FILE NAME: National Safety Council (NSC)

DATE: 1954

DOC#: NSC076

DOCUMENT DESCRIPTION: Transactions of the NSC - Volume 22

Effect of Alcohol Level in Blood*

Ounces of Whiskey Consumed in 1 Hr. or less	Percent Alcohol in Blood	Behavior
¾	0.01	Normal.
1	0.02	Feeling of warmth pleasant social behavior.
2 - 3	0.05	Judgment blunted. Boastful, impulsive. Officially still sober.
5 - 6	0.1	Fumbling, staggering gait, clumsiness, slurred speech.
8	0.15	Officially drunk. Responses and motor coordination strongly affected.
10	0.2	Helpless, nausea.
16	0.3	Stupor.
24	0.4 - 0.5	Coma.
30	0.6 - 0.7	Paralysis of the respiratory center — Death.

*Pfizer Spectrum, JAMA, March 27, 1954

Skin and Body Contact

Approximately 60 per cent of all complaints received by our department are concerned with dermatitis and skin irritations resulting from contact with petroleum materials.

By far, the majority of these complaints are from customers so this is a subject that is very important in the marketing of petroleum products.

Cases among our employees or in our refineries are few when compared with those among industrial users of petroleum products, and it is believed that the reason for this is due mainly to the degree or extent of contact.

In the petroleum industry skin contact is not generally experienced to the extent that it is—for example, in the metal working industries where a daily eight hour skin contact with cutting oils often takes place.

It is definitely established that skin is not an impermeable barrier to chemical substances, and it is increasingly important as a route of absorption for many materials. Action of chemicals on skin may be local resulting in dermatitis. Examples we are familiar with are kerosene, cutting oils, and so forth, or a chemical may be absorbed through the skin and cause damage to blood or internal parts of the body.

Lead tetraethyl as an illustration does not affect the skin or cause dermatitis but can penetrate the skin and cause internal poisoning.

Regarding external or local skin effects, chemicals may be classified either as primary irritants or sensitizing agents.

A primary irritant is a chemical that may cause dermatitis in individuals frequently after only one contact. They may have a strong chemical action, such as acids, alkalis, amines, and so forth or they may have a weak chemical action but require prolonged contact to cause dermatitis. Most petroleum hydrocarbons are primary irritants but are classed in the latter category in that prolonged or extensive contact is usually required to cause skin irritation.

Sensitizing agents, on the other hand, are chemicals that are innocuous to most skins but capable of producing dermatitis in a few susceptible individuals following repeated contacts over a long period of time. Sensitization may require weeks, months or even years of contact with the material before dermatitis develops.

The petroleum industry is now handling large quantities of chemical additives and inhibitors, many of which are strong primary irritants and very active chemical compounds. By nature, inhibitors usually have to be very potent chemicals because, while they are used in very low concentrations, they exert a powerful influence on the characteristics or performance of the product, and many of the inhibitors are just as potent towards man.

One very active class of inhibitors are the amines and substituted amines, and we are particularly concerned about them because they are very damaging to the eyes, and a splash can readily result in blindness. The amines are usually strong smelling caustic liquids, insoluble in water, hence difficult to remove by washing. They can cause severe eye burns and necrosis of eye tissue. In addition, most amines are readily absorbed through the skin; and even low quantities may cause internal damage and death.

The following will show the effect on skin of one such amine-dimethyl phenylene diamine:

Amount	Skin Area	Effect
0.001cc	1 sq. cm.	Heat — redness — rash
0.005cc	1 sq. cm.	Blister formation
4.0cc	12 sq. in.	Death

Employees should be fully alerted as to hazards of such materials and should be educated to the use of protective goggles, gloves and aprons when handling such products, an activity within the scope of the safety engineer.

The foregoing applies to concentrated or undiluted inhibitors. Finished petroleum

products should and usually do contain such a small quantity, and the inhibitor is so diluted as to result in practically no more harm in the finished product than there would be from the straight mineral oil itself.

Industrial dermatitis cases some times result in bizarre and erroneous conclusions as to their cause even by those who should know better.

I recall a case of a young man who worked in a gasoline station and developed a severe dermatitis. He went to a physician who made patch tests on him and found he had a sensitivity to special gasoline but no reaction to regular gasoline. Apparently, the physician had heard special gasoline contains a lot of lead because the case was diagnosed as resulting from an excess of lead tetraethyl in the special gasoline. We thought this strange because while we all know that lead tetraethyl is a violent poison and can be absorbed through the skin, it is not a primary skin irritant and has never been known to cause dermatitis. A review of records of gasoline shipments into the particular area showed the regular gasoline actually contained the same or some times more lead than the special gasoline, clearly proving that lead tetraethyl was not to blame, but that some other material was responsible.

Inhalation

Of the three avenues by which chemicals can be taken into the body, inhalation probably has received by far the most study and investigation because it is the most important consideration in industrial health.

The vast amount of research on the inhalation of materials has resulted in publication of very useful data on safe human exposure levels known as Threshold Limit Values or Maximum Allowable Concentrations.

This is a list of several hundred commonly encountered chemicals, solvents, dusts, and so forth, the toxicology of which has been carefully studied by medical research and industrial experience.

The list is compiled annually by the American Conference of Governmental Industrial Hygienists and is published by the American Medical Association. It tabulates the maximum amount of the various materials workers can safely be exposed to for an eight hour working day without injury to health.

