He takes things easy. He works in the open. It is an entirely different type of activity than factory work at a bench or machine, which is rather monotonous, very often involves repeating the same thing for hours at a time.

DR. SELBY: Did he answer your question, Mr. Dorsett?

MR. DORSETT: No. Having worked in a factory for more than eight hours per day, it doesn't.

DR. SELBY: Will the panel venture any other response? Have the workers been coddled, I think is the question.

MR. DORSETT: Not only the workers, but all of us.

DR. LUDWIG TELEKY (New York State Department of Labor): I made an investigation many years ago about day and night shifts, and we found that physiological changes in changing the shifts are mostly evident within one week, mostly in a few days. I agree entirely with Professor Kleitman that changing of the shift every week is too much. I think every three to four weeks certainly may be the most nearly perfect one, because it conforms with certain English findings.

I think it is well to change the shift at 12 o'clock at night. I believe that in this way two shifts have an advantage. I think it would be very interesting to see which one is better, to change the shift at 12 o'clock at night or to change the shift at 10 o'clock at night.

A third question is the question of the meals between shifts. There are such very interesting investigations of Haggard and Greenburg, but those two men have forgotten something, that is the same meals and the same rest time. We have a lot of investigations which show us that short rests in the working time are very useful for the efficiency of the worker. I believe that this combination of short rests and small or large meals between the shifts is very efficient for increasing production.

DR. SELBY: Thank you, Dr. Teleky. I regret that there is time for no more discussion.

Manuscripts which were prepared in connection with this panel will be published by the Foundation.

PLAINTIFF'S EXHIBIT

A SCIENTIFIC SOLUTION OF THE MULTIPLE SHIFT PROBLEM

NATHANIEL KLEITMAN, Ph.D.*

In the ordinary routine of existence certain hours are customari allotted to sleep, work, meals, and leisure activities. By following such routine for many years one becomes attuned, as it were, to a cycle of exi tence, which is reflected in his readiness to work well during the workin hours and to sleep well during the hours usually devoted to sleep. Th present emergency has necessitated the employment of two or three, or ove four shifts, in carrying out the President's request to keep the plants goi twenty-four hours a day, seven days per week. The introduction of multip shifts has brought up a number of problems with respect to work at unusu hours and the necessity of adapting one's other daily activities to the ne schedule. A variety of practices have been adopted in various establis ments, the extremes of which are very frequent rotation of shifts on o hand, and the maintenance of so-called "steady" shifts on the other. many cases the practice was the deliberate choice of the workers themselve in others, the shift system chosen was what the management or lab leaders thought would be best for greatest productivity.

When a night worker complains of his inability to sleep well in th daytime, he thereby unintentionally conveys the information that he is ver sleepy at night, when he should be wide-awake at his bench or machin This is because sleep and wakefulness are mutually complementary, consi tuting the two phases of the cycle of existence, like the trough and crest a wave. The sleepiness of the unhappy night worker is not only due to h working during the customary hours of sleep, but also to the fact that h slept poorly the day before. Thus, an acceptable solution of the night shi problem should have a two-fold effect: Greater wakefulness and efficien during the new working hours and better sleep during the odd sleeping hour

To solve this problem intelligently we must know something about th working of the human machine, the manner in which we adjust ourselves a schedule of living, and the ease or difficulty with which this schedule ca be changed. At birth we spend most of our time in sleep, and there is n evidence of any twenty-four hour cycle in our bodily activities. We ar however, born into a world which is run on the routine of daytime wor evening leisure, and night sleep, and we very early in life are subjected an enforced schedule of hours in conformity with the habits of our elder As a result, already in the second year of life we have a well establish twenty-four hour or diurnal cycle of existence. We further fortify th cycle by regularity in our daily schedule of living. This is especial noticeable in children whose hours are controlled by their elders, in that th get sleepy (the advent of the sandman) at a very definite hour and, if ke up beyond that hour, show themselves to be rather unmanageable, althoug they are well behaved during their usual waking period.

If you look at a clinical or fever thermometer you will notice an arro at the 98.6° F. mark. All the lines above that mark are in ominous re These markings have created the utterly false impression that the norm temperature is something quite fixed. Actually it is no more constant tha for instance, the pulse rate, the two incidentally varying in same mann

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Instead of a normal body temperature, we have a temperature range, varying for different people, and for the same person at different times. This range is about one, two, or even three degrees F. over a twenty-four hour period, and the change in body temperature from hour to hour is such as to create what we call a twenty-four hour body temperature curve. Under ordinary routine conditions of existence, the peak or plateau of the temperature curve is reached some time during the *afternoon*, usually between 1:00 and 7:00 P. M. At that time our efficiency is greatest. The minimal body temperature is reached during the early morning hours, somewhere between 2:00 and 5:00 A. M. If one stays awake overnight, those are the hours of worst inefficiency and greatest difficulty of remaining awake. When one adjusts himself to a new routine of existence, with other than customary hours of sleep, work, meals, and leisure, one gradually acquires a body temperature curve, with the highest efficiency and less sleepiness during the new activity hours and just the opposite during the new sleeping hours.

A variety of physical and mental tests have demonstrated that hardly anyone is at his best immediately on waking up in the morning. In fact, performance at that time may be as poor or poorer than just prior to going to bed the night before. However, from this low level of performance, one shows a gradual improvement, reaching a peak or plateau of greatest efficiency sometime between noon and evening. Beyond that, efficiency again falls off, and at a certain hour, in people with regular habits, a state of drowsiness develops, and the individual usually retires at that time. If, however, one is kept awake during the entire night, he will show an increased progressive drop in performance between 2:00 and 5:00 A. M., but from then on will show an upward turn so that at the time of his usual awakening, his performance will be nearly as good as it was at the bedtime the night before. Because the twenty-four hour cycle of sleep, work, meals, and leisure is not inborn, but individually developed by following a definite routine, it can be displaced forward or backward by faithfully following a new routine.

How can these facts be applied to the solution of the multiple shift problem?

The application of these facts to the solution of the multiple shift problem has two aspects: (1) rotation or maintenance of shifts and (2) shift distribution or timing.

Rotation or Maintenance of Shifts

It takes several weeks for a new 24-hour sleep-work-meals-leisure cycle to be properly established. Such achievement is wholly impossible under the system which prevails in some establishments of weekly or bi-weekly shift rotation, because the individual is not given a chance to adapt himself to a new routine. He essentially remains on the customary cycle of daytime work and night-time sleep. This makes him dislike work at odd hours. It causes him to be sleepy at a time he should be wide awake and wakeful when he should be sleeping; it leads to a decrease in production rate and a greater tendency to accidents. The way to overcome this effect is to keep each worker on a given shift for extended periods of time. Since rotation of shifts is very often adopted as a measure of fairness to all workers, the principle of equality of treatment can be preserved by having the workers change shifts once in several months, instead of weeks, or even days. The

change in shifts can be staggered and made to coincide with short periods of vacation, in line with the suggestion that vacations should be distributed around the entire calendar year, instead of concentrated during the summer months. Where the workers themselves prefer it, the maintenance of "steady" shifts, with no rotation whatsoever, can be accomplished with due regard to seniority rights. Whether the shifts are "steady" or rotated some effort should be made to modify community life to the extent of making leisure activities at other than customary hours possible. For instance broadcasting companies might be induced to make transcriptions of their popular evening hour programs for rebroadcast during the afternoon and late night hours. Moving picture shows could be extended either way by a few hours, and parties, group meetings and lectures organized with an eye to the leisure hours of each third of the working population.

Shift Distribution or Timing

It is clear enough that a person working from midnight to 8:00 A. M. which is the customary night shift, makes his new work period coincide almost completely with his old sleep period. It is easier to adjust one's self to another shift timing in which the displacement of the cycle is smaller. Taking, for example, three eight-hour shifts, the following is suggested:

Red (Sunset) shift. Working hours from noon to 8:00 P. M. Evening and early night free for leisure activities. Sleep from 1:00 or 2:00 to 9:0 or 10:00 A. M.

White (Victory) shift. Working hours from 8:00 P. M. to 4:00 A. M. Sleep from about 5:00 A. M. to 1:00 P. M. Afternoon and early evening free for leisure.

Blue (Dawn) shift. Working hours from 4:00 A. M. to noon. Leisure in the afternoon. Sleep from about 7:00 P. M. to 3:00 A. M.

This shift timing has a number of advantages. One of the distinc advantages is the relatively small displacement of the customary sleeping hours, as no one is compelled to sleep in the afternoon hours, when it hardest to sleep. Another advantage is that it also makes shift changing fall at hours which are not general community rush hours. If several plan are located in the same vicinity, the transportation problem created ma require the White-Blue shift change to be staggered from about 3:30 to 4: A. M., and the others correspondingly.

The special advantages lie in the appeal of each of these shifts to ce tain groups of workers divided according to age, interests, family stat and recreation habits. It may be pointed out that each of the three shif should appeal to the following groups:

The Red shift will appeal to young unmarried men and women who li to have their recreation late in the evening, as it would enable them to st up to or beyond midnight and sleep later in the morning.

The White shift will appeal to middle-aged individuals whose social l has altered. As their children have all grown up they would not be d turbed while sleeping during the forenoon hours. They would have t afternoon free, as they would not be due to begin work until 8:00 P. M.

The Blue shift fits in very well with the schedules of families of t intermediate groups, where there are small children. The father could to bed early in the evening at the children's retiring time. He would ret from work shortly after noon and have the afternoon free.

Of course, several members of the same family, even though of different ages and interests, will probably choose to work on the same shift.

With five eight-hour working shifts per week, the weekly holiday of two days may have an upsetting effect on the establishment and maintenance of the displacement cycle, in that it is too much to expect workers to stay up during the odd hours which they devoted to work during the five days preceding. One answer to this problem is to decrease the week-end break to one day, and the forty-eight hour six-day work is coming, where it has not yet been adopted. The effect of the common tendency to revert to "community" sleeping hours on free days is minimized, if the sleeping hours on work-days are displaced in one direction or another only four hours, instead of eight (as necessary under the graveyard shift system). Another solution of the week-end break problem is to have the workers continue without interruptions on a seven day per week basis for a number of weeks and then be given one week's vacation, but that is a matter that has to be settled locally, with the cooperation of the workers themselves, and is certainly more feasible in certain types of work than in others.

In special situations an acceptable solution of this problem is to institute four six-hour shifts, each worker putting in seven days per week, or a total of forty-two hours. After twenty weeks of work one would thus put in 840 hours, which is the same number that he would put in in twenty-one weeks at forty hours per week. He would then have earned and receive a week's vacation, and if rotation of shifts is adopted, the change can be made after the week's vacation. By having twenty twenty-firsts of the whole force working, one twenty-first can be off on successive weeks. With the four-shift arrangement, the distribution could be as follows:

A. The Red shift: working hours 3:00 P. M. to 9:00 P. M.
Sleeping hours as in the Red eight-hour shift.

B. The White shift: working hours 9:00 P. M. to 3:00 A. M.
Sleeping hours as in the White eight-hour shift.

C. The Blue shift: working hours 3:00 A. M. to 9:00 A. M.
Sleeping hours a little earlier than in the Blue eight-hour shift.

D. The Gold (Sunshine) shift: working hours 9:00 A. M. to 3:00 P. M.
Sleeping hours, as usual, at night.

Some industries may find it impossible to run their machinery continuously and may have to adopt two ten-hour shifts. These shifts could be distributed as follows:

A. The early shift from 4:00 or 5:00 A. M. to 2:00 or 3:00 P. M.

B. The late shift from 2:00 or 3:00 P. M. to midnight or 1:00 A. M.

By this arrangement no one would be expected to work during the early morning hours of greatest inefficiency. The shifts could be "steady" or of infrequent rotation.

In sum, the scientific solution of the multiple shift problem is not bound up with the number of shifts and the duration of each. The important elements are a minimum displacement of the normal cycle of activity and a sufficient time on the odd schedule of hours to enable the individual to adjust himself by not only developing, but also keeping the newly established cycle.

I wish to acknowledge with thanks the aid received from members the Staff of the Division of Labor Standards of the U. S. Department Labor in preparing this outline.

The observations and experiments upon which these recommendatio are based are described in detail in Chapters XV, XVI, and XVIII of book, "Sleep and Wakefulness" (University of Chicago Press, 1939).

Appendix: A Form of Appeal to the Workers

A. Rotate shifts once in several months, if at all.

B. Abolish the "graveyard" shift by 4 A. M., noon, and 8 P. M. sh changes.

C. While on a certain shift, sleep during the same hours every d including your days off. Select a schedule of meals corresponding to yo working hours and maintain it at all times.

D. Induce your family to adjust their activities to your schedu Create "neighborhoods of time"—associate with others on your time routi Develop community activities, club meetings, tournaments, lectures, a movies to coincide with your new leisure hours.

E. Above all, observe regularity in your daily routine of work, mea leisure and sleep. Remember that a sleepy war worker is inefficient a likely to harm himself and his machine, but is a big help to the enemy.

TYPES OF FATIGUE IN INDUSTRY

WILLIAM H. FORBES, Ph. D.*

It is a serious and common error to think of fatigue as a single entity. It is, on the contrary, a general term covering very different conditions which arise from different causes and require different treatment. For the purposes of this discussion I should like to distinguish between three main types: physical fatigue, mental fatigue and nervous fatigue.

Physical fatigue is due to continued and hard muscular exercise. When pronounced, it is always recognizable, and in a rough way measurable, by the increased ventilation and heart rate and the various well-known changes in the blood (increase of lactic acid, etc.) which are found immediately after violent exertion. It is of great importance in troops, and formerly was important in industry—probably still is in China and other heavily populated but non-industrialized areas. It is not of any importance in the modern industries of this country, where for ten cents enough electrical energy can be purchased to do the foot pounds of work which a strong man can barely do in a week. Relatively few men in industry do more than twenty percent of the physical work of which they are capable. In the rare circumstances in which it does become an important factor the cause and treatment of the condition are so clear that the situation is remedied as soon as possible and without expert advice. Even when severe and repeated this type of fatigue has not been proven to have harmful effects when uncomplicated by other types.

Mental fatigue is a condition which arises after long-continued mental work which does not involve any emotional strain. It is of very minor importance in industry. It will occur, for example, in a man who is writing at his leisure a book or report in which he is interested but upon which nothing depends. It is of no consequence to him when or whether the book is finished. This type of fatigue cannot be measured objectively.

Nervous fatigue is the type which occurs whenever there is great pressure on a person to get as much done as possible in a given time, or whenever there is much emotional strain accompanying the work. It is of enormous importance in industry, in fact, it is this kind of fatigue that almost everyone refers to when, at the end of a day, he says, "I am tired." It is hard to decide which of the three main causes of nervous fatigue—pressure to work at full capacity, emotional strain, or numerous imperative and distracting stimuli—is the most important. All enter into the picture and often are accompanied by some "physical" and "mental" components. There is no objective measure of nervous fatigue, but dissatisfaction, irritability and listlessness are common symptoms.