A few of the materials commonly encountered in the petroleum industry are listed below:

Gases and Vapors

Substance	PPM
Benzene (benzol)	35
Carbon dioxide	5000
Carbon monoxide	100
Carbon tetrachloride	25
Gasoline	500
Hydrogen sulfide	20
Naphtha (petroleum)	500
Octane	500
Sulfur dioxide	10

Toxic Dusts, Fumes, and Mists

Substance	Mg. Pe. Cu. M.
Iron oxide fume	15
Lead	0.15
Sulfuric acid	1

Mineral Dusts

Substance	MPPCF
Asbestos	5
Dust (nuisance, no free silica)	50
Silica	
high (above 50% free SiO_2)	5
medium (5 to 50% free SiO_2)	20
low (below 5% free SiO_2)	50

These values are based on the best available information from industrial experience, from experimental studies, and, when possible, from a combination of the two. They are not fixed values but are reviewed annually by the Committee on Threshold Limits for changes, revisions, or additions as further information becomes available.

Threshold Limits should be used as guides in control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations. They represent conditions only within which it is felt that workers may be repeatedly exposed, day after day, without their health being adversely affected. It is felt, at the present time, that workers should not be exposed to a working environment containing any of these substances in excess of the value indicated.

I cannot over emphasize the importance of the Threshold Limit Values and believe that every safety man should be familiar with them and have copies of the complete table, because they have been incorporated in states' codes and have the force of law in many states, and therefore, must be complied with. So far some nineteen states have written Threshold Limit Values into their laws and often management is not aware of such requirements but would be in a vulnerable position if trouble resulted from excessive exposure to any of the materials. Usually it is up to safety people and indus-

trial hygienists to alert management to the existence of these codes and to institute measures for measurement of air contaminants so as to insure compliance.

Even a common material like gasoline has a maximum safe level which is 500 parts per million. The results of exposure to concentrations greater than 500 ppm is shown by the following:

Gasoline Exposure

Symptoms: Headache, irritation of eyes and throat, dizziness, nausea, loss of consciousness, death.

	Parts Per Million	%
Maximum Allowable concentration for prolonged exposure	500	0.05
Slight symptoms after several hours	1000	0.1
Maximum concentration tolerable for 1 hr.	5000	0.5
Dangerous for short exposure	15000	1.5
Fatal for short exposure	25000	2.5
Lower explosive limit	14000	1.4

Product Labeling

One very important function of the industrial hygienist in the petroleum industry is precautionary labeling of product. This is receiving more and more emphasis as state after state passes labeling regulations. The most recent is the state of New York where the Council on Public Health passed on February 26, 1954 labeling regulations which became effective August 24, 1954 as Chapter IX-A of the New York State Sanitary Code. These labeling regulations have the force and effect of law and require precautionary labeling on any product which entails a hazard in a reasonably anticipated use.

A hazard is defined as—"the risk of injury or illness which may be encountered during or as a result of any reasonably anticipated type of handling or use of a substance, or during its specified use, if any, by reason of the toxicity of the substance through ingestion, inhalation or absorption through the skin, or due to its corrosiveness or irritating properties, or because of its flammability or explosiveness."

Similar labeling regulations already exist in California, Illinois, Oregon, and the Territory of Hawaii and are in the making in New Jersey, New Hampshire, Ohio and Rhode Island. More can be expected. Fortunately, most state regulations are guided by recommendations of the Manufacturing Chemists' Association, Inc. and with some few exceptions, conformity in one state results in conformity in other states.

It is recognized that as a rule, labeling regulations of many products are advisable and result in safer handling of the material by customers, but it requires extensive work, knowledge of product and toxicological information to determine what products must be labeled and how they should be labeled. In our company's operations, we use somewhat over 2,000 basic chemicals or raw materials and manufacture some 3,500 finished products which must be reviewed individually in regard to the above.

To illustrate, the following are just a few of the hazardous materials that are encountered in petroleum refinery operations or that might be compounded into finished products:

Materials Encountered in Petroleum Refinery Operations

Respiratory Irritants	Toxic Materials	Skin Irritants
Acrolein	Aniline, liquid	Acids — all kinds
Acetaldehyde	Aniline, dyes	Amines
Aluminum Chloride	Benzol (Benzene)	Benzol (Benzene)
Ammonia	Cadmium	Caustics
Asbestos	Carbon Monoxide	Chromium Salts
Ditertiary butyl para cresol	Chlorinated hydrocarbons	Coal-tar Compounds
Dusts, physiologically inert, general	Chrome compounds	Cobalt, metal and compounds
Dusts, attapulgus clay	Cobalt, metal	Dyes
Dusts, bauxite	Hydrogen sulfide	Inhibitors
Dusts, catalyst	Inhibitors	Nickel salts
Formaldehyde	Lead, metal & fumes	Oils, general
Fluorides	Lead, oxide, litharge	Oils, high boiling from Cat & Steam Cracking
Furfural	Lead, tetraethyl	Oils, insoluble cutting
Inhibitors	Lead, soaps	Phenol
Lime	Manganese	Pitch
Nitrogen oxides	Mercury	Solvents
Ozone	Methanol	Ultra Violet Radiation
Silica	Radioactive materials, general	Wax, untreated
Smoke	Toluol (Toluene)	
Sulfur dioxide	Xylol (Xylene)	
Pine Oil	Zinc	
Welding fumes		

The petroleum industry has made remarkable progress in development of new and better products and in improving processing operations. Accompanying this progress has been new problems of toxicology and health engineering which must be studied and investigated with the same zeal as other types of research.