Slight degrees of this condition are normal, harmless and unavoidable at the end of a day's work. Marked degrees, however, are very undesirable, leading to discontent, accidents, illness, and inefficiency. The most important single step which can be taken to minimize this type of fatigue is the very difficult one of developing and fostering a spirit of spontaneous cooperation and friendship within the group of workers, and harmonious relationships with the foremen and management. Next in importance and even more difficult is the provision of an emotionally satisfactory life outside of the factory. Supervision can play no part in this—it will defeat the object. About all that can be done is to try to assure good housing and good surroundings. Sometimes a personnel director can be helpful. Other steps which should be taken, though they are of less importance than the two preceding ones, are to provide reasonably comfortable working conditions, adequate lunch places and periods (and in some industries other rest periods), and where possible to see that the facilities for transporting people to and from work are reasonably quick and adequate.

I have assumed that the pay and working hours are satisfactory. The experience of the English has shown that in most industries it is probably unwise to allow men to work over 55 hours a week as a regular thing. Some days off and occasional longer holidays are essential. Women do not differ markedly from men in their ability to stand long hours, but it must be remembered that many of them must do a considerable amount of housework, cooking, or marketing in addition to their work in a factory.

In short, there is only one type of fatigue which is of paramount importance in industry. It cannot be wholly avoided, but it can be minimized by anything which will get the men working together contentedly as an informal and spontaneous team.

LT. COL. LANZA: We will now hear from Dr. Irving Clark, who for many years has been identified with the Norton Company, and is one of the pioneers in industrial hygiene in this country.

* Harvard Fatigue Laboratory.

PLAINTIFF'S EXHIBIT

HEALTH HAZARDS IN THE USE OF ARTIFICIAL ABRASIVE GRINDING WHEELS

W. IRVING CLARK, M. D.*

Grinding wheels are very important cutting tools in modern industry. They are used to cut, shape and smooth pieces of steel. They are versatile, being capable of removing quantities of stock or of producing a mirror finish. They are to be found in every shop where steel is fabricated into machines.

The total weight of grinding wheels shipped in 1941 by all American wheel makers was approximately 78,400 tons. During the first 7 months of this year the production was at the rate of 125,000 tons a year, an increase of 60% over 1941. This is a good indication of the widespread use of the grinding wheel in the war industries and of its vital importance in the armament schedule.

Grinding wheels are used both wet and dry. When used dry a cloud of dust is produced unless the wheel is provided with a properly designed hood and exhaust. When used wet there is little dust produced.

Dust is the health hazard in the use of grinding wheels. The dust produced in industry by the use of artificial abrasive grinding wheels may be divided into the dust of the abrasives themselves, the dust of the bond, and the dust arising from the object being ground. The abrasives constitute approximately three-fourths of the grinding wheel, the bond, one-fourth.

The artificial abrasives in common use in industry are aluminum oxide and silicon carbide. The bonds vary from complex silicates to organic substances. The materials ground are mostly metallic and the dust innocuous. The effect of the dust of the abrasives and bonds will be discussed in this paper.

In considering any dust, its effect upon the tissues of the experimental animal is of great importance. The dusts in question have been thus studied at the Saranac Laboratories by Dr. Leroy U. Gardner and his associates; in the laboratory of the U. S. Public Health Service in Washington, and in laboratories in Europe. As a result of the study of the effects of many different types of dust upon the tissues, pure inorganic dusts have been generally divided into absorbitive, inert and proliferative dusts.

Absorbitive dusts are those which disappear rather quickly from the tissues and which cause no injury.

Inert dusts tend to remain in the tissues but may be gradually removed. They provoke a slight reaction by their presence but this is not severe enough to cause damage of any importance and is what might be expected in the case of any non-irritating foreign body. Aluminum oxide, silicon carbide, and the wheel bonds belong in this class. Active dusts produce definite pathological conditions in the tissues and their action leads to injury of the tissues, the formation of abnormal amounts of connective tissue and, in the case of free silica, activate or increase susceptibility to tuberculosis. The action of the active dusts has been thoroughly covered in an excellent report by this association.[1]

The reaction of lung tissue to inorganic mineral dust depends upon the type of dust, the size of the dust particles in the air breathed, and the number of dust particles of a certain size present in the air. As a result of experimental work with animals and of autopsies on human beings it has been found that few dust particles larger than ten microns enter the lungs and that the great bulk of particles which reach the air cells are less than five microns in size. A micron is 1/25,000 of an inch, so that the particles can only be seen and counted by using a high power microscope. The protective devices of the body prevent a large number of particles from ever reaching the air cells.

These protective devices are the fine hairs of the nose, the moist mucous membranes of the nose and throat, the coughing reflex of the larynx, and the cilia of the trachea and large bronchi, which by their whip-like motion are constantly removing mucus and inhaled particles from the chest to the mouth. All these barriers must be passed by the entering dust particles before they can reach the terminal bronchioles and the air cells of the lungs.

Let us imagine that the dust particles have at last reached the air cells and from there on trace their course in the body. The air cell responds to the presence of the dust by throwing off flat cells from its lining or by extruding cells from the neighboring tissues. These cells are of a special type and have as one of their functions the ability to move from place to place through the tissues, and another, of being able to engulf or eat foreign particles. They are called dust cells. They absorb the dust particles until each cell is almost saturated and under the microscope appears filled with dust. The cells remain for a long time in the air cell, but some slowly move out of the cell, worming through the surrounding tissue and blood vessels into the minute lymph channels which eventually drain into the large lymph vessels of the lungs.

These larger lymphatics are true vessels and through them the lymph passes to the roots of the lungs or to the pleura. They run along the sides of the blood vessels and bronchi, but the flow of lymph is from the air cells toward the roots of the lungs. At the roots of the lungs the lymphatic vessels terminate in glands which act as filters. The dust cells gradually are collected by the lymphatics and are carried by the lymph current to these glands, where they are caught and deposited. This does not by any means occur to all the dust cells. Many stop in the lymphatics or in the lymph islands and perivascular lymph tissue, or they may remain in the tissue spaces. In such cases the dust cells eventually disintegrate, depositing the dust along the lymphatic course. As the glands at the lung roots become filled with dust cells there is backing up of the lymph flow, so that more and more dust cells remain in the lymph vessels and lymph spaces to deposit their loads of dust. The dust particle itself provokes only a very mild reaction of the neighboring tissues, which results in the formation of a small amount of fibrous tissue, often so little that it can only be detected by a microscopic examination. This slight fibrosis does not increase.

Inhaled dust appears to gravitate to the pleura and to any area of low grade infection which may be present in the lung. Thus fibrous tissue which results from previous infection is marked by dust deposits. The deposit of dust beneath the pleura follows the pleural drift of the lymphatics. The low-grade reaction which follows is evidenced by varying degrees of pleural thickening.

If through gross negligence heavy clouds of fine dust have been inhaled over a period of many years the amount of scar tissue may be considerable

* Norton Company.

The deposited dust may fill portions of the lung and provoke by its mechanical irritation a real fibrotic reaction. Such a condition could not occur unless the worker was doing dry grinding with no exhausts for many years.

A great deal of information as to the effect of dust on the lungs of human beings has been derived from the study of x-ray films of those exposed, and these studies support the experimental studies previously referred to.

Symptoms

The symptoms of pneumoconiosis from grinding wheel dust are nil unless the patient has had enormous exposure to dust over many years. In this case the patient may complain of shortness of breath on exertion and of a dry cough.

Sputum is not raised unless there is a complicating bronchitis or other infection of the chest.

Physical Signs

There are no physical signs except in cases which have had extreme exposure. Such cases show an emphysematous type of chest with generalized dullness on percussion and with prolonged expiration. There may be retraction above and below the clavicles, but this is rare, as indeed is this *type of case*. A good functional test is to see if the patient can hold his breath for 30 seconds. If he can he is usually able to do his regular work. Expansion of the chest may be reduced, but measuring the chest in inspiration and expiration requires cooperation on the part of the patient, which is *frequently questionable*.

If pulmonary tuberculosis or bronchitis is present the physical signs are those of the complicating diseases.

Diagnosis

The diagnosis is made from a history of exposure and by an x-ray of the chest. The examination consists, first, of a flat film taken in the postero-anterior position, in order to determine whether the chest shows signs needing further investigation. *If the flat film is suggestive* a stereoscopic set of films is taken. Frequently a picture which apparently shows pneumoconiosis in the flat film fails to show it in the more accurate stereoscopic films. A lateral film is also taken in questionable cases. Fluoroscopy is important to determine diaphragmatic adhesions.

The roentgenological appearance of the lungs of those exposed to the *artificial* abrasives is as follows: Irregular exaggeration of the *linear markings*, with possibly some beading confined to the trunks and some increased *root shadow*. Such findings, while frequent among workers having an inert dust exposure, are also found in persons having no exposure to dust; and are classed as being within the range of healthy lungs and adnexa.[2]

The most important complication of pneumoconiosis is pulmonary tuberculosis. It is seldom that a worker exposed to the artificial abrasive dusts is incapacitated for work unless this disease is present, but there appears to be little more tuberculosis among those exposed to this type of dust than in the general community.

In the summary of the Symposium on Tuberculosis in Industry, held at Saranac Laboratory in 1941, Gardner states: "Of the dusts only those high in free SiO_2 are known to alter susceptibility to tuberculosis appreciably."[3]

The author would agree with this from his personal experience. I other words, one would not expect a high percentage of tuberculosis amon workers exposed to the artificial abrasive dusts.

The Saranac Laboratories have made a number of studies on animal of the activating effect of *inorganic* mineral dusts upon the tubercle bacillu

In an experiment performed several years ago it was found that th inhalation of silicon carbide dust activated an attenuated tubercle bacillus i the experimental animal. There was *no* activation by aluminum oxide dust. This experiment has not so far been borne out by the experience of two o the largest manufacturers of artificial abrasives in the United States. I both companies the incidence of pulmonary tuberculosis was approximatel that of the population of the community. In *one* company the incidenc was a trifle less and in the other a trifle more.

The author believes that those cases which have occurred are due to th *breaking down* of a previous inactive lesion as a result of time, or to inte current *infections*, and represent what may be expected in any communit of workers.

Pneumonia, bronchitis and similar chest infections do not appear to b more frequent among those who are exposed to the artificial abrasive dust. These workers do not appear to be more susceptible nor does their disea appear to be more severe or protracted than among men employed elsewher

The only treatment for pneumoconiosis is preventive. Once the du is lodged in the lungs it cannot be displaced but, as has been pointed ou its presence is in most cases harmless. The basis of prevention is remov of the dust at its source, by the means of *hoods* and suction. This is a engineering problem and will not be discussed here.[5]

The next best preventive measure is the wearing of respirators. Th is difficult to enforce, as workers find them hot and in some types heav However, the respirator affords excellent protection and intelligent worke can be persuaded to wear them. They are of particular value when t worker must do some special piece of grinding work in which there is great deal of dust, and no exhaust can be provided. It must be remember that the fine inhalable dust particles remain in the air as long as three hou after a dusty operation has been completed, so that workers in the ar should wear respirators long after the visible dust disappears.

There has been a great deal of discussion as to what is permissib dustiness in the air of a dusty department. Hatch[6] has set the figure 50 million particles under 10 microns per cubic foot of air as being t' upper limit of *non-siliceous* dust allowable. The amount of dust is dete mined by a dust count made with the standard impinger and counted on specially ruled slide with light field illumination. Dust counts, as an in cation of the health hazard, are *on* the whole unreliable. They are weath vanes only, as they represent the *conditions* existing at the time of t count and at no other time. A *high count* points to the need of engineeri correction, but a low count does not mean absence of hazard unless obtain again and again. The amount of visible dust is a *good* index of the amou of invisible dust present and may well be used as an index for the necessi of a dust count.

There has been a tendency in the past to confuse the pneumoconio caused by inert dusts with silicosis, a disease caused only by *free* silica.

Pneumoconiosis is a general term to indicate that the lungs have inhal some type of dust. Silicosis means that the type of dust inhaled contain a certain percent of free silica. As the inhalation of dust containing free silica is known to be harmful, and also to render the subject susceptible to pulmonary tuberculosis, it is important to observe the distinction. The dusts of the artificial abrasives do not appear to be harmful if the exposure is reasonable, nor do they appear to increase the susceptibility to pulmonary tuberculosis.

In order to check these generally accepted beliefs concerning the artificial abrasive dusts, the author has written to the physicians heading up the medical departments of twenty-two companies which are the largest users of grinding wheels in the country, to find their experience with pneumoconiosis caused by the dust of grinding wheels. Eighteen replies were received. In no case was pneumoconiosis a problem and the incidence of tuberculosis was low. Naturally these companies used the usual protection of dust exhausts and respirators for special types of work, but it is extraordinary to obtain the same answer from so many different industries. Several insurance companies which are among the largest and which insure against industrial accident made similar reports. They found disability arising from the use of artificial abrasive grinding wheels was not one of their medical problems.

The author has followed employees for over thirty years who have been exposed to the inhalation of artificial abrasive dusts in amounts very much greater than occurs in the use of grinding wheels. The manufacture of these wheels abounds in dusty processes, many of which have taken years of engineering experiment to eliminate. From this it would appear that the experience among the workers of his company would bring to light in dramatic fashion any severe health hazard due to the inhalation of artificial abrasive dust. Several studies backed by continuous observation, examinations, and x-rays have failed to disclose any definite health hazard to the healthy worker. As a further check, all those who have been exposed for 25 years or more have been reviewed with the following results:

Total number reviewed	96
In good health and working	87
Pensioned but in good health	9

None of these men appear to have been affected by their many years of exposure to the constituents of the artificial abrasive grinding wheel.

Of deaths from pulmonary tuberculosis during the past 28 years one-third have occurred among men having had exposure to artificial abrasive dusts, two-thirds among those having no such exposure. The proportion of men working in such exposures to those working elsewhere is about 25%. This does not give a complete picture. Almost all the men in this group had had exposure to dusts other than abrasive dust at some time during their period of employment.

In two cases where autopsies were obtained a previous silica exposure was suggested, which had not been suspected nor obtained by past occupational history. To quote from the Saranac report on one case:

> "Rather than attribute the nodular fibrosis in these lungs to the action of SiC, it would seem preferable, in view of previous experience, to assume that enough quartz (8.8%) was present to cause a slow reaction. The source of the free silica cannot be established."

and from the other:

> "In view of the multiplicity of factors involved in producing this advanced disease now seen in a terminal stage, it would not seem proper to draw any conclusion as to the etiologic role of SiC as a cause of fibrosis. Judgment will have to be reserved until some simpler cases, uncomplicated by infection and coincident exposure to free silica can be studied."

In this case the lung ash showed 5.7% free silica. We were unable find from his occupational history or from his work where this exposu occurred. I quote these two cases to show how difficult it is to get accura information and to show why it is as yet necessary to depend upon co posite experience here and abroad, rather than upon statistics in determ ing the probable hazard of the inhalation of artificial abrasive dust. T Journal of the American Medical Association sums up the hazard as follows

> "Only silica (SiO_2) is capable of inducing silicosis but any other mineral dust under conditions of prolonged and gross exposure may cause some increase in pulmonary fibrosis. If the relative potential harm of silica is rated as 100, those other non-toxic mineral dusts may be rated only on an order of 5 or 10. Moreover, the fibrosis itself is not pathognomonic since many other dusts, alkalies, acids or vapors may induce somewhat similar, if not identical, x-ray markings."

The artificial abrasives belong to the group of non-toxic mineral du referred to above.

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FURTHER STUDIES OF ALUMINUM POWDER IN COMBATING SILICOSIS

J. L. BLAISDELL, M. D.*

A year ago at this meeting I submitted a preliminary report on the effects of the inhalation of metallic aluminum dust in silicotic individuals, being applied as a form of therapy in individuals with already established silicosis. This work has been carried out in Timmins, Ontario, which is the center of the Canadian gold mining industry.

Briefly, to review the story, these mines have been engaged in research work over a considerable number of years in conjunction with research workers in the Banting Institute, notably Dr. Dudley Irwin, the work being carried out under the direction of the late Sir Frederick Banting.

It was found by three Canadian observers, Drs. Denny, Robson, and Irwin, that the experimental production of silicosis in animals could be prevented by the use of fine metallic aluminum dust. If the silica dust to which these animals were exposed contained one percent of finely particulate aluminum, the animals did not develop silicosis, whereas the control animals receiving silica dust alone developed silicosis quite comparable in character to the human disease.

These observations were published by Drs. Denny, Robson and Irwin in 1939. Dr. Crombie and I were asked to form an independent committee to investigate these claims and to determine whether or not the inhalation of metallic aluminum dust would be of any benefit to those who already had the disease.

I might emphasize the fact that these research workers that I have mentioned did not suggest, in their communication of 1939, that aluminum dust was of any particular benefit in the treatment of silicosis. It was advanced merely as a preventive or prophylactic measure.

For this purpose we established a clinic in Northern Ontario, and selected a number of cases of established silicosis that we considered suitable for this form of treatment. Although in this center there are approximately 350 cases of silicosis, we selected only about 50 as being suitable for treatment. We attempted to find cases of silicosis that were uncomplicated by infection, cases that did not have too much emphysema, cases uncomplicated by other diseases such as nephritis or syphilis, and men also who have been exposed to dust recently. We did not select any cases that had been out of dust for any considerable period of time. As a matter of fact, the majority of the cases that we have treated were exposed to dust continuously, carried on their ordinary occupation as miners, and had a certain amount of exposure to silica dust all through their period of treatment.

The theory behind this work, of course, is that metallic aluminum, when inhaled into the lung, in the presence of tissue fluids forms a coating of one of the hydroxides of aluminum around the silica particle, thus rendering it insoluble and preventing the formation of silicic acid, which we feel is the injurious agent.

Before treating these cases we studied them very carefully by clinical and x-ray examination, carefully taken history, and by respiratory function tests described by Professor McCann at the University of Rochester and by his co-workers there.

The dust that we used in this treatment is specially prepared in a mill of this sort. There is an aluminum cylinder enclosed in a box lined wit soundproofing material. The aluminum cylinder contains 25 pounds of sma pellets of metallic aluminum. The cylinder is rotated by a motor, with reducing gear, at about 80 revolutions per minute. The aluminum pelle grind against each other and produce an extremely fine black dust, near all the particles of which are under five microns in size, a great many them under one micron. We have had this dust examined with the electr microscope and have been surprised to find how fine these particles are.

The mill is enclosed, and an ordinary glass bottle acts as a sedimenti chamber. The air enters the mill through perforations in the shaft, whi is hollow, flows through the mill and becomes laden with dust. The larg particles of dust settle out into the sedimenting bottle and the subj breathes from the top of the bottle. There is a two-way valve which pr vents re-breathing into the system, and a small, short mouthpiece.

Treatments were given daily, beginning with five-minute periods a gradually increasing to thirty minutes daily. Periodic physical exami tions and x-ray studies of these men were made throughout the course treatment. We also carried out a large number of tests of respiratory fu tion, including lung volume studies, studies of total pulmonary capaci ventilation tests at rest, during a standard period of exercise, and followi exercise.

Of the fifty cases selected, only 34 have completed a satisfactory num of treatments to date. Some of these men have received as many as treatments. The majority, however, have received about 250 treatments.

I may say that a similar investigation has been undertaken recently Dr. J. W. G. Hannon, of Washington, Pennsylvania, and his results so obtained tend to confirm our own.

Summary and Conclusions

This investigation has shown conclusively that the administration aluminum powder in the manner described is entirely harmless and proven definitely beneficial in a number of cases under our observation. of 34 cases studied, 19, or 56 percent, have shown clinical improvem apparent chiefly in the lessening or disappearance of shortness of bre of cough, pain in the chest, and fatigue. A reduction in the incidence of c and a gain in weight have also been noted in many of the cases.

While 14 cases have remained stationary, it must be emphasized they are no worse and their condition has not progressed, in spite of tinuous employment in silica dust during the period of our investigati

The respiratory function tests, repeated at intervals of every t months, have shown improvement in 13, or about one-third of the tr cases, while 22 remained stationary but are no worse in spite of conti exposure to silica dust over a period of about two and a half years.

A group of controls, untreated by aluminum, have shown progre their disease in 65 percent of the cases, while they were under observat

Aluminum dust cannot be regarded in any sense as a cure for sil so far as restoring normal lung tissue which has already undergone fi change is concerned. Its use, however, appears to be followed by bene results in a significant proportion of cases, chiefly in the ameliorati symptoms and in the increased capacity for work.

In view of these findings, and the experimental work of Denny, R and Irwin, we believe that the inhalation of finely particulate metalli minum powder will prevent the development of human silicosis.

*Queen Alexandra Sanitorium, London, Ontario.

PRACTICAL X-RAY TECHNIQUES FOR MASS PHYSICAL EXAMINATIONS

E. P. PENDERGRASS, M. D.*

During the past few years roentgenographic surveys of the chest of large groups of individuals has become an important new addition to the practice of medicine and public health. Under the stimulus of the war, this method has been so extensively employed, both by the military services and by industry, that it has already acquired refinements and established a reputation for reliability, which in ordinary times might have taken many years to attain.

From the experience of the military services in several million pre-enlistment and pre-induction roentgenographic examinations of the chest, the following facts may be stated:

1. At least 75 to 95 percent of early active tuberculosis can be discovered only by x-ray examinations.
2. About one percent of the male population of military age in the United States have active tuberculosis, and most of the cases can be detected only by x-ray examinations.
3. A high proportion of cases of early tuberculosis detectable only by x-ray examination are likely to break down under such strain as that entailed by military duty, incapacitating them for further service and making them a menace through contagion to their comrades.
4. Roentgen examination of the chest is much quicker than the ordinary methods of physical examination, as well as being more reliable.
5. Roentgen examination furnishes an authoritative and permanent record which may be indispensable in future medico-legal adjustment That refers not only to the 14 by 17 paper, but it refers particularly to the smaller methods, that is, the 4 by 5, the 4 by 10, 3 by 4, or 15 mm. film.
6. Many other diseases in addition to tuberculosis may be discovered in mass surveys.
7. The procedure will amply repay the initial cost, by the saving of effective military manpower and the reduction of the ultimate cost to the Federal Government in pensions.

These principles are just as applicable to industry as to the military services, for in these days when the maximum in human effort is needed, the industrial worker must be healthy and protected from the ill health of the man by his side. Furthermore, industrial management must be kept from bearing the burden of future liability through ignorance of the state of a worker's health upon employment. It is a fact that selective service boards are turning down men with heart and lung lesions who may ultimately apply to various industries for jobs. It is likely, in the present manpower scarcity, that a great many individuals with chest lesions will find employmen[t.] And it is a foregone conclusion that the nature of this employment in man[y] instances may tend to fan the coals of a pre-existing disease that may i[n] time incapacitate not only the new employee but lead to an unnecessary an[d] hazardous exposure of the previously healthy, the older and more exper[i]enced worker at his side.

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Now as to the title of my presentation, "Practical X-ray Techniqu[es] for Mass Physical Examinations," I do not propose to burden you with suc[h] a discussion at this time. Instead I would propose that the Trustees of th[e] Foundation appoint another committee, or use one of its present committee[s] whose function it would be to act as an advisor to those of you who have [a] problem concerning the institution of a program of mass surveys of t[he] chest. Such a committee would be in a position to help small as well [as] large industries in these difficult days.

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OCCUPATIONAL DERMATOSES IN THE WAR INDUSTRIES

LOUIS SCHWARTZ, M. D.*

Introduction

For simplicity, this paper is restricted to dermatoses affecting only those engaged in manufacturing materials for actual combat. Included are airplanes, tanks and other armored vehicles, motors, firearms, explosives, and vesicant and incendiary agents of chemical warfare.

General Considerations

Workers may be affected not only with occupational dermatoses but, like the general public, with skin diseases not of industrial origin. Since the cause is a factor in both the treatment of a dermatitis as well as in the prevention of recurrences, every effort should be made to determine the causative agent. It is essential that this etiological diagnosis be established whenever possible in all dermatoses occurring among industrial workers. In order to do this, consideration must be given to the history of the dermatitis, to its distribution, and to its appearance. These must all point to the worker's occupation in order to confirm the diagnosis of occupational dermatitis. In many doubtful cases, the patch test must be employed to differentiate the condition for dermatitis of non-occupational origin, and sometimes to discover the actual irritant.[1]

Treatment

Once the diagnosis of occupational dermatitis is established, the treatment should be directed toward protecting the skin from further injury. Only the mildest medicaments should be employed in acute cases. In vesicular dermatitis, wet dressing of boric acid, Burow's solution, or calamine lotion may be used. When the lesions are no longer moist, Lassar's paste or boric acid ointment may be applied.

Mild cases should be permitted to work while under treatment. They often become immune or "hardened" after they recover. Severe cases should be removed from the irritant while under treatment. Recurrent cases should be transferred to jobs where they do not come in contact with the irritant.

Prevention

For individual protection personal cleanliness is of prime importance. Sufficient washing accommodations should be provided and sufficient time allowed for the workers to use them adequately without fear of missing transportation to their homes.

Protective Clothing

Protective clothing made from impermeable materials is preferred because it cannot be saturated with irritants. Rubber, synthetic rubber, synthetic resins, leather, oilcloth, and other impervious fabrics suitable to protect against the particular irritant should be used for gloves, sleeves, aprons, or coveralls. The clothing should be cleaned daily.

When gloves are used, sleeves fastening over the gloves at the [illegible]

* Medical Director, Dermatoses Investigation Section, U. S. Public Health [illegible]

1 Schwartz, Louis, and Tulipan, Louis: A Text-book of Occupational [illegible] the Skin. Philadelphia, Lea & Febiger, 1939.

will prevent the irritant from entering the gloves. The impervious sleev should reach well up the arm. Vent holes near the tops of the sleeves wi permit the perspiration moisture to evaporate. Leather gloves should l made of soft, washable leather or chamois. They should have no roug seams to irritate the hands and fingers. All protective clothing should l individual and should not be used by another worker until it is wash and disinfected.

Protective Ointments

Protective ointments should be used only when protective clothing impracticable. Only such protective ointments of which the composition known should be used. In this way it is possible to evaluate the protecti value of the ointment.[2]

There are two types that may be used against cutting oils and solvent the water-soluble (invisible glove) type and the innocuous fat type. T first tends to repel oils and petroleum solvents; the second prevents th from entering the pores and also buffers their action on the skin.

The washrooms should have a good industrial soap available for t use of the workers.

Such a soap should be freely soluble in hard, soft, hot, or cold wat It should not contain abrasives or irritant scrubbers. It should not cont added free alkali. Special cleansers should be provided for workers who ha dermatitis or who cannot use the ordinary soaps without damaging the sk Sulphonated castor oil neutral in reaction, to which 2 percent of a synthe wetting agent is added, makes a good soapless cleanser for such workers

Cutting Oils

Cutting oils are the chief causes of dermatitis in the manufacture motors, tanks, shell casings, projectiles, and airplanes wherever cutt and turning of metals is performed. The oils are divided into two la groups, the soluble and the insoluble.

The soluble cutting oils rarely cause dermatitis, despite the fact t they are usually teeming with bacteria.

The insoluble oils are usually sterile, yet they are the principal cau of cutting oil boils and dermatitis. The metal slivers in them may wo the skin; the sulfur, chlorine, and inhibitors they contain may irritate skin; the petroleum oil itself may plug the pores, causing comedones wl may form boils if infected by bacteria from dirty clothing or unwashed s

The hydrogen sulfide and sulfur dioxide generated in cutting oils the heat of the cutting operation may also irritate the skin. Some cutt oils contain organic chlorine compounds. These are particularly irritat causing acne not only on the arms and thighs, as do other cutting oils, also on the face, neck and body. Especially is this the case if they vapo or give off a mist, as they do under heavy cutting conditions.

The petroleum portion of the oils also has a defatting action on skin, which after prolonged use may cause drying, fissuring and crack Some petroleum oils also have the property of causing keratoses and rare cases, skin epitheliomas.

2. Schwartz, Louis: Protective Ointments and Industrial Cleansers. The Me Clinics of North America, July, 1942, pp. 1195-1212. Philadelphia, W. B. Saur Company.

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The treatment of comedones, folliculitis and boils consists of cleanliness and mild antiseptics, frequent changes of work clothes, frequent washing of the skin, and surgical evacuation of pus. For dry, defatted skins, an emollient such as cold cream or lanolin 70, castor oil 30, perfume 1, may be given to the worker to rub into the skin after work.

Prevention

Prevention consists in cleanliness of persons, clothes, machines, and oils, adequate washing and bathing facilities; suitable soaps and cleansers; sufficient clean towels and waste to use at work. Frequent change of work clothes, impervious sleeves, and aprons on some jobs where there is excessive contact with the oils. Protective ointments should be used only when other measures are insufficient. They should be of the type that fills the pores with an innocuous vegetable or animal fat, thus preventing the entrance of the cutting oil. The water soluble "invisible glove" type of ointment may also be used.

Dopes, Paints, Thinners, Degreasers and Other Solvents

Solvents produce dermatitis by defatting the skin. They may also cause allergic dermatitis.

"Dopes" used on fabric parts of airplanes can cause dry, chapped hands or acute eczematoid vesicular dermatitis of other portions of the body.

Paint thinners, petroleum solvents such as kerosene, and Varsol, act in a similar manner.