The advent of catalytic cracking resulted in production and handling of aromatic hydrocarbons, and of importance to us, health problems long associated with the coal-tar industry.

The use of new chemical catalysts, inhibitors, and other chemical compounds involve health problems that chemical industries have faced for years.

To illustrate this trend we need only look at the modern gasolines, fuel oils and motor oils. Years ago motor oils were practically 100 per cent petroleum in nature with little, if any, additives; today they contain up to 15 to 20 per cent of chemicals, additives and inhibitors, and this trend will continue because there is no question that additives are necessary and contribute much to improve performance characteristics.

Every step in this direction, however, does pose new problems of health and safety among our plant personnel and our customers. Because the petroleum industry is becoming more and more involved in the handling of all kinds of chemicals having various degrees of physiological effects upon man, I would like to quote the following concerning chemicals from a publication issued by Du Pont's *Harkell Laboratory of Toxicology:*

"It Takes All Sorts"

"Chemicals, like people, can be mild, fractious and often exasperating. Like people, chemicals are of many types and dispositions. Most are uncomplaining, law-abiding citizens who present no special problems. Some are unstable and unpredictable. Some are out-and-out neurotics, requiring a sharp and observant discipline. Others, harmless by themselves, may be influenced by bad company. Still others are troublemakers in solitary, but docile and helpful in tandem. Some are just plain bad actors."

It is my firm opinion that good industrial hygiene in the petroleum industry is dependent upon combined skills of many and requires earnest cooperation of industrial physicians, industrial nurses, toxicologists, chemists, safety men and industrial hygienists working together as a team. We all have a very important part in the picture.

Safe Handling of Insecticides

By F. R. WILLSEY

Farm Safety Specialist, Purdue University, Lafayette, Ind.

Insecticides are *supposed* to kill! Of course, they are supposed to kill only insects but the fact that they are intended to kill anything at all should be enough to cause us to be alert.

In one sense this problem of "Safe Handling of Insecticides" isn't a new problem at all. For years, we've had insecticides that could and occasionally did kill humans. We have also had some that were less dangerous. On the other hand, in a few short years we've changed from a few old standbys to over 5,000 products involving about 70 chemicals.

Why all this change?

1. Apparently people don't like to eat worms as well as they did. At least public opinion seems to demand higher quality products now that people realize such products can be produced.

2. And the government doesn't think people should eat so many insects. That's indicated by the fact that we have more laws and regulations governing quality of products, labeling of insecticides, spray residue, and so forth.

3. Insects travel more. They hitch-hike rides on the very latest transportation facilities. As a result they get more places and get there quicker than they could a few years ago.

4. New chemicals, plus research, makes new insecticides possible. In fact with each

1954 TRANSACTIONS VOLUME 22

Current Safety Topics in the

ELECTRICAL EQUIPMENT INDUSTRY AND PUBLIC UTILITIES INDUSTRIES

as presented in sessions of the Electrical Equipment and Public Utilities Sections at the 42nd National Safety Congress

(Continued on next page)

NATIONAL SAFETY COUNCIL • 425 North Michigan Avenue • Chicago 11, Ill.

Officers of the

PUBLIC UTILITIES SECTION

NATIONAL SAFETY COUNCIL 1954-55

General Chairman—W. S. KITCHEN, System Safety Supervisor, Appalachian Electric Power Co., Roanoke, Va.

Vice-Chairman—H. T. JAYNE, Safety Supervisor, Philadelphia Gas Works Div. of The United Gas Improvement Company, Philadelphia, Pa.

Secretary—E. T. MARSHALL, System Safety Engineer, Pennsylvania Electric Company, Johnstown, Pa.

Section Program Committee—E. T. MARSHALL (Chairman), System Safety Engineer, Pennsylvania Electric Company, Johnstown, Pa. *Electric Power Member*—F. G. HARRIMAN, Safety Manager, New England Power Service Co., Boston, Mass. *Gas Member*—J. M. FALLS, Assistant to Manager of Industrial Relations, Northern Indiana Public Service Company, Hammond, Ind. *Water Member*—H. L. ROCSE, Safety Engineer, Kansas City Water Department, Kansas City, Mo. *Communications Member*—R. S. LOWE, Plant Training and Safety Supervisor, Northwestern Bell Telephone Co., Omaha, Nebr.

Section Engineering Committee—JACK APPEL (Chairman), Safety Engineer, Commonwealth Edison Co., Chicago, Ill. *Vice Chairman, Electric Power*—E. DUNBAR, Safety Director, Potomac Electric Power Company, Washington, D. C. *Electric Power Members*—F. J. ALIBI, Safety Director, City of Seattle, Dept. of Lighting, Seattle, Wash.; D. A. CAMERON, Secretary-Treasurer and Engineer, Electrical Employers Association of Ontario, Toronto, Ontario, Canada; F. J. HUGHES, Safety Director, Pacific Power & Light Co., Portland, Ore.; T. D. HUGHSTON, Supervisor, Safety and Training, Texas Power & Light Company, Dallas, Texas. *Vice-Chairman, Gas*—EARL E. TAYLOR, Safety Engineer, Southern California Gas Co., Los Angeles, Calif. *Gas Members*—E. E. EDMONDSON, JR., Safety Director, Texas Eastern Transmission Corp., Shreveport, La.; J. B. HALL, Manager of Accident Prevention, Equitable Gas System, Pittsburgh, Pa. *Vice-Chairman, Water*—WENDELL R. LA DUE, Superintendent and Chief Engineer, Bureau of Water & Supply, Akron, Ohio. *Vice-Chairman, Communications*—J. E. MILLER, Administrative Supervisor, Western Union Telegraph Co., New York, N. Y. *Vice-Chairman, Special Projects*—S. T. ROBESON, Safety Supervisor, Carolina Telephone & Telegraph Co., Tarboro, N. C.

Section Education and Training Committee—W. J. EASTON (Chairman), Director of Accident Prevention, Cincinnati Gas & Electric Co., Cincinnati, Ohio. *Vice Chairman, Posters*—V. L. WOMELDORFF, Safety Director, Illinois Power Company, Decatur, Ill. *Poster Members*—H. K. COOK, Assistant Manager, Safety Department, Philadelphia Electric Co., Philadelphia, Pa.; J. G. DICKINSON, Supt. of Accident Preven-

tion, Wisconsin Electric Power Co., Milwaukee, Wis.; C. A. FISCHBACK, Safety Supervisor, Southern California Edison Co., Los Angeles, Calif. *Vice-Chairman, Visual Aids*—R. E. McELDOWNEY, JR., Safety Director, United Fuel Gas Co., Charleston, W. Va. *Visual Aid Members*—F. H. LA MASTER, Safety Engineer, R.E.A., U. S. Dept. of Agriculture, Washington, D. C.; F. D. NORBERG, Safety Director, Utah Power & Light Co., Salt Lake City, Utah. *Vice-Chairman, Training Plans and Programs*—A. B. LARSEN, Supervisor, Construction Training, Commonwealth Edison Co., Chicago, Ill. *Training Plans and Programs Members*—H. W. MASTERS, Safety Director, Asplundh Tree Expert Co. & Utilities Line Const. Co., Inc., Jenkintown, Pa.; M. M. MEHRING, Safety Supervisor, Consumers Public Power District, Columbus, Neb.; E. D. JONES, Safety Director, City Utilities of Springfield, Springfield, Mo.

Section Publicity Committee—E. M. CHASE (Chairman), Safety Director, Central Vermont Public Service Corp., Rutland, Vt. *Vice-Chairman, Public Relations*—R. R. CONN, Supervisor of Training & Safety, Power Station Dept., Duquesne Light Co., Pittsburgh, Pa. *Public Relations Members*—R. M. CLARK, Safety Director, Atlantic City Electric Co., Atlantic City, N. J.; R. S. METZGER, Dir. of Claims, Safety & Real Estate, Toledo Edison Co., Toledo, Ohio. *Vice-Chairman and News Letter Editor*—T. F. WICKORD, Safety Supervisor, Commonwealth Edison Co., Chicago, Ill. *Assistant News Letter Editors*—R. H. ELFSTROM, Supervisor of Industrial Safety, British Columbia Electric Co., Ltd., Vancouver, B. C., Canada; C. K. HOOD, Adm. Supervisor, Western Union Telegraph Co., New York, N. Y.; R. A. WILLIAMS, Safety Director, Arkansas Power & Light Co., Pine Bluff, Ark.

Section Statistics and Contests Committee—J. E. HICKMAN (Chairman), Safety Engineer, Los Angeles Dept. of Water & Power, Los Angeles, Calif. *Members*—W. F. BACHMAN, Safety Director, Omaha Public Power District, Omaha, Neb.; CHARLES E. HAMMON, Safety Director, Columbus and Southern Ohio Electric Co., Columbus, Ohio; PAUL WINDSOR, Safety Director, Bureau of Safety, Chicago, Ill.

Section Membership Committee—L. CLANCY NANRY (Chairman), Assistant Director of Safety, Detroit Edison Company, Detroit, Mich. *Members*—JAMES R. BIVENS, Assistant Director of Employee Relation, Columbia Gas System Service Corp., New York, N. Y.; D. E. HUSK, Safety Director, New Jersey Power & Light Co., Dover, N. J.; A. B. SHEHEE, Safety Engineer, R.E.A., U. S. Dept. of Agriculture, Washington, D. C.; J. M. WEAVER, Safety Director, Indiana and Michigan Electric Company, Fort Wayne, Ind.

Members-at-Large—B. A. THORNTON, Elkhart, Ind.; P. A. ALBERTY, Columbus, Ohio; R. E. WALTER, Omaha, Neb.

Councilors (Past General Chairmen)—1916-17, J. B. DOUGLAS; 1919-20, WILLIS Maclachlan; 1925-26, B. B. McCULLOCH; 1926-27, GEORGE OPP; 1927-28, C. J. RUTLAND; 1928-29, H. F. WEBB; 1930-31, E. S. BEAUMONT; 1931-32, G. A. DOELLER; 1932-33, C. B. BOULET; 1934-35, F. J. KREH; 1935-36, R. M. GODWIN; 1938-39, R. S. METZGER; 1939-40, H. A. PTOLEMY; 1940-41, CHARLES S. BOWDEN; *1941-42, P. L. G. HASSKARL; 1942-43, D. C. DUNCAN; 1943-44, E. S. MINER; *1944-46, J. T. O'BRIEN; 1946-47, J. O. LESLIE; 1947-48, J. B. PORCHER; 1948-49, E. L. FITZGERALD; 1949-50, JOHN MacLELLAN; 1950-51, E. S. HANNAFORD; 1951-52, W. H. ADAMS; 1952-53, W. T. ROGERS, Safety Director, Ebasco Services Incorporated, New York, N. Y.; 1953-54, P. M. GENTZEL, Safety Coordinator, Ohio Edison Company, Akron, Ohio.