The fumes of the solvent chlorinated hydrocarbons used in degreasing tanks *sometimes* cause severe allergic eczematoid dermatitis.

The treatment of dermatitis from these solvents is the same as described previously.

The preventive measures consist chiefly of impervious protective sleeves, aprons, and gloves. Gloves for painters may be of leather or canvas, but those using petroleum solvents should wear synthetic rubber gloves. Protective ointments of the type described under cutting oils may be used on the face and neck of sensitive workers.

Electroplating

Electroplating is primarily a rust preventive process. Chromium and cadmium are the principal materials used, but silver, zinc, copper, and nickel are also *frequently employed*. In addition, there are a number of rust preventing processes: parkerizing, chromadizing, anodizing, etc. In all these processes the tanks contain strong alkaline or acid fluids which give off irritant fumes. Ulcers of the nasal septum resulting in nose bleeds, and even perforation, are common. Dermatitis is frequent from mist and fumes coming off the alkaline, chromic acids, dichromate, and cyanide solutions in the plating tanks. Dermatitis also occurs among those who clean the metals with strong acids and alkalis prior to electroplating, and among those who handle the wet metal *from the plating plants*.

The worker's *nasal mucosa* should be protected with ointments like lanolin or vaseline, (never carbolated, because of possible harmful reaction from the phenol). Protective garments should be worn. (See section on protective clothing.)

Welding

Welders and solderers are exposed to irritating fumes. Welding stainless steel and aluminum alloys requires *fluoride fluxes*, which evol[ve] fluoride and hydrofluoric acid *fumes*. If not properly removed by suct[ion] vents, fumes may irritate the nasal mucosa or skin. The nostrils and sk[in] should be protected with non-carbolated vaseline or lanolin. The skin mu[st] also be protected. (See section on protection.)

Tetryl

Trinitromethylnitramine, commonly called tetryl, will sensitize a[nd] cause dermatitis in *from* 10 to 15 percent of all new workers, one to t[wo] weeks after they begin handling it, although in a few cases it may requ[ire] several months for sensitivity to become manifest. Workers coming [in] contact with the dust from dry grains of tetryl *and from* tetryl pellets [are] more frequently affected than those handling wet tetryl. Those exposed [to] the dust may first develop nose bleed or bloody discharge from the no[se]. The nasal mucous membrane becomes turgid, and small superficial erosi[ons] may sometimes be seen. Distinct ulceration of the mucosa has not b[een] observed. On those exposed to dry tetryl, the dermatitis usually begins [on] the *face*. The naso-labial folds and the skin under the lower eyelids [are] first affected. There may be sufficient edema to close the eyes. The s[kin] may be blistered and have the appearance of a second degree sunburn. [In] isolated cases or where the history of working with tetryl is not known [it] may be attributed to cosmetics used on the face or hair. The hands [and] other portions of the body coming in contact with tetryl will be discolo[red] to a yellowish brown. These parts may also be *inflamed*. In some ope[ra]tions where small amounts of tetryl are handled and where there is but li[ttle] dust, the hands and arms may be first affected. The hair is stained a r[ed]dish brown in brunettes and a yellowish red in blondes. In some cases [the] genital and anal regions become stained and even inflamed because they [are] touched by tetryl soiled hands. Points of friction such as the collar l[ine], the wrists, and the areas on the hands where the coarse seams of heav[y] poorly fitting gloves rub the tetryl into the skin are *favorite sites* [of] dermatitis.

Prevention

Operations where there is much tetryl dust should be properly ven[tilated]. Workers at those operations should be supplied with soft, washable lea[ther] gloves and impervious sleeves and aprons as well as with a protec[tive] ointment. The following formulae have been found to be good protec[tive] ointments against tetryl:

No. 1

Shellac	13
Isopropanol	31
Linseed oil	4
Titanium oxide	12
Sodium perborate	13
Talcum	20
Carbitol	3

Allow to stand for 48 hours and decant the fluid accumulated over the surface.

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No. 2

Casein	20
Zinc Oxide	20
Yellow oxide of iron	2
Water	58

The ointment can be applied to the face and hands before going to work, removed at lunch and re-applied after lunch. The workers who fill primers, detonators, and boosters with tetryl should be supplied with light chamois washable gloves as well as with sleeves and aprons. If for any reason gloves cannot be worn, the protective ointment can be used. All workers need not use these protective measures. Only new workers and those who are sensitized to tetryl need to take all these precautions. The worker who has been exposed for a long time without taking these precautions and has not had dermatitis need not do so. Neither need the worker who has become "hardened" or immune following an attack of tetryl dermatitis.

Supervised showers after work should be compulsory for all workers exposed to tetryl.

Treatment of Tetryl Dermatitis

Mild cases of tetryl dermatitis, that is, where there is but little edema of face and eyes, may be permitted to continue work and can be given wet dressings of boric acid or aluminum acetate to use at home, and boric acid ointment or zinc oxide ointment, to use while at work. Only severe cases or those who cannot get well while at work need to be removed from the job. Most cases get well while working and (hardened) can continue work without further trouble. About 50 percent of those who are taken off the job in order to get well can also return to work without further trouble. The others must be kept away from tetryl.

Tetryl indelibly stains the skin, but the stains can be almost entirely removed by continued washing two or three times daily with a [illegible] strong sodium sulfite solution, and this followed by soap and water. The staining of the hair can be prevented by wearing impervious caps, but once the hair is stained, it is best not to attempt to restore its color. It is better to prevent further staining by wearing the impervious cap, and the new hair as it grows out will not be stained.

Tetryl Manufacture

Workers at the openings of retorts used for sulfating are exposed to fumes and splashes of sulfuric acid, dimethylaniline and aniline sulfate and should be provided with impervious sleeves, aprons, and gloves.

In the nitrating building workers at the nitrating retort are exposed to hot tetryl, the acids, and nitrous fumes. Men stirring wet tetryl crystals in the tubs, and those who transfer the wet tetryl from the tubs to wooden carriers in which it is carried to the refining buildings, get wet tetryl on their clothes and hands, and when the tetryl dries, some of the workers develop dermatitis. In the refining building the workers also are exposed to wet tetryl as the refined wet tetryl is shoveled into wooden carriers for transportation to the drying house. In the drying house the tetryl dust is thick on the floors, walls, windows and the clothes of the workers. [illegible] largest percentage of tetryl dermatitis occurs among these men; [illegible] of the workers in the drying house develop tetryl dermatitis. In the packing and boxing buildings there is considerable tetryl dust generated by the screening operation, and dermatitis is fairly common among these workers.

All workers in the nitrating, refining, drying, and packing houses should [be] provided with protective ointment for use on the face twice daily. Th[ey] should also be furnished with soft, washable leather gloves and impervio[us] sleeves and aprons. The sleeves should fasten over the gloves at the wris[t]. In the packing, boxing and drying houses it may be of advantage to furni[sh] the workers with transparent impervious head and face coverings to prot[ect] the face.

To perform patch tests with tetryl, place a small amount of the powd[er] on an acetone-moistened piece of gauze about ¼ inch square and 4 pl[y] thick. Apply to the normal skin, cover with a piece of cellophane 1 in[ch] square, and this with a 2 inch square piece of adhesive plaster. Allow [to] remain on for 24 hours; and then read the reaction. Read again 3 da[ys] later for delayed reactions. The gauze may also be moistened with [a] saturated solution of tetryl in acetone and applied as a patch test.

TNT

In a workroom where there is TNT dust, the newcomer experiences [a] bitter taste.

Trinitrotoluene causes sensitization dermatitis in a smaller percenta[ge] of new workers than does tetryl. The dermatitis usually begins in from [...] to 14 days after work with TNT is begun. It usually attacks the han[ds,] wrists, and forearms, but the points of friction, collar line, belt line, a[nd] ankle are also often affected. It is unusual to find TNT dermatitis on t[he] face, but the genitals and the submammary area are sometimes affect[ed] from soiled fingers. A generalized eruption may also occur in rare cas[es]. The lesions on the palms are characteristic in appearance. They are dee[p] seated sago-like vesicles and are accompanied by considerable edema a[nd] discomfort. As the dermatitis subsides, the skin on the palms peels in lar[ge] thick pieces with new skin beneath. The lesions on other parts are not [as] characteristic as those on the palms, consisting simply of papules, vesicl[es] and crusts, followed by flaky desquamation. TNT also stains the skin a[nd] discolors the hair but not as much as tetryl. Cyanosis or blue lip is fai[rly] frequent among workers exposed to TNT while it is rare from tetryl.

The preventive measures, including protective clothing, ointmen[t,] showers, etc., and treatment given for tetryl dermatitis, also apply to T[NT] dermatitis.

TNT Manufacture

Men working over the nitrating retorts are exposed to fumes a[nd] splashes while inspecting and sampling the progress of the reaction. Th[ey] should be furnished with impervious sleeves and aprons, and with leat[her] or cotton lined rubber gloves. The workers in the work house, flaki[ng] house, and packing house should also be provided with washable, s[oft] chamois or leather gloves and impervious sleeves and aprons.

Patch tests with TNT may be performed in the same manner as [de]scribed for tetryl.

Fulminate of Mercury

This sensitive explosive is used in detonators and primers. Most of t[he] dermatitis from fulminate occurs in making detonators, especially in [hot] weather. In making primers, the fulminate is used in wet form, but it dr[ies] on the clothes and skin and will cause dermatitis even on the covered par[ts]

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as it seeps through the clothes. The dermatitis is allergic in character and occurs chiefly on the face, neck, and arms. Inhaling the dust may cause nasal mucitis; an erythematous, weeping, crusted dermatitis in the perinasal area is not uncommon. Conjunctivitis and dermatitis of the eye lids also occurs. The other ingredients of the primer mix, such as antimony sulfide, may be added causes of the dermatitis. The treatment and prevention are the same as described under tetryl.

DNT

DNT, or dinitrotoluene, also causes sensitization dermatitis, but not in as high a percentage as TNT. There is no characteristic appearance to the dermatitis caused by DNT. It is the usual eczematoid dermatitis—erythema, papules, vesicles. The sites are usually the wrists, collar line, belt line, forearms and hands. The prevention and treatment are the same as given for TNT. The patch test technique is also the same.

Ammonium nitrate can cause dermatitis, but even in a smaller percentage of workers than does DNT.

Lead Azide

Lead azide which like mercury fulminate, is used in detonators and primers, is manufactured from sodium azide reaction with lead nitrate or acetate. Fumes given off from this reaction produce headache if inhaled.

Unlike mercury fulminate, lead azide rarely produces dermatitis on those exposed to it in the manufacture of detonators, primers, etc. One patient has been observed with dermatitis who handled a primer mixture containing both lead azide and mercury fulminate. Patch tests with both explosives were positive.

Since dermatitis occurs so rarely from exposure to lead azide, special measures for protection of the skin are not indicated.

The patch test technique is the same as described for tetryl.

Shell and Bomb Loading

Workers in plants where shell loading, bomb loading, trench mortar loading, and renovating of projectiles are performed, are exposed to skin hazards from all the explosives used as well as from solvents used for degreasing and for paint thinners.

Tetryl may cause sensitization dermatitis usually on the face, five days to several months after work is begun. It will stain the skin and hair a yellow color and will cause epistaxis. Workers engaged at weighing, screening and blending tetryl are exposed to large quantities of tetryl dust and should be provided with clean work clothes daily. They should insert lanolin or vaseline into the nostrils several times a day to protect the mucous membrane. They should be provided with a protective ointment to use on the face, arms, and hands. If rubber gloves or soft, washable leather gloves, impervious sleeves and aprons are worn, the protective ointment need not be applied to the hands and arms. Showers after work should be compulsory.

Workers engaged in making tetryl pellets are exposed to tetryl dust when filling and cleaning the hoppers and when handling the finished pellets. They should be protected with protective clothing, ointments, and compulsory showers as described above.

Workers loading boosters with tetryl pellets or filling small bags wi tetryl, and those placing the boosters into shells, as well as those placin tetryl into hand grenades and into fuses are all exposed to tetryl dust a should be protected as described above.

TNT may cause sensitization dermatitis after five days to sever months of exposure. It also stains the skin and hair a yellow color, b not so pronounced as does tetryl. While TNT does not cause nose bleed, often causes cyanosis or "blue lip." TNT usually attacks the hands, b cases of generalized dermatitis may also occur. Workers engaged in weig ing, screening, and sifting TNT are exposed to considerable TNT dust. Th should be furnished clean work clothes daily and showers should be com pulsory and supervised after work. Impervious sleeves and aprons and sof washable chamois or leather gloves should be provided and washed dail (Steeping the gloves in a 10 percent solution of sodium bisulfite followe by several rinsings in water decontaminates them.) A protective ointme (as described under tetryl) may be applied to the face and other expos parts. Workers melting TNT and those pouring it into shells, bombs, et as well as the tappers and drillers, should be given the same protection described above.

Folliculitis and boils sometimes occur on the hands and arms of worke with molten tetryl. These are caused by the crystallization of the tetr as it cools and the enmeshing of the hairs. When the crystals are pull off the skin, the hairs are pulled out and infection may result. Protecti clothing will prevent this.

DNT is used in smokeless powder. While it causes sensitization derm titis, it does not affect as many as does TNT, nor are the cases as seve The preventive measures are the same as for TNT.

Fulminate of Mercury is used in detonators and primers and affects considerable percentage of the workers. Even when handled wet, as it is detonators, it will dry on the clothes, sift through, and cause dermati on the covered parts—the abdomen and the chest. Soiled fingers m carry it to the genitals and cause dermatitis on those parts.

Fulminate is also used in primers. Here it is mixed with antimo sulfide, potassium chlorate, and ground glass. The dermatitis among wor ers filling primers may be caused by the fulminate or the antimony sulfi or both. Patch tests with the primer ingredients will determine the act irritant. The same protective measures are recommended as those f tetryl or TNT.

Ammonium nitrate used with TNT to make amatol is comparativ only a mild skin irritant and workers protected against TNT are protec against ammonium nitrate.

Lead azide is used only in small quantities. Dermatitis from it m occur, but is rare.

In performing patch tests with these explosives they can be applied the skin in powdered form on a piece of gauze and allowed to remain on 48 hours. Late reactions should be looked for up to 3 days after removi the patches.

Solvents are used to a large extent in cleaning and degreasing she in spray gun stenciling, and in renovating old projectiles. Kerosene, pet leum spirits, Stoddard solvent and oakite are some of the solvents us

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They all can cause dermatitis by their defatting and keratogenic action on the skin. Workers in contact with them should wear solvent proof gloves, sleeves, and aprons. If for any reason these cannot be used, protective ointments, special cleansers and emollient creams should be supplied the workers. (See protective ointments and cleansers.) Workers should not be permitted to dip the unprotected hands in these solvents.