Special Representatives—R. P. DOUGLAS (Chairman, Accident Prevention Committee, Edison Electric Institute), Safety Director, The Detroit Edison Company, Detroit, Mich.; LEO R. NUHFER (Chairman, Accident Prevention Committee, American Gas Association), Safety Director, The Peoples Natural Gas Company, Pittsburgh, Pa.; WENDELL R. LA DUE (Representing the Water Utility Industry), Superintendent and Chief Engineer, Bureau of Water Supply, Akron, Ohio.

Staff Representative—GEORGE MacDONALD, National Safety Council, Chicago, Ill.

---

*Deceased

larger undertakings. It is a good sign of progress, one that will pay off in later years. Like others, however, we are faced with the continuing necessity to combat exposures incident to the march of time. Steps are being taken to increase the tempo of these efforts.

Control Measures

Control measures at Ontario mines are under the jurisdiction of the management concerned, and in particular the operating head of the division or department concerned.

If a mine does not have a ventilation engineer, a member of the operating staff—not infrequently the superintendent or chief engineer—assumes these duties. Assistance is rendered periodically by engineers of the committee on silicosis; the latter do the dust sampling in such cases. Thus, another limiting factor is hurdled.

The ventilation engineers at the larger mines—and those employed jointly by groups of smaller mines—observe and report on control measures to their superiors, usually the superintendent or the manager of the property concerned. These engineers do their own dust sampling and are helped by the committee's engineers where assistance is desired in special problems. Periodically, also, arrangements are made for all these engineers to jointly discuss their techniques and practices.

The point to note, however, is that control work—such as dust sampling and ventilation surveys—is necessary. It is the only way to assess conditions and improve them where necessary. It bears mention, too, that surveys not infrequently disclose surprising results—deficiencies that need correction; improvements that should be made at enclosures in the crushing plant; et cetera.

Depending on the purpose, various means have been used at Ontario mines to collect samples of aerial dust. However, for more than a quarter of a century all routine and most test sampling has been done with the konimeter. This little instrument, despite its shortcomings, is indeed a useful tool.

The supply is manufactured here, where it is known as the Gathercole konimeter. And thereby hangs a tale, in keeping with the subject of this paper. The Gathercole instrument was developed many years ago through the auspices of the Technical Silicosis Research Committee—because dust control was being hampered by various factors occasioned by having to import konimeters from a distant country.

As shown in the statistical study to which reference was made at the outset of this paper[*], most of the silicosis in Ontario had its origin in gold mines, where it would appear that the amount of quartz in aerial dusts ranges from 14 to 28 per cent, approximately, as determined by X-ray diffraction patterns.

Konimeter samples are heated to about 1000°F. before and after acid treatment and are counted at a magnification of 150× against a dark field.

Through the years, we have come to appreciate that, in our case, konimeter counts of the order of 100 to 300 particles per cubic centimeter are good; those of the order of 500 to 700 or 800 are fair, only; while those in excess of 1000 ppcc are poor.

The sins of the past have been erased for the most part and the dust count at many installations and operations perfected in recent years approximate 100 ppcc.

Educational and Other Aspects of Field Service

However, there still is much to do. Indeed there always will be—because methods and personnel change.

We combat these circumstances in a variety of ways. The industry as a whole, and individual mines, are guided and stimulated by the continuing and numerous activities of the committee on silicosis and its engineers—their reports, papers, addresses at meetings, et cetera.

Much education and training was—and continues to be—accomplished by the use of a motion picture on dust control and ventilation. Produced in 1939, primarily to help supervisors, the film has been screened at meetings of supervisors at many mines and in most mining centers. It has been shown also to the workmen at numerous mines, at branches of the mining institute—and at this foundation's conference in 1951. The picture covers all operations and is illustrated by photomicrographs of dust samples.

Much good is done, also, by lecturing periodically at the universities—because the students of today will be the operators of tomorrow.

But, the most valuable aid has been the development and maintenance of a continu-

ing service in dust control and ventilation that is readily available to the operator—large and small—at reasonable cost.

The cost of our engineering services is modest. The savings cannot be estimated. It takes time to develop facilities of this kind but they are well worthwhile. They improve with age, too, not only because the engineers thus engaged become more experienced, but because they mature with the operators.

A feeling of mutual respect and confidence is engendered through years of close contact between all parties concerned with this endeavor; one which enables all the cards to be laid face up on the table, so to speak; so that conditions may be discussed frankly, and remedial measures of practical value, implemented where they should be.

The word "practical" is emphasized. Nothing is gained if proposals are otherwise; in fact, a limitation in keeping with the title of this paper may be introduced.

To illustrate: Some years ago one of this association's engineers surveyed conditions at a mine that then was several housand feet deep. It was making a modest profit on a daily production of a few hundred tons of gold ore. The survey showed that the underground ventilation should be improved. During discussion of this problem, the manager took from his files a proposal provided by a well known engineer whom the company had retained in this connection. The latter recommended that the ventilation be improved by sinking a shaft from surface to the bottom of the mine, to enable fresh air to be delivered to various horizons; the layout included a suitable system for its distribution.

The conversation which ensued between the manager of the mine and this association's engineer was more or less as follows:

Manager: What do you think of the report?

Reply: It is a good report.

Manager: Will the system work?

Reply: Sure, it will work. The question is, however, will the patient survive.

Manager: That's what I wonder, too.

It suffices to say that a compromise was designed and installed, one which still gives reasonably good results today, ten years later. It is worthy of note, too, that subsequently this same company took steps to correct undesirable air conditions in its crushing and screening plant and in its assay office. Would any of these things have been done as soon as they were if common sense had not been used to solve difficulties in the underground ventilation?

This principle illustrated by this example is not new. It is simply the fact that much can be accomplished by judicious consideration of all the circumstances involved. Management is not callous. Where this appears to be the case, the probability is that it is unaware of actual conditions and/or does not know a practical remedy. It is up to the engineer to clarify such circumstances and, to the extent possible, devise remedies in keeping with the fact that the remedial measures will be unnecessary if operations do not show a profit.

The purpose of this paper was to discuss limiting factors in dust control and ventilation—the kind that despite their importance are seldom dealt with to an appreciable extent in the technical literature on this subject.

It was shown that many of these are human in origin and that unless, and until, they are solved a program to provide and maintain good air conditions will fail.

The responsibilities of the man, of those who design and consult on machines and processes, and of management were discussed; and it was pointed out that success in a program of this kind hinges mainly on the attitude of management.

It was shown, too, that there is much more to this problem than recognition of the need to do this and that, to correct undesirable conditions. Those whose duty it is to provide remedial measures need help to enable them to do so and can profit much from the guidance, counsel and service of a control organization within the industry itself.

The paper was based on experiences over twenty years in a large mining industry which, through its efforts of this kind and through those of understanding governmental agencies, has enjoyed a measure of success in the prevention of silicosis.

Many conclusions may be drawn from these observations. One is: Where there is the will, there is a way. Another is: It is impossible to control all exposures to harmful dust all the time.

The former conclusion needs no further comment. The latter one suggests the use of aluminum therapy—to combat unavoidable dusting, the human element and individual susceptibility, where the risk of silicosis may be appreciable. Aluminum is used for these purposes at almost all gold mines in Ontario.

Appendix "A": Extracts from the Mining Act of Ontario

Section 160: (40) (a) The ventilation in every mine shall be such that the air in all of its workings that are in use or are to be used by workmen or others shall be free from dangerous amounts of noxious impurities and shall contain sufficient oxygen to obviate danger to the health of anyone employed in any such mine. In any mine workings where such conditions cannot be obtained by natural ventilation approved means for mechanical ventilation shall be provided and kept in operation until such workings have been abandoned or until satisfactory natural ventilation shall have been brought about therein.

(119) Every dusty place where work is being carried on in a mine shall be adequately supplied at all times with clean water under pressure or other approved appliances for laying the dust caused by drilling or blasting operations.

(185) In every mill or plant where, by reason of dry crushing or otherwise, there is in the air of the building dust in quantity to be injurious to health suitable apparatus shall be installed for its removal.

Section 167: (1) At every mine the owner or manager shall cause the following plans on a scale acceptable to the Chief Inspector to be kept up to a date not more than six months last past:

(d) Adequate ventilation plans, showing the direction and velocity of the main air currents, the location of permanent fans, ventilation doors and stoppings and connections with adjacent mines.

---

(8) "A Statistical Study of the Known Cases of Silicosis in the Mining Industry of Ontario," by N. F. Parkinson, Executive Director of the Ontario Mining Association.

The Unwatering of the Osceola Lode

(A Symposium)

The General Project

By C. A. CAMPBELL

Mgr. of Mines, Calumet Div., Calumet and Hecla, Inc., Calumet, Mich.

The Calumet Division of Calumet & Hecla, Inc., operates seven underground mines which are located on the Keweenaw peninsula in northern Michigan. The ore deposits lie within the central portion of the Keweenaw series, which consists chiefly of lava flows. The beds dip to the northwest at about 36° to the horizontal, and flatten slightly at depth. Native copper, with a minor amount of silver, is the ore mineral and is found in the amygdules along with many secondary silicates and carbonates.

In 1948, the management of Calumet & Hecla, Inc., could see that several of their mines would be depleted in the near future, and that, if production and employment in the area were to be maintained, it would be necessary to open additional mines. A committee was established to review the various possibilities that existed and to recommend mines that could be opened. In analyzing the various possibilities, certain essentials were required in a new mine and they were as follows:

1. Time: The new mine must be ready to start operating at about the time the old mines close.

2. Quantity of Production: The new mine must be able to produce enough copper to largely offset the production lost from other sources.

3. Location: The new mine must be so located as to use present milling, smelting, power, shop and transportation facilities.

4. Capital Cost: The new mine must be capable of being brought into production

1954 TRANSACTIONS
VOLUME 20

Current Safety Topics in the PETROLEUM INDUSTRY

as presented in sessions of the Petroleum Section at the 42nd National Safety Congress

Vol. 20

(Continued on next page)

NATIONAL SAFETY COUNCIL • 425 North Michigan Avenue • Chicago 11, Ill.