Girls using asphalt paint on primers should be provided with synthetic rubber gloves; or if this is not feasible, a protective ointment and a special skin cleanser to remove the paint from the hands.

Finger cots should be provided for workers loading cartridges with smokeless powder and for those spring arming fuses, to protect them from cuts from the silk cords and scratches from the spring.

Dermatophytosis

Of importance because of its frequent confusion with or as a complication of industrial dermatitis is dermatophytosis (athlete's foot). The salient symptoms are itching between the toes, the instep, and on the soles, or on the palms and the sides of the fingers. Small vesicles, some of which may be deep-seated, appear on the sites of the itching. Later there may be a mass erosion of the skin between the toes, especially the 4th and 5th, with soggy desquamation and a characteristic odor. The eruption on the hands is thought by some to be a sensitization from an original focus on the feet, and are called dermatophytids. They go on to erosion and scaling.

There are many effective methods of treatment, if used with good judgment, depending on the location and stage of the disease. Treat the patient, not the case. More harm is done by overtreatment than by undertreatment. The most frequent sources of overtreatment are the improper uses of strong medicaments, the commonest of which is Whitfield's Ointment.

Principles of Therapy—In acute vesicular cases, soak the foot for 15 minutes twice a day in an antiseptic solution, such as 1:8,000-5,000 potassium permanganate, followed by thorough drying and powdering with a bland talcum powder. With a more chronic condition, the use of mild (½ strength) Whitfield's Ointment is helpful. If full strength Whitfield's Ointment is used, it should not be used for more than a week, or until the epithelium is peeled off, and then followed by a bland ointment, such as zinc oxide, until the inflammation subsides. The antiseptic coal tar dyes, gentian violet and brilliant green in 2 percent solution, have also given good results. It is usually impossible for the hands to recover until the infection has been eradicated from the feet. Often treatment of the feet alone will be followed by disappearance of the lesions from the hands without any definitive local therapy. But in most cases, the phytids on the hands are benefited by Lassar's paste with 2 percent salicylic acid, or some mildly stimulating ointment or keratolytic.

Secondary infection in scratches or in the fissuring between the toes may occur and is usually controlled by wet dressings and rest.

Important in prophylaxis and prevention of reinfection is foot hygiene. This consists of not going barefoot, and of thoroughly drying the feet, especially between the toes after a bath, and the application of a drying powder. Powders which contain a mild antiseptic are useful and available, but thorough drying and the use of any bland talc is helpful. It is important to have workers wear wooden sandals or some form of individual foot pro-

tection while walking from locker rooms to showers and back, and not take them off even in the showers. In this way the infection cannot be co tracted or spread. It is useless to have antiseptic foot baths in front of tl showers if the worker is to walk barefoot to and from the antiseptic troug The importance of wearing clean stockings daily and disinfecting old sho which may harbor the fungi must not be overlooked.

Selection of Workers

A considerable proportion of skin troubles may be avoided by the prop selection of workers. Thus individuals with a known hypersensitive skin a shown by neurodermatitis, allergic manifestations, or history of atopy infantile eczema should not be employed in skin hazardous occupation Neither should those with dry skins be employed at jobs where they mu wet the hands in solvents. Nor should cases of marked acne be subjecte to contact with cutting oils. Negroes are usually more resistant to man skin irritants than are whites.

In the rush of war employment it is often impossible to be as selectiv as one would wish; but whenever selection according to type of skin be suited for the particular skin hazard is possible, it should be attempte An actual trial of the employee at work might be made, because many ind viduals are able to work when clinical judgment suggests that they ma not be able to.

Pre-employment patch tests are not advocated because the workers d not become sensitized until after they have worked, and a negative pre employment patch test does not mean that the worker will not become sens tized. Neither will it tell whether the sensitized person will become immun or "hardened." Besides, there are legal complications to pre-employmen patch testing.

DR. NAOMI VISCARDI (Aero Parts Mfg. Co.): I work with girls i the airplane industry. I want to know whether to put in liquid soap or pow dered soap. What is your opinion as to the kind of soap?

DR. SCHWARTZ: The question is whether I advocate liquid soap o powdered soap in the airplane industry. It depends on the type of soil yo wish to remove from the hands. If it is just ordinary, easily removabl dirt and grime, an ordinary hand soap is all right. Ivory soap is as goo as any. The same liquid soap is a little stronger in its action. But whe you have tenacious grime, a powdered soap is better, because it contains a scrubber, and the scrubber helps to remove the dirt. I am not going to g into the composition of these industrial cleaners, because it is a long story but the powdered soaps that contain scrubbers are better for removing soil than those which do not contain the scrubbers.

MR. WRIGHT: I have a problem with chrome tanneries, where they are using chromate solution, 50 percent. We have tried protective creams, but most of the creams on the market are water soluble, and those things wash off and give no protection. Do you know of a water insoluble cream?

DR. SCHWARTZ: Indeed I do. There are a number of water insoluble creams on the market. A cream, for instance, that consists of 70 parts of anhydrous lanolin and 30 parts of olive oil, to which you might add some perfuming agent to take away the odor of lanolin. Lanolin and castor oil is a very good water-repellant cream. Also the cream we prepared against tetryl is a good water-repellant cream, because it consists of shellac reinforced with zinc perborate. Now shellac is soluble in alcohol but insoluble in water.

The Public Health Service some time ago published an article entitled, "Industrial Cleaners and Protective Ointments." If you will write to my office I will send you a copy of that, which discusses these creams and tells the names of the firms who manufacture them.

MR. E. O. KOHLER (American Steel & Wire Company): Do you find from your experience that people that handle a developer containing a metol base and a hypo fixer are sensitive, not necessarily to contact with the material but perhaps to the fumes from it?

DR. SCHWARTZ: Dermatitis among photographers from metol I won't say is fairly common, because it doesn't occur very often, but I should say that metol is one of the principal sensitizers that cause dermatitis in the photographic industry. Now whether a person will get dermatitis from the fumes of metol will depend on the degree of sensitivity which he has. Most of the dermatitis comes from direct contact with the developing solution, but I can conceive of a worker being so sensitive that perhaps even the vapors of the metol may affect him. I have known people who were so sensitive that if they even went into the grounds of the factory in which the chemical to which they were sensitive was manufactured, they commenced to itch.

A MEMBER: Would you tell me how effective in the prevention of dermatitis from cutting oils is the filter which uses fuller's earth, and also has an arrangement to heat the oil as it is being filtered through the fuller's earth?

DR. SCHWARTZ: The question is, how efficient in the prevention of dermatitis is the machine which heats the cutting oil and filters it at the same time with fuller's earth?

Now the sterilization of cutting oils, as I said, with antiseptics, is taboo, because they are sterile anyhow. So why sterilize them with heat? However, in view of the fact that at the National Institute of Health we have cultured dozens of these insoluble cutting oils that came from sources of cutting oil dermatitis, and which were supposed to be infected, and we have failed in any case to obtain a culture of pathogenic organism, it seems to me to denote that the sterilization of cutting oils even by heat is unnecessary.

However, the filtration of cutting oils to remove the slivers and the particles of metal is very necessary. Therefore the fuller's earth end of it I approve of. I also do not disapprove of pasteurizing. However, I question whether it does very much good in the prevention of dermatitis.

MR. A. C. FUNKE (Michigan Mutual Liability Company): I would li to ask whether you have had experience with unpolymerized and polymeriz synthetic resins that might cause dermatitis from a dust point of vie phenol formaldehyde particularly.

DR. SCHWARTZ: Yes, I think I have had experience with most of t polymerized resins, and referring to the phenol formaldehyde type, it is most frequent cause of dermatitis among the synthetic resins. We ha made extensive studies and found that it was the formaldehyde fraction th caused four times as much trouble as the phenol fraction, as far as sensi zation is concerned, and that the more unpolymerized, the more uncured was, the more dermatitis it was liable to cause. For instance, the powder resin made for moulding contains four or five percent of hexamethyle tetramine, which is used to furnish additional formaldehyde in the mouldin You all know that hexamethylene tetramine is a powerful skin irrita and there is even some free phenol in it.

I would say the unpolymerized resins cause a great deal more derm titis than the polymerized, and completely cured resins cause no dermati at all.

Tuesday Afternoon
November 10, 1942

PROF. DRINKER: The Preventive Engineering Committee during the past year has issued one bulletin, under Major Hatch, and another is about to appear by Mr. Hemeon of the Massachusetts Division of Occupational Hygiene. Heretofore, as you know, the engineering group has issued bulletins from time to time, on subjects of special interest, such as problems in air analysis, dust measurements, and the like. We stand ready to continue that service, but conditions have so changed since our meeting of a year ago, due of course to the war, that we feel a little reluctant to suggest topics or to start new projects unless we are certain that they are ones of special interest to the membership.

We would welcome suggestions from the members as to projects that they think need special study or projects which they think could be described by us now in the form of brief bulletins. Those suggestions would most conveniently be made through the Foundation itself, through the Director, and Dr. Holden.

The Engineering Committee has no elaborate research program for the forthcoming year. We have no apologies to make for that, but changing conditions have altered our program and most of us, like most of you, have more work than we can handle. If we are to take up or supervise any special research projects we want to be sure there is a really urgent need for them, and we would still like to limit ourselves, if we can, to studies of such a nature that the benefit will be a lasting one. You can, however, arrange for surveys from the Foundation. I know that they will be ready to help you on matters of that kind.

Therefore we look to you to suggest to us, by questions today or by writing, questions that you want answered and research topics that you think are worthy of consideration by the Foundation through any of its agencies.

As you know, Professor Hatch is now with the Sanitary Corps of the Army. Yet we were able to get him here today to report on the research that he was doing at University of Pennsylvania, research that was sponsored by our Committee.

PLAINTIFF'S EXHIBIT

MEASUREMENTS OF RATE OF AIR DISPLACEMENT AS A BAS FOR DETERMINING EXHAUST VENTILATION REQUIREMENT

MAJ. THEODORE F. HATCH, Sn. C., and
LT. ROBERT H. WALPOLE, JR., Sn. C.*

Objective of Study

The objective of this study was to develop, so far as possible, a fun mental basis for determining the design requirements of exhaust syst which would *serve in place of the empirical procedures now commo* employed.

Factual Basis for a Fundamental Method of Hood Design

(a) All atmospheric contaminants released by industrial processes dispersed into the plant atmosphere by air movement only. If there w no air motion past the offending process there would be no distribution the contaminant beyond the immediate zone of release.

(b) The function of an exhaust hood, therefore, is not to capture contaminant but to collect the air into which the contaminant is dispers

(c) The rate of air flow into an exhaust hood, as a consequence, m equal or exceed the rate of flow of air past the process.

(d) The extent to which the hood ventilating rate must exceed rate of air movement depends upon the hood efficiency, that is, upon amount of clean air which must be exhausted in order to capture all of *contaminated air.*

Measurement of Rate of Air Displacement as a Basis for Hood Desigr

(a) Since it is the air movement away from the zone of contamin release which the exhaust hood must prevent, it is clear that one shou know the rate at which air is flowing through the area in order to determi the minimum rate of exhaust ventilation required.

(b) The primary recommendation resulting from this investigati therefore, is that, preliminary to the design of an air exhaust system, rates of air displacement existing at the various processes be measured

(c) Rates thus obtained will serve, with suitable factors of safety, determine the air flow capacity of the exhaust system.

(d) This procedure contemplates the direct study of the actual pr cesses to be controlled and does not depend upon assumed similarity wi other processes and experience with them.

(e) The proposed method does not have universal application since requires that the pattern of air flow past the process be rather clea defined. It also requires a certain degree of enclosure of the process. application is believed to be wide, however, and experience with it in t design of a large-scale system has demonstrated its practical value.

(1) A progress report on the University of Pennsylvania study of Exhaust Ventilation sponsored by the Foundation.

* Formerly of Department of Public Health and Preventive Medicine, School Medicine, University of Pennsylvania; now with U. S. Army.

Method of Measuring Rate of Air Displacement

(a) Air motion around an industrial process may result from a number of causes which may be divided, according to source, into two classes: external and internal. Examples of the former are: normal room convection currents, action of nearby belts, flywheels, movement of reciprocating parts. Internal sources include those which are inherent in the process and others which are only incidental. Inherent sources include the strong convection currents set up by hot bodies (such as a casting, steam bath, welding operations), by the expansion and contraction of a stream of falling rock as it leaves a belt and falls into a bin, the fan action of a grinding wheel or of a hammer mill, etc.

(b) The air flow established by such sources is not confined to a definite path and cannot, therefore, be measured by the usual methods of metering. In the present study use was made of the well-known technique of measuring the dilution of a suitable test substance, in this case a test gas introduced into the air stream. Knowing the rate of introduction of the gas and its equilibrium concentration in the air stream, one can calculate directly the rate of air flow from the relationship

$$Q = \frac{F}{C}$$

Where Q = rate of air flow
F = rate of feed of test gas
C = concentration of test gas in air stream

The method has been described and its errors and limitations discussed in a recent Foundation bulletin. In its present form it is relatively simple to use but has the serious disadvantage of not yielding instantaneous concentrations which must be known in many cases where the rate of air displacement is not continuous, but rises periodically from zero or a low level to a maximum value and then back again. (Example, barrel filling.) In place of the chemical method of analysis for the determination of the test gas concentration, a direct-reading meter should be used. No such instrument is now available for carbon dioxide. In certain studies toluene has been employed as the test gas, since it can be measured instantaneously in a direct-reading photometer. For obvious reasons, solvent vapors could not be employed in industrial plants. Recent developments in the use of infrared photometry for measuring carbon dioxide are promising. Another possibility is to employ a test gas containing a radio active substance, the concentration of which could be simply measured. These and other suggestions should be investigated further, since the basic idea of determining ventilation requirements from measurement of the rate of air displacement appears to have considerable practical value.

Suggested Steps in Hood Design

(a) Study the process with a view to determining the source or sources of air motion which is established during its operation.

(b) If a source is external and independent of the process take every practical means to eliminate it. Should the source of air movement be within the process but only incidental to it, every consideration should also be given to its elimination. For example, a flywheel or other rotating part may be shielded; convection currents rising from a hot tank can be minimized by insulating the side walls; leaking parts in a compressed-air operated machine should be repaired.

(c) Even a source of air movement which is inherent in a process m[...] be reduced in strength. For example, the amount of air displaced by falli[...] rock increases with the height of fall. By substituting a stone ladder for [...] uninterrupted chute the total drop is broken into several steps whi[...] together will produce less air displacement.

(d) In the case of semi-enclosed processes determine the points [...] entrance of the air as well as the escape openings. In many cases t[...] opportunity for air to get in can be greatly reduced, thus minimizing t[...] rate of displacement. For example, the airflow resulting from the stru[...] fan-action of a hammer-mill can be reduced by carefully restricting t[...] inlet. The air movement into an enclosed screen may be reduced by pr[...]viding a storage chamber between the screen and feed chute so that the [...] cannot gain entrance from the chute.