Industrial Hygiene in the Petroleum Industry

By A. C. PABST
Industrial Hygienist, Socony-Vacuum Oil Co., Inc., New York, N. Y.

Industrial hygiene is a field that is closely interwoven with industrial safety. In fact, it can be regarded as a medical engineering phase of safety.

Unfortunately, many people do not know what industrial hygiene is and the functions of an industrial hygienist. The reason for this is that industrial hygiene is a comparatively new science and practically unknown twenty years ago.

Today there are only about 800 industrial hygienists in the United States, and a large number of this group are not in industry, but working for the federal government or state departments. Usually, people hearing the word "hygiene" recall they had a hygiene course in high school which dealt with personal habits such as bathing, cleaning the fingernails, teeth, and so forth and immediately jump to the conclusion that an industrial hygienist in industry must be interested in keeping employees clean.

In my initial visit to many refineries, it seemed that the first place I was taken was to locker rooms to inspect shower and lavatory facilities. In some degree, industrial hygienists are interested in the employee's cleanliness, but only so far as it is necessary to protect his health. We are more interested in keeping an employee's lungs, skin, and other organs clean and free from hazardous gases, liquids, and other harmful substances.

Hygiene is defined as that branch of medical science that relates to preservation of health. Therefore, industrial hygiene may be defined as the science of prevention and control of occupational illness. It resolves itself into the problem of finding factors or conditions in work places that may cause or contribute to the illness or serious discomfort of employees, and of devising methods and means of eliminating or controlling such conditions. Another term that may best describe industrial hygiene might be industrial medical engineering.

The industrial hygienist has done much toward bringing medicine and safety engineering into close cooperation partly because his interests overlap these two fields.

The typical industrial hygienist usually started out as a chemist or chemical engineer who became interested and studied toxicological effects of chemicals on man. Consequently, he has a good background of chemistry and engineering combined with some medical knowledge—a sort of one-third doctor, one-third engineer and one-third chemist. His objectives are protection and improvement of health and safety of workers in industrial environments from all manner of harmful exposures related to occupation.

Industrial hygienists and safety engineers have pretty much the same objectives and should be regarded as members of the same team. Actually, the functions of each are sometimes so inter-related it is not possible to draw a clear line of separation between the two fields, nor is it necessary to do so for if a man's health is endangered by working conditions it is an important part of his safety picture. In many industries, safety and industrial hygiene are combined in the same department.

In the petroleum industry, however, industrial hygienists are usually attached to the medical department and work as closely as possible with the safety department for the protection of the employees. There is good reason why the petroleum industrial hygienists must lean heavily upon the safety department. In the petroleum industry the concept of industrial hygiene is relatively new as compared to the chemical and other industries, consequently, the number of petroleum industrial hygienists is exceedingly small.

On the other hand, safety departments are well established, well acquainted with and close to every day problems of the petroleum industry. They have considerably more coverage and manpower.

To illustrate, the American Petroleum Institute's roster of safety and fire protection personnel list some 1,200 names, probably not all, in this occupation. Contrasted to this, to the best of my knowledge, there are at present only 17 industrial hygienists

working for petroleum companies—an industry ratio of approximately 70 safety men to one industrial hygienist. Most of the major oil companies now have at least one industrial hygienist and anywhere from 50 to 100 safety men so you can see it is very necessary for us to work with and through our safety people.

Basically, the practices of industrial hygiene in the petroleum industry is the same as in any other industry and it can be boiled down to four general principles:

1. A knowledge of the toxicology of chemicals and materials.

2. A review of all chemicals or materials used and how handled and tabulation of toxic or potentially hazardous substances.

3. Measurement of worker exposure to hazardous substances.

4. If required, recommendation and installation of adequate control measures and evaluation of the effectiveness of such corrective steps.

Toxicology of Chemicals

In regard to the toxicology of chemicals, it is usually difficult to adequately define a hazardous material because practically anything can be safe or harmful depending upon how it is used or where it is used.

For example, air and water are not regarded as harmful, but both are quite deadly under certain conditions—air if injected into the blood stream and water if introduced into the lungs.

In the same manner, the use of carbon tetrachloride in a process having properly designed ventilation would not be hazardous, while the use of carbon tetrachloride for mopping floors would be quite dangerous. Most safety people are aware that carbon tetrachloride is a hazardous chemical because there has been considerable publicity regarding its toxicological effects, and in some cases, restrictive labeling requirements have been passed, for example, in New York City. Many other chemicals used in the petroleum industry have inherent toxic qualities of the same magnitude, yet are not so well known.

In regard to toxicology, there are three ways in which a substance can cause adverse effects upon man:

1. It can be ingested or swallowed.

2. It can be harmful by direct contact with the skin or parts of the body.

3. It can be inhaled as a gas, vapor, mist or dust.

Ingestion

Fortunately, petroleum materials are not commonly or intentionally taken internally and therefore, trouble from this is rather rare in a refinery, although it does occasionally occur unknowingly. I recall watching a worker who had been complaining of stomach trouble, whose duties involved the compounding of litharge or lead oxide in a doctor solution. This man proceeded to empty bags of litharge into an outdoor mixing tank and because of the dust and mists generated he correctly wore a respirator. Of course, his hands were covered with lead oxide, and to my amazement, the first thing he did when he came down off the catwalk was to take an orange out of his lunch box which he started to peel and eat—probably one of the most effective ways to get lead poisoning.