(e) After identifying the sources of air displacement and eliminati[...] or minimizing all that are subject to control, the next step is to study t[...] pattern of air flow. For this purpose a visual smoke generator may [...] employed.

(f) Next, construct a temporary enclosure (if one is necessary) of [...] pattern that will confine the flow in the manner desired.

(g) Using the temporary enclosure, measure the rate of air flow [...] the dilution technique.

(h) From the rate of air displacement thus determined and the know[...]edge of air flow pattern obtained by smoke tests an estimate may be ma[...] of the factor of safety to be employed. Thus, the rate of ventilation [...] determined.

The time required to make the tests outlined above is not great and [...] is believed that the information thus obtained will result, in many insta[...]ces, in improved design and performance of exhaust systems.

Application to the Study of General Ventilation

(a) For the control of a number of industrial operations, general roo[...] ventilation is employed. The rate of ventilation should be determined so [...] to dilute the contaminant down to a safe level. If the rate of production [...] the contaminant is known, then the minimum rate of room ventilation shou[...] be

$$Q = \frac{F'}{C_{max}}$$

Where Q = minimum rate of ventilation required
F' = rate of release of contaminate
C_{max} = maximum permissible concentration of contaminate

(b) The value of Q obtained in the above manner can be safely e[...]ployed only if the contaminant is completely mixed with the ventilating a[...] Such a favorable situation rarely exists, however. On the contrary, zon[...] of low ventilation and even dead pockets frequently occur. By means [...] the dilution technique the ventilation characteristics of the room may [...] evaluated and a quantitative basis for improving the system of gene[...] ventilation obtained. The steps are as follows:

1. Feed the test gas at a constant rate into the zone of release of the contaminant.
2. Determine the equilibrium concentrations of the test gas at

the various working locations and in the air as finally discharged from the room.

3. Under conditions of complete mixing the concentrations thus obtained would be alike. If, at any sampling point, the concentration is higher than at the final outlet, one knows that the rate of effective ventilation in this area is less than for the room as a whole and in reverse proportions to the concentration found.

4. From such a survey it will be possible to improve the system so as to effect more uniform ventilation and, perhaps, without any actual increase in the total ventilation.

5. If, in addition to the equilibrium concentrations, the rates of buildup of the test gas concentrations and the rate of decay after the gas feed is shut off are obtained, one can predict the cycle of concentrations of the contaminant which will obtain at the various points of exposure for a given cyclical release of the contaminant. The mathematical relationships will be considered in another report.

Acknowledgments

Grateful acknowledgment is made to the Industrial Hygiene Foundation and to the American Air Filter Company for their financial assistance which made this study possible. It is regretted that, because of the war, the work had to stop while still in the preliminary stage. A full report will be made of the work and especially of the application of the proposed technique in the design of a large exhaust system. It is to be hoped that the method will receive further field tests and that a simpler and more flexible test procedure will be developed.

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PLAINTIFF'S EXHIBIT

KEEPING SCORE ON TOXIC MATERIALS AND PROCESSES IN THE PLANT

EDGAR C. BARNES*

To give you briefly the background for our methods controlling the use of toxic materials, we are a relatively large manufacturing industry using hundreds—yes, thousands of different materials, many of them toxic materials. It is not a case of controlling one or two or three types of hazards, but hundreds of hazards, and thousands of people exposed to those hazards. We have in our headquarters medical department an industrial hygiene laboratory, which has functioned over a period of 10 years, and a number of systems have been developed there which are probably of interest to you.

We soon found that we had to disseminate the factual information, such as you have been hearing today, to the proper personnel in our plants in order that it could be properly applied, worked into the design of equipment and processes developed utilizing that information. It was necessary to get that information in the hands of persons who deal with the different materials and processes involved.

The industrial hygiene laboratory is also interested in obtaining advance notice from engineers, plant personnel, superintendents, etc., so that we may have a knowledge of what materials they are thinking about using or planning to use, so that we may at least try to keep ahead of them.

Our headquarters engineering department utilizes a card system for keeping track of these different materials in use in the plant. On these cards, four by six, they record the name and assign a number to the material, record the suppliers' names, the engineering characteristics of it, and other pertinent data which would be useful to the various engineers and shop personnel who use it. That seemed like a logical place to provide some information on the toxicity or possible effect on the health of the workers from the use of the material.

We have added, at the top of each of these cards, under the name of the product, a very brief statement regarding the toxicity of the material or precautions that should be taken in using it. As an example, if we have a card on benzol, it will definitely state at the top of each of these cards that this material is toxic; its vapors should not be breathed and excessive contact with the skin should be avoided.

These cards serve the useful purpose, first, of keeping the laboratory informed, and second, of transmitting information from our industrial hygiene group to the shop supervisors, the engineers, and other persons in the organization who work with these materials.

As stated, only generalized information is placed on these cards. It is impossible to determine beforehand all the applications that may be made. It may go into a hundred different processes, and you can't anticipate all of those uses, so that it is impossible to provide specific information. We do give a general indication of the toxicity of each mixture or substance.

It has been our feeling that if we can satisfactorily control the use of materials in the plant, and then prove that the control is satisfactory by periodic physical examination of the employees, we will not have cases of

* Westinghouse Electric & Manufacturing Company.

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occupational disease develop. It has proved to be such over the years.

Now these materials are used, as I indicated, in many different types of processes, so that we must give these people very definite and concrete information on each of these different processes. Our headquarters engineering department provides our shop supervisors with a written process specification. It describes what materials to use, how much is needed, what temperature to use, what kind of a tank is required, etc. They are very specific written instructions on how to carry out each process.

That again seems to be a very logical place to transfer information. Therefore arrangements were made for all of these process specifications to come through the industrial hygiene laboratory for their observation and the adding of information about the toxicity of the materials involved.

For a good many years we used general statements; however, they applied specifically to the particular process involved. Later there were requests from the supervisors for more specific and concrete information. When we have occasion to make studies in their individual departments, we provide data to compare against the information which we gave them. Therefore a tabular arrangement was made, which does give them a rather concrete information about the safe limits of different materials.

In Figure I is shown the first type of caution clause which we used on our process specifications. The rest of the specification is not particularly useful in this discussion. The caution clause on this one, for example, reads: "Varnish No. — and Solvent No. — are inflammable. Keep all sparks and flame away. Do not breathe the fumes from these materials. Adequate ventilation shall be provided. Avoid contact of Varnish No. — with the skin."

That was very helpful, and again we had a transfer of information back and forth from the different development engineers, research engineers and shop personnel, in that all of these specifications come through our laboratories, thus advising us of what is being done in the plant, and we in turn provide information about the toxic materials that are involved.

Later, at the request of our shop supervisors, more specific data were included, as shown in Figure II.

This is the tabular heading, which is placed on the first page of each of the process specifications. In the first column is the name of the material and its material number. Then the chart is divided into two general headings: Fire and Explosion Hazards, and Potential Health Hazards. Under Fire and Explosion Hazards we give them some information about the flash point, which is very helpful in controlling the possibility of explosion or fire hazards wherever the material is used. For our purposes we have divided them into three groups, lettered (a), (b) and (c), (a) being the standard ICC classification of an inflammable liquid with a flash point of less than 80° F. For practical control purposes that isn't quite high enough to be considered a dividing line between the relatively safe solvent and the relatively unsafe solvent at room temperatures, because your room temperatures may frequently go above 80° F. We therefore made our dividing line at 110°, adding the second classification (b), 80° to 110°, and (c) over 110°. Thus each potentially hazardous material which is called for in a specification is labeled (a), (b) or (c), depending on its flash point.

In ovens and work places the fire and explosion hazard is limited by controlling the percentage concentration of the vapor in the air, either in a

WESTINGHOUSE
Electric & Manufacturing Company

Process Specification No.____

September 12, 1938

Changed: September 23, 1938

VARNISH TREATMENT OF COILS FOR____

1. GENERAL:
This specification covers the process to be followed in applying a varnish treatment to the coils of____.

*CAUTION:
VARNISH #____ AND SOLVENT #____ ARE INFLAMMABLE. KEEP ALL SPARKS AND FLAMES AWAY. DO NOT BREATHE THE FUMES FROM THESE MATERIALS. ADEQUATE VENTILATION SHALL BE PROVIDED. AVOID CONTACT OF VARNISH #____ WITH THE SKIN.

OPERATIONS:

Figure 1.

closed container or in an open space. Vapor concentrations are restricted to 25 percent of the lower explosive limit, as we feel that a four to one factor of safety is necessary for most of the operations involving the use of these inflammable vapors.

Under the heading "Potential Health Hazards—Breathing Zone" we specify the maximum permissible vapor concentration, using two different columns. In some instances we have a relatively short exposure each day and in other instances continuous exposures. For most practical purposes these two figures do not need to be the same. As indicated in the table, the maximum permissible concentration of benzol is 100 parts in 1,000,000 for exposure of 1 to 8 hours per day, and for an exposure of less than one hour per day, 200 parts per 1,000,000. In the case of toluol, 200 parts per 1,000,000 was set at the top limit, even for the short time exposure.

Under the section entitled "Handling," it is impossible to give a specific statement. We have, by utilizing our safety manuals and our safety supervisors in the plants, informed the shop supervisors of the different types of protection which can be applied to the use of these materials, such as rubber gloves, protective hand cream or protective clothing. In one column it is indicated whether the material is corrosive, such as an acid or alkali, and in the other column the need for personal protective clothing is indicated. If the chart indicates yes, in either of these columns, they have information which can be applied to the specific need.

This scheme of providing information has proved exceptionally useful in times such as we are going through today, when many substitute materials are necessary. The plan has given us an opportunity to discuss the use of the materials with the shop supervisors and the engineers, and to make certain that proper protective measures are taken.

SAFETY REQUIREMENTS: (For explanation, refer to Process Specification No.——).

MATERIAL	FIRE AND EXPLOSION HAZARDS: Flash Point (A Less Than 80° F.; B 80°-110° F.; C Over 110° F.)	FIRE AND EXPLOSION HAZARDS: Maximum Permissible Vapor Concentration, Ovens and Work Places, Percent Volume in Air: Ordinary Equipment	FIRE AND EXPLOSION HAZARDS: Maximum Permissible Vapor Concentration, Ovens and Work Places, Percent Volume in Air: With Flammable Vapor Alarm	POTENTIAL HEALTH HAZARDS: Maximum Permissible Vapor Concentration, Breathing Zone, Parts per Million in Air: For 1 to 8 Hours per Day	POTENTIAL HEALTH HAZARDS: Maximum Permissible Vapor Concentration, Breathing Zone, Parts per Million in Air: For Less Than 1 Hour per Day	POTENTIAL HEALTH HAZARDS: Handling (See Safety Manual or Safety Supervisor): Corrosive — Requires Personal Protective Equipment	POTENTIAL HEALTH HAZARDS: Handling (See Safety Manual or Safety Supervisor): May Require Personal Protective Equipment
Benzol	A	0.35	0.70	100	200	No	Yes
Toluol	A	0.33	0.65	200	200	No	Yes

Figure 2

PROF. DRINKER: I would like to ask Mr. Barnes if he has ever attempted to get the firms who sell these chemicals to do this labeling for him. Do you think it would be practicable?

MR. BARNES: I think it might be ideal, but I am not so sure that it can be done.

PROF. DRINKER: The reason I asked that question is that I am working nearly all my time now for the Maritime Commission, which is a very large employer of labor. One of the most serious problems we face from a health standpoint is the use of paint vehicles, thinners and the like, of unknown composition. Usually they have only a trade name, and the paint foreman hasn't the slightest idea what they are. Only occasionally is there an indication given as to their chemical nature. We need to have some kind of adequate labeling of those items. I was hoping that if somebody like Westinghouse started it first it would be a little easier for us.

MR. BARNES: It has been our experience that we have to find the answer to these problems ourselves, and in the case of solvents, such as Professor Drinker mentioned, not only the trade names but the actual materials sometimes don't seem to be known. It is necessary to make fractional distillations of the solvents and find their true chemical composition. In some instances we just haven't been able to find out any other way. We make a practice of determining the composition of the solvents.

MR. PAUL HARDESTY (U. S. Chamber of Commerce): Do I understand you, Mr. Barnes, to imply that you have some form of periodic physical examination?

MR. BARNES: Yes. It would require too long a time to describe the details now. I will just say that each job in the plant is classified for the type and frequency of the periodic physical examination. I don't mean to imply that all employees received a periodic physical examination. However, all employees working with hazardous materials, or where the safety of themselves or others is involved, receive periodic examinations on a definite schedule, which is determined by the job. That classification determines who receives an examination and, in cases of disease or reaction to toxic materials, they become the patients of the doctor and are followed under those conditions.

DR. S. C. LONG (Atlantic Refining Company): May I ask how often you make these physical examinations on the men who handle benzol?

MR. BARNES: The frequency of examination depends on each individual process or job. We have tied it down to each job in the plant. If we have an operation where there is a benzol exposure which has been proved, through years of experience, to be relatively safe, the examinations will be made every six months, or once a year. If we are going into a new situation, where we don't know what the hazards are going to be, we may make the examinations once a month. Through experience, from determinations over a period of time, we reclassify the job to every six months or a year or whatever is necessary.

MR. FUNKE: In case you find a definite hazard in a certain department, are any of those men trained in first aid, promptly to take care of any serious conditions that may arise at any time?

MR. BARNES: Yes, I would say that something like 10 percent of our total employees are trained in first aid.

MR. FUNKE: With specific instructions on typical or possible conditions?

MR. BARNES: That is right. That is a problem for the safety department, basically, because it is a short time, accident type of exposure. The people in those departments understand what the hazards are and what first aid measures to apply. Frequently written instructions are provided for them.

MR. FUNKE: I was referring particularly to chemical accidents.

MR. BARNES: That is right.

PROF. DRINKER: To many of us it is a pleasure to welcome the next speaker here as a comparative newcomer to the staff of the Industrial Hygiene Foundation, who has for some years been a colleague to many of us: Dr. Francis R. Holden.

WHAT THE FOUNDATION PLANT SURVEYS ARE DISCLOSING

FRANCIS R. HOLDEN, Ph. D.*

Foundation surveys made this year disclose an increased appreciation by management of the application of interpretive and preventive health measures to conditions in the workplace. This viewpoint is especially true of those companies that have active medical and safety departments, even though they may have no trained hygienists.

Industrial, medical and safety departments often detect hazardous exposures in time to prevent serious consequences. The extensive educational program sponsored by governmental agencies, various societies and the Foundation are showing results. Numerous requests for information and services from member and non-member companies alike are indications of industry's efforts to prevent occupational disease and to foster employee health.

Foundation surveys frequently show that equipment for exhaust ventilation is used improperly. Often an exhaust system for controlling dust where batch cars are loaded has been designed, for reasons of economy, to have only a few chute exhausts in operation at any one time. Workmen, through improper instruction or supervision, will open all the exhaust valves, resulting in insufficient suction at any point to remove the dust.

Similarly, there is frequently a failure to provide adequate air to compensate for that removed by exhaust system. This neglect is true especially in winter when windows and doors are closed. The result is that the required amount of air cannot be removed and unless the system has been greatly overdesigned the health hazard will not be controlled. At least as much air should be provided as will be exhausted and this air should be conditioned during cold weather. By means of louvres, it is possible to feed air into the room, avoiding drafts.

We have observed a number of cases where an operation would be exhausted by means of a fan located in a wall near a window, or through a portion of a large window. Workmen desiring to increase the ventilation will open the window, setting up a return air current that carries the dust, gas, vapor, or fume back into the workplace. The fallacy of this procedure can be illustrated by means of a smoke bomb, which clearly shows the exhausted material returning to the room through the open window. We have also found cases where dangerous gas, vapor, dust or fume enters adjoining departments through open windows after having been exhausted from an operation nearby. The obvious answer is to extend the exhaust duct above the level of the roof.

Recently, during an inspection of a spray booth department in a large plant, it was seen that the exhaust system was not operating. It had been shut down because of a complaint from a nearby department that the vapors made the men sick. The vapors were exhausted into a court, exposing many workmen to a hazard that was not a part of their job.

The use and care of respirators continues to be a problem in spite of the know-how information published by the U. S. Bureau of Mines and other organizations, including our own. Most surveys disclose at least one case where the wrong respirator is used. A most common mistake is the employment of dust respirators for protection against vapors. There are also many instances where the maintenance of respirators is inadequate or negligible. Under such circumstances it is difficult to obtain the necessary cooperation from workers. Wearing a respirator is usually a new experience for a recently employed workman. He must be taught to obtain a comfortable fit and the reason for the respirator should invariably be explained.

Many companies have their troubles in getting workmen to wear respirators. But a clay products firm had the opposite experience. A general order warned in effect that employees would wear their respirators "or else." One wintry morning the plant manager coming to work found the janitor busily sweeping snow and wearing a respirator!

Not all industrial health problems are solved by specialists. A recent hazard involved exposure to a material which is a skin irritant. Glass plates were immersed in a mixture of unpolymerized resin, and in spite of the utmost care some of the resin would wet the clothes of the worker. The liquid would then remain in contact with the skin for several hours, producing a dermatitis. Rubber and cloth aprons were of no value, as the resin penetrated them. The mother of one of the girl workers suggested that a sheet of the polymerized resin itself would be impervious to the liquid. Several thin sheets were then prepared and proved an absolute protection.

"Criminal negligence" regarding one's own health and safety is an ever-present problem. An inspection of an acid-pickling process in a steel plant disclosed what appeared to be complete disregard for the potential dangers of the acids by the workers exposed. Nevertheless the accident and health experience in this department had been excellent with one exception. A workman decided to clean thoroughly his dinner bucket after finishing his turn. He dampened a cloth with concentrated hydrofluoric acid and proceeded with the cleaning. The next day his hands were in a very serious condition and grew rapidly worse. It was finally necessary to amputate several of the fingers to arrest the necrosis which resulted.

There is needed middle ground between frightening a workman to the point where he is of little value, and where he shows a wilful disregard or ignorance for the dangers of his occupation. A continuous systematic program of education and supervision administered by foremen and supervisors, backed by top management, has amply demonstrated its practical worth.

The need for speed in production today is of paramount importance, but it should not be at the expense of forethought in the provision of safeguards for health and safety. Mr. Barnes, in his excellent paper on keeping score on toxic materials in the plant, has provided a practical, working method for accomplishing that task. All too frequently the first knowledge that the medical or safety department has of a new process, machine or material is when it is in operation, perhaps in an obscure corner of the plant. Forethought will prevent dangerous exposure. The cost is higher for placing makeshift safeguards or exhaust equipment on a machine after it is in use. Time is lost and confidence in management is endangered if adequate planning is neglected in supplying proper protective devices.

The Foundation is now engaged in a study of the toxicity of the products of reaction from the manufacture of a new chemical by a member company. During the laboratory stages of the developmental work on this

* Industrial Hygiene Foundation.

chemical there were no indications of danger. Ten days after it was placed in pilot plant production two workmen were stricken seriously from exposure to the chemical or one of the byproducts.

By means of the data obtained from animal studies it will be possible to avoid a recurrence of this tragic experience. Every new chemical or product should be investigated as to its toxicity before it is prepared in large amounts and released to the public. This practical common-sense procedure is followed by several larger producers of synthetic chemicals. At least two of the companies are members of the Foundation and can furnish details of their experience to other interested members.

There are still too many cases of dermatitis caused by workmen washing in kerosene, gasoline, or carbon tetrachloride. Protective creams will prevent grease and grime from being ground into the skin. The protective cream and the dirt can be removed simply by warm water. In stubborn cases a safety soap may be needed.

Restrictions on strategic materials for our military needs have resulted in the increased severity of some common hazards. The amount of tin present in solders has been reduced, resulting in an increased amount of lead and occasionally the addition of other toxic metals such as cadmium. Exposures to fumes from solder should be re-evaluated in the light of these new conditions. There will undoubtedly be cases where protective measures which were adequate for the normal solders will fail to prevent lead or cadmium poisoning.

A summary of typical surveys conducted by the Foundation so far during the year 1942 is appended to this report. The industries studied in this way comprise large and small companies and include chemical, steel, stone products, glass, electrical, and container manufacturers.

Typical Surveys Conducted by Industrial Hygiene Foundation

Industry	Type of survey	Hazards	Findings and Recommendations
Chemical manufacturer	Toxicity study	Gases and dust	Hazard determined—long term study recommended
Chemical manufacturer	Toxicity study	Dust	Study in progress
Coated products manufacturer	Spot survey	Vapors	Hazard under control
Electrical equipment manufacturer	Spot survey	Dust	Hazard under control
Electrical equipment manufacturer	General survey	Dusts, vapors, gases & fumes	Spot surveys recommended
Glass manufacturer	Spot survey	Dermatitis	Hazard controlled by protective creams & protective clothing
Glass manufacturer	Spot survey	Dusts, vapors & gases	Hazards under control except for incorrect use of exhaust equipment
Glass manufacturer	Spot survey	Dust & Spray	Check on previously installed equipment; found satisfactory
Heavy chemicals manufacturer	Two weeks atmospheric study	Atmospheric pollution	Extent of hazard determined
Metal container manufacturer	Spot survey	Vapors, gases & dermatitis	Exhaust ventilation recommended; creams & protective clothing introduced
Steel producer	General survey	Dusts, vapors, gases & fumes	Spot surveys recommended
Steel producer	Spot survey	Dust	Exhaust ventilation, use of water to reduce dust; new raw material storage
Steel producer	General survey	Dusts, vapors, gases & fumes	Spot surveys suggested
Steel producer	Spot survey	Fumes & gases	Exhaust ventilation recommended
Steel manufacturer	Spot survey	Dust	Exhaust ventilation recommended
Stone products company	Spot survey	Gases & dust	Exhaust ventilation suggested where needed
Stone products company	Spot survey	Dust	Exhaust ventilation recommended
Zinc and lead producer	Two months atmospheric study	Atmospheric pollution	Hazard under control

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PROF. DRINKER: Many of us are of the opinion that the members of the Foundation could help the Foundation and very materially help themselves by reporting any unusual problems or new problems which arise. This practice would make it possible for other interested members to immediately profit by your experience. Here are a couple of questions that were put up to us, and I have an idea that one of these at least can be answered by some member who perhaps is not aware that others have the same problem.

Do fluoride fumes from welding operations present a serious occupational disease hazard?

Many of us know that it is a potential hazard in light alloy weldings, especially magnesium, and perhaps it is also a problem in certain steel making processes. I don't think many people have any data that extend over any long period. I wonder if any of the members would care to comment on the question. I have no adequate answer to it, I will admit.

DR. F. C. FRARY (Aluminum Company of America): We had experiences before the last war with the welding of aluminum—not duralumin, as somebody said this morning, because that cannot be torch-welded. All fluxes contain small amounts of fluoride. We have large shops in which I suppose we have had as many as fifty welders busy at a time. So far we have never had any indications of any difficulties due to the small amounts of vaporized salts. Our own experiments have indicated that most of the salts which are vaporized are not fluorides but chlorides. I think that it is very unlikely, unless you have extremely poor ventilation, you will have any difficulty with the fluxes which are commercially used or which we commercially use in the welding of aluminum. I can't say as to magnesium, although we have welded magnesium also for the last four or five years without, as far as I know, any injurious effect.

PROF. DRINKER: Perhaps Dr. Irish could comment on this.

DR. D. D. IRISH (Dow Chemical Company): Of course we haven't had nearly the experience Dr. Frary has had with aluminum. I will confirm that there are no fluorides evolved. We tried to make studies under actual welding conditions, and we couldn't find any. That is in our actual plant where they are welding. We don't have concentration of work, and there was plenty of space for ventilation. It is surprising the small amount given off. We made a careful study and we didn't find it in the operation, although in the laboratory you can detect it. When considerable heat and flux are used fluorides are present, but we didn't find them in the actual welding operation.

DR. VISCARDI: We have a plane factory and we heat treat at 960 degrees with sodium and potassium chloride. Has any study been made regarding the effect of exposure to this operation?

PROF. DRINKER: The question is, is there any special precaution that need be taken from potassium and sodium chloride used in heat treatment at a temperature of 960 degrees. I can't answer that. I am not personally aware that there would be any danger.

DR. FRARY: May I ask if that is the heat treatment of duralumin?

DR. VISCARDI: No, it is aluminum.

DR. FRARY: I think the bath used is not potassium or sodium chloride, but sodium nitrate with or without potassium nitrate. The risk which you have there is that if you get the bath overheated you may get oxides of nitrogen, or if you get organic matter in it there is danger of fire or explosion. Such baths should be in a very well ventilated place, and extra care should be used to be certain that the workmen don't add any organic material which would reduce the nitrates, forming nitrites or possibly oxides of nitrogen. The fumes from the nitrates themselves would be harmless.

PROF. DRINKER: Another question that was asked of us: Is there any way in which immediate or rapid clarification could be assured on controversial subjects such as the toxicity of carbon tetrachloride? Elkins, formerly of the Massachusetts Division of Occupational Hygiene, has suggested a safe limit of 25 to 50 parts per million, and Dr. Smyth a limit of 100 parts per million.

It is my own opinion that if you get agreement much closer than that you are fortunate. I don't think that the values are far apart. I think you will probably find that most persons, when there is any question from two sources as reliable as those two, will probably back the lower one, although there are cases now, I am informed, in plants, when the lower figure is really unobtainable.

Would any one care to comment on this question of 25 parts per million for carbon tetrachloride versus 100 parts?

DR. E. R. HAYHURST (Columbus, Ohio): May I suggest that an important factor is the depth of breathing that the man has to engage in on his job.

HEALTH PROBLEMS IN SUDDENLY EXPANDING INDUSTRIAL COMMUNITIES

HUNTINGTON WILLIAMS, M. D., Dr. P. H.*

The theme of this meeting, "Keep War Workers Well!" is a joy to the health officer. The wording in its special field is identical with the "keep well" purpose of all health departments, whether they be national, state or local; and whether the time is of peace or of war. What a thrill Ramazzini or Thackrah would get if either or both of these worthies, our intellectual forbears in industrial hygiene, could be with us in Pittsburgh for this two-day session!

It is only possible for me to sketch a few of the more important health problems for you as they present themselves on the health officer's horizon in industrial communities that are expanding rapidly because of war. Naturally, the focus in order of importance in any such list will vary somewhat in different communities. We won't be far wrong in putting housing at the top of the list. The type of near-slum or overcrowded rooming house or trailer camp community that war workers are forced to live in as a result of boom industry is frequently disgraceful. Often through lack of sewer or other primary sanitary facilities there may be a health hazard of first magnitude. Communities are usually doing the best they can with the housing puzzle and the health officer hopes that the industrial manager will be fully aware of its nature and patient with the efforts being made to solve it.

The health officer thinks of his wartime population increases as groups of defense industry families that are more in need of protective health and medical services than are the stabilized normal citizenry. A rapidly swollen population with many young families will create the need for more maternity beds in hospitals than may be available, for more time and attention from practicing physicians than is possible with shortages caused by current military needs, and the same applies to nursing and dental and related medical services. A health officer is most unhappy if there are large numbers of children over six months old that have not been protected against diphtheria by toxoid inoculation. In a community where there is compulsory vaccination for school attendance he is distressed if an influx of out-of-state or rural defense workers increases the ratio of persons not vaccinated against smallpox; or if new official housing projects swell the local population in an area of his community with thousands of babies for whom no well-baby clinics are available; and he will go to work actively to service these needs.

The matter of rural families coming into cities surely does create communicable disease problems. We had late last July a most unusual case of diphtheria in a baby only 27 days old. City-bred children rarely get diphtheria under six months of age. Their mothers are thought to transmit their own blood antitoxin immunity, which apparently continues for some months after birth in their children. In this unusual case the mother had been born in a small rural town in a neighboring state where there probably was little or no diphtheria over the years. She had lived in that vicinity all her life until 1941, when she moved to Baltimore so that her husband could secure employment in a war industry.

The health department considers this type of question as related to

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other war worker problems of environmental sanitation. Sewer and toilet and drinking water facilities, of course, are never out of mind. Sanitation of the milk and food supplies likewise presents urgent situations, for there may be an inadequacy in the local milk supply or in the portion of it that is pasteurized and safe. In the vicinity of shipbuilding plants or other war industries there may be mushroom growths of restaurants that have trouble in securing competent food handling personnel who know how to avoid the dangers that lead to food poisoning outbreaks.

Now you are probably thinking that first among the health problems in expanding industry would be those resulting from new processes or from plant conversion or expansion. Of course, any health department with an active industrial hygiene service is pretty constantly in touch with matters of this kind, although many local health departments leave industrial hygiene to their state health departments or branch units thereof, or else call on the U. S. Public Health Service for help. Apart from the general sanitary facilities of a plant such as safe and adequate plumbing, ventilation and lighting, there are many opportunities for a health department to serve industry on a consultation basis for the purpose of studying and controlling health hazards due to potentially poisonous chemicals or raw materials or processing methods. Examples from our recent experience would include lead, silica and other toxic dusts, welding fumes, benzol and other volatile solvents, and dangers from radium dial painting.

Let me take a moment to picture for you two instances to show the type of cooperative relationship that may be established between industry and a local health department after years of effort have been expended on building a bridge of confidence in this matter of industrial hygiene.

Small Plant A. Two to eight employees. Benzol as a solvent for rubber. In November, 1940, a Mine Safety Appliances representative reported to our city health department an inquiry they had received regarding the use of benzol as a solvent for rubber in the preparation of insulation coatings for small electrical switches, under a government contract. This was a dipping operation and the plant executive was concerned with the explosion hazard from possibly too much benzol in the atmosphere. He had not considered the health hazard from the inhalation of benzol vapor. We studied the air benzol content at the plant and found it above safety for worker inhalation. We also found that there had been no provision for benzol vapor removal. There were cartridge-type respirators available but they were not being worn regularly by the workers. We recommended that local exhaust ventilation be provided. The father of the plant manager happened to be a well-known physician and through Dr. John M. McDonald, medical director of our Bureau of Occupational Diseases, arrangements were effected for us to make more exhaustive studies in this plant early in 1941. These studies included analyses of air samples, and blood and urine specimens from three workers. A local exhaust ventilation system had been provided but had not proven as helpful as the plant manager had hoped. Even so, there was apparently no bad effect from the atmosphere on the workers up to March, 1941.

A year later, in March, 1942, we returned to this plant and more samples of air and two series of urine specimens were examined. There had been increases in the benzol content of the atmosphere and the urine specimens showed evidence of benzol absorption by the workers. There had apparently been a decrease below normal in the inorganic sulfate content of the urines tested. Chronic exposures of this type following such warnings would threaten the health of the workers with a severe anemia that is commonly the result of chronic benzol poisoning. The conditions we found apparently had resulted from a marked increase in the work expected of this small plant. Eight persons were employed in the process, five females and three males. All eight were exposed to the benzol vapor. It was clear to us that there was need for prompt corrective measures to prevent benzol poisoning and the plant manager was most cooperative.

During the following month of April, 1942, ethyl acetate was substituted for benzol as a solvent although there still remained some benzol in the rubber base as received. Air studies in the plant showed a marked decrease in the concentration of benzol vapor and improvement was also evident from the results of further urine analyses. Indeed, an entire new building was being constructed with improved ventilation to correct the former hazards.

Our latest survey in August, 1942, showed that the work was being done in the new building, that ethyl acetate was no longer available and so benzol was again being used as the rubber solvent, but air samples showed low concentrations of benzol and the urine analyses gave negative results for any evidence of benzol absorption by the workers.

Here we have a splendid example of a small plant where the owner and manager was not familiar with the health hazard involved in the use of benzol. When it was brought to his attention he cooperated fully with the industrial hygiene service of our city health department in authorizing the studies to demonstrate that the hazard did exist and then in taking steps for its elimination.

Large Industry B. Five plants—approximately 4,000 employees. Division of radium dial painting—10 employees. In this instance the plant superintendent, in September, 1940, was first in touch with the Director of the Safety Department of the State Accident Commission, who telephoned Dr. Wilmer H. Schulze, in charge of our city health department industrial hygiene services. The plant was about to begin operations in the radium painting of dials for use under government contract and was seeking all obtainable information as to the precautions that would be necessary.

After a conference between the plant superintendent and Dr. Schulze, the latest mimeographed information on the health hazards of radium painting and their prevention was secured from the Division of Industrial Hygiene of the U. S. Public Health Service and supplied to the superintendent with an offer of assistance from the city health department. This was in November, 1940. The following month the plant began operation in this field with nearly all control and protective procedures established. The city health department was thanked cordially for its assistance and guidance.

In April, 1941, the city health department and the plant in question requested and secured the assistance of the U. S. Public Health Service in making plant studies of exposure to radium emanations. Following this, several precautionary measures were recommended and adopted and arrangements were completed for the periodic medical examination of exposed workers by insurance company physicians. In July, 1941, further studies in the plant and observations of the operations led to the suggestion of additional precautions which were promptly followed. The plant management has prepared and posted a series of operating regulations dealing with radium

paint which are put up in the room where work of this type is carried on.

Here again we find that the management of a large plant with a very particular health hazard sought guidance and before inaugurating the especially hazardous process established protective procedures in the closest teamwork with the national, state and local official agencies interested in aiding industry in its efforts to protect the health of the worker.

These are examples taken from current experience in a city health department whose interest in industrial hygiene goes back to studies of carbon monoxide poisoning in 1922. These studies resulted in a strong local ordinance for the control of gas poisoning which was enacted in 1925 and has been enforced under health department control with increasing effectiveness ever since that time. From this vital beginning there has been a fairly active expansion in industrial hygiene in our health department since 1932. This was because industrial hygiene is a logical and integral part of any general public health program; because of Dr. Schulze's personal interest and competence and because no one else in our city or state was officially active in this field of endeavor. Our annual reports since 1932 show a wide scope of service and an expansion into occupational disease control under additional trained medical and laboratory and field staff. These later developments have been associated with the more recent state legislation in Maryland that was enacted under the wise leadership of Theodore C. Waters.

Now in what way can all this be of some practical interest to you who are responsible for the direction and control of wartime industrial units in your own communities? What can you do about matters of this kind?

It would seem that, by and large, industrial plant managers, personnel directors and operating officials in industry are loath to make use of the services in industrial hygiene that are available for the asking from health departments. Slow and laborious efforts have been made on both sides to build the bridge over which these services might flow. In some places, as in the state of Connecticut for instance, firm and deep foundations have been laid in a most satisfactory manner.

The war of course accentuates the tempo of life in every field; and I would have you take away from this meeting a feeling of dissatisfaction and unhappiness over the slow pace, the trickle of service, the hesitancies and doubts that now stand in the way of maximum service in industrial hygiene from health departments, state, local or national, to industries that are called upon for almost superhuman wartime endeavor.

Now, of all times, Chambers of Commerce or Associations of Manufacturers, both big and small, need to know this desire for service on the part of health departments. There should not be the slightest hesitation for a plant manager to pick up the telephone and call the city or state health commissioner and say, "I want you to send over your man and study this process and tell us whether there is any health hazard involved in this or that new work we are undertaking, or old work that we are expanding."

Plant managers need to spend an hour scrutinizing these matters. They need to face the fact, as seen in the case of Small Plant A, mentioned above, that a plant manager may be wholly unaware of the presence of any health hazard in his plant. Such a manager may particularly need to ask for a general plant survey by a trained industrial hygienist. He or his designated agent may need to study the type of medical service he now employs. A part-time physician, interested primarily in industrial surgery, a man already overworked perhaps because of war shortages of physicians, will not always be in a position to take the interest needed in preventive medicine in the plant that employs him. And do not forget that the public is watching your performance in these matters. You may remember two presentations of the subject in the Reader's Digest, one in March, 1941, entitled "Ill, Doc" and one in June, 1941 under the heading, "What Makes the Worker Like to Work?" In large industries the plant manager may need some keen technical assistant to serve as liaison officer between the plant and the industrial hygiene service that is available from the state or local health department.

It is splendid for the 250 member companies to have the services of the Industrial Hygiene Foundation with its headquarters here in Pittsburgh. There will always be more than enough work for this Foundation to do in research and consultation and guidance, but it probably can only scratch the surface in the great volume of industrial hygiene and occupational disease control work that needs to be done in the thousands of industrial communities that make up the manufacturing and economic life of our nation. And so, at long last, state and local health departments are recognizing industrial hygiene to be an integral part of public health service, as a responsibility of states and communities that must be met if there is to be any well-rounded public health program at all.

We, in our city health department, have been pleased with the requests we have received for public health service from industry, but usually the requests come from old friends who have been working with us for years. I have in mind a printing plant who called up not long ago when one of their workers had developed typhoid fever. They wanted to know what to do. Another large plant, one of the biggest in our area, with whom we had also been in touch for years, called us recently to ask if they could get a blood lead test on one of their workers in whom they suspected lead poisoning. Now, we have been doing blood lead tests for seven years for industry, but the physician in this plant apparently never knew it or had forgotten it and of course had probably lost innumerable opportunities for letting us help him and his large corporation in this and in other ways.

We sense a reluctance on the part of industry and industrial physicians to call on us, although I think we have leaned over backwards in endeavoring to betray no confidence with management, to serve on a consultation and not a regulatory basis, to seek to serve employer and employee alike, but in a manner that would always leave the door open for further calls. Yet over the past eleven years the Baltimore City Health Department can count on less than the ten fingers of two hands the number of industrial plants that have of their own volition come regularly to it to confer on their industrial hygiene problems. The other industrial units with which we have worked have, however, been receptive to approaches we have made to them. With only one exception all the plants we have worked with have been friendly and cooperative; but by far the greatest number in our community would appear to ignore entirely their needs in this matter and our desires to serve them, and this in spite of a city-wide educational effort to sell our wares.

State medical societies throughout the country are endeavoring to broaden the interest and imagination and scope of information of industrial physicians through institutes and training courses and by other means. In the past few weeks Dr. Raymond Hussey in our community has secured the inauguration of a new and unique course known as Physiological Hygiene

7—Industrial Health for Physicians and Surgeons, at the Johns Hopkins School of Hygiene and Public Health.

The task ahead for 1942 and 1943 was well described a short while ago by a great industrial leader as follows:

> "The number one job of the armed forces right now, brutal as it may sound, is to kill Nazis and Japs. The responsibility of the home front is to speed up production and delivery of material to our armed forces to do that killing with dispatch and finality. The only way our industrial machine can accomplish that task is to keep its workers on the job and working at high efficiency. Their health must be maintained. I am not being altruistic but extremely practical."

And so, with an eye to what has been achieved thus far, and a deep appreciation of opportunities like this for us to study our problems together, it would seem that we should all welcome the present war impetus. With promptness we can and should build a better bridge between industry and health services and stimulate the two-way traffic over it for the purpose of maintaining a maximum of health and efficiency among industrial workers. An absent worker is a loss, whether absence is due to illness or worry, and whether the illness developed in the plant or at home. This means that the problem is more than just one of good plant hygiene; it calls for statesmanship in management after study and awareness of the broader implications of community health, with more than a thought to housing, communicable disease control, medical services and related civic responsibilities. In this national endeavor to keep war workers well it is indeed fortunate that the Industrial Hygiene Foundation of America is playing a leading role.

PROF. DRINKER: We now have the pleasure of turning the meeting over to the Legal Committee Chairman, Mr. Theodore C. Waters.

REPORT OF LEGAL COMMITTEE

THEODORE C. WATERS*

With the increased activity in our war production program, many new legal problems have arisen that are of concern to those executives directing the nation's production efforts. We have come to realize that upon management rests the responsibility for the maintenance of the health of industrial workers, and in the discharge of that responsibility it is essential that management should be advised of and comply with the various laws, rules, and regulations applicable thereto. This year our Committee has been requested by the Managing Director to include in its report reference to the following subjects:

I. Summary of state and federal laws relating to the employment of women in industry.

II. An analysis of occupational disease compensation laws introduced at the 1942 sessions of the state legislatures.

III. Activities of legislative interim commissions to study and recommend legislation for occupational disease compensation.

IV. Discussion of important court decisions construing occupational disease compensation statutes.

I. SUMMARY OF STATE AND FEDERAL LAWS RELATING TO THE EMPLOYMENT OF WOMEN IN INDUSTRY

In order that our war effort may attain its goal at the earliest possible moment and with the minimum cost in human lives, it is necessary that the armed forces of our nation should have first call upon our young able-bodied manpower. To the ranks of the armed service have been called the cream of the manpower of the nation—the type of men that industry has heretofore sought for employment. On the other hand, there has been a tremendous increase in our industrial activity related to the war effort, with the resulting demand for employees to produce the goods that will make effective the effort of our armed forces. There is not sufficient manpower available to fill this need, and the womanhood of our country has been and is being called in increasing numbers to assume a most important part in our national effort.

Many states have various laws applicable to the employment of women in industry, and I will summarize some of these laws for your information. The Women's Bureau of the United States Department of Labor has recently published Bulletin No. 167 that deals with "State Minimum Wage Laws and Orders." A first and second supplement to that bulletin were published in 1940 and 1941. I will not attempt to analyze these laws, since the bulletins referred to will give you full data upon this subject. You are also familiar with the Fair Labor Standards Act, more familiarly referred to as the Federal Wage and Hour Law, which covers employees engaged in interstate commerce, and the production of goods for interstate commerce.

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* Mullikin, Stockbridge, and Waters, Baltimore, Md.; Chairman, Legal Committee, Industrial Hygiene Foundation.

The U. S. Department of Labor has summarized State Labor Laws for Women, covering the following classes of laws:

1 — Prohibitory and Regulatory Laws
2 — Night Work Laws
3 — Maximum Hour Laws
4 — Day of Rest Laws

1
Prohibitory and Regulatory Laws

Twenty-two states[1] and the District of Columbia have no prohibitory or regulatory laws regarding the employment of women. In seventeen states[2] women are prohibited from working in mines; Oregon prohibits their employment in messenger service; Connecticut, Massachusetts, Missouri, New York, Vermont and Washington require specified unemployed periods before and after childbirth; Louisiana forbids them cleaning moving machinery; California prohibits the lifting or carrying of heavy weights; Colorado prohibits their employment in the operation of coke ovens; Ohio prohibits their employment as crossing watchmen, molders, workers in blast furnaces, etc.; Pennsylvania prohibits their employment for maintaining fires in hand-fired boiler furnaces, handling nitrators in the manufacture of nitroglycerine, and the operation of cranes, together with forms of welding; New Jersey and Pennsylvania prohibit their employment in the manufacture of nitro and amido compounds and other substances containing lead in excess of 2 percent; Ohio and Utah prohibit their work in smelters; Arizona, New York, Ohio, Oklahoma and Wisconsin prohibit their work in quarries.

2
Night Work Laws

Eleven states[3] prohibit the employment of women at night in manufacturing establishments. All of these states now provide for exemption in war manufacturing for women twenty-one years old, and over. In some of these states the night work laws especially provide for exemption, while in others the Governor or State Labor Departments have granted exemptions under their general powers.

3
Maximum Hour Laws

There are five states (Alabama, Florida, Indiana, Iowa, West Virginia) that do not limit the length of the work-day or work week. In twenty-one states[4] and the District of Columbia the maximum work-week for employ-

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1. Delaware, Florida, Georgia, Idaho, Iowa, Kansas, Kentucky, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Carolina, North Dakota, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, West Virginia and District of Columbia.
2. Alabama, Arizona, Arkansas, Colorado, Illinois, Indiana, Missouri, Maryland, New York, Ohio, Virginia, Oklahoma, Pennsylvania, Utah, Washington, Wisconsin and Wyoming.
3. Connecticut, Massachusetts, Nebraska, New Jersey, New York, Delaware, Indiana, Pennsylvania, California, Kansas and Wisconsin.
4. Connecticut, Louisiana, Massachusetts, Nevada, New Hampshire, New Mexico, New York, Oregon, Pennsylvania, Utah, Virginia, Wyoming, California, Illinois, Ohio, Rhode Island, Washington, Arizona, North Carolina, North Dakota, South Carolina and District of Columbia.