Unfortunately, when petroleum products get into the hands of customers ingestion is more frequent, usually by small children whose parents carelessly leave products within easy reach. You know that every year there are fatalities reported from children drinking kerosene. We have had hurry calls from doctors involving children drinking such products as penetrating oil and fly sprays.

Some times adults are even worse as there are many cases of anti-freeze poisoning, drinking of brake fluid and one I recall of our radiator flush which contains muriatic acid and chlorinated hydrocarbon. However, this product is fully labeled including poison warning with the skull and cross bones.

It should be emphasized that hardly a substance exists that is not capable of producing effects on the human body if taken in sufficient amounts or under the wrong circumstances. Even common table salt if used in sufficient quantities is toxic. It is reported that many years ago the Chinese used table salt as a means of committing suicide. Every chemical substance, therefore, has a non toxic dose for man and a toxic dose for man. This can be well illustrated by the following slide on a widely used commodity:

National Safety Council

(Board of Directors, continued)

MARTIN RONNING, Chief Engineer, Power Machinery Div., Minneapolis-Moline Co., Minneapolis, Minn.

ROBERT T. ROSS, Manager, Employee Service, Industrial Relations, Ford Motor Co., Dearborn, Mich.

P. L. SIEMILLER, General Vice-President, International Association of Machinists, Chicago, Ill.

LEE E. SKEEL, Chief Justice, Court of Appeals of Ohio; Eighth Appellate District, Cleveland, Ohio.

ROBERT R. SNODGRASS, President, Atlas Auto Finance Co., Atlanta, Ga.

LESLIE J. SORENSON, City Traffic Engineer, City of Chicago.

H. J. SPOERER, Director of Industrial Relations, The Youngstown Sheet & Tube Co., Youngstown, Ohio.

J. C. STENNETT, Manager, Accident and Fire Prevention Dept., National Assn. of Mutual Casualty Companies, Chicago, Ill.

R. S. STEVENSON, Executive Vice-President, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

W. A. STEWART, President, American Optical Co., Southbridge, Mass.

RANDALL C. SWANSON, Farm Safety Specialist, University of Wisconsin, Madison, Wis.

COL. W. L. TUBES, Assistant for Ground Safety, DCS/Personnel, HQ U. S. Air Force, Washington, D. C.

ARNOLD H. VEY, Director, Bureau of Traffic Safety, Dept. of Law and Public Safety, Trenton, N. J.

ARTHUR W. WALLANDER, Assistant to the President, Consolidated Edison Co. of New York.

MISS JUDITH WALLER, Director of Public Affairs and Education, National Broadcasting Co., Chicago.

MRS. GEORGE WELLES, JR., Duluth, Minn.

DR. GEORGE M. WHEATLEY, 3rd Vice-President, Metropolitan Life Insurance Co., New York, N. Y.

E. L. WHEELER, President, Wheeler Protective Apparel, Inc., Chicago, Ill.

DR. WILLIAM P. YANT, Director of Research and Development, Mine Safety Appliances Co., Pittsburgh, Pa.

1954 TRANSACTIONS VOLUME 17

Current Safety Topics in the

MINING INDUSTRY

as presented in sessions of the Mining Section at the 42nd National Safety Congress

17 3

(Continued on next page)

NATIONAL SAFETY COUNCIL • 425 North Michigan Avenue • Chicago 11, Ill.

Limiting Factors in Dust Control and Ventilation

By C. S. GIBSON
Safety Dir., Chief Eng., and Sec'y., Comm. on Silicosis,
Mines Accident Prevention Ass'n of Ontario, Timmins, Ont., Canada

The cardinal requisite for prevention of silicosis is the provision and maintenance of adequate means to avoid exposure to harmful dusts.

Experience is a great teacher in this respect. Its greatest lesson is that it is better to be sure than sorry. For this and other reasons of economic significance, industry today is giving wider recognition to the fact that good dust control and ventilation are assets, whatever the nature of the exposure.

Most dust can be controlled. Appreciation of this point is important. It means that most silicosis can be prevented, on the job. The ways to do so have been described in technical literature. Applications can be observed. Their utility is known.

However, not unlike other pursuits, the path of progress in preventing undesirable exposures is studded with obstacles. These in effect are limiting factors because unless, and until, they are overcome the desired results will not be obtained.

Limiting factors may be segregated into two groups. First, there are the engineering and operational problems of one type and another. Most of them are not too difficult to overcome. There are, however, aspects in this connection that justify particular consideration; for example, the dissemination of knowledge, promotion of interest in this subject, and means to help those who need help.

Second, there are limiting factors which are mainly human in origin. That is to say, the results to be had are related primarily to the decisions and actions of persons; for example, the attitude of management is vitally important because so much depends on it.

This paper deals mainly with kinds of factors indicated above. The text is based on observations and experiences in a mining industry that has enjoyed a measure of success in the prevention of silicosis.(*)

The Mining Industry of Ontario

The industry as a whole employs about 35,000 persons, about two-thirds of whom have dust-exposure occupations.

Most of the mines are multi-level underground operations in steeply dipping veins. The veins vary in width from a foot or so to several hundred feet, and may or may not be branching systems. The depth of these operations ranges from a few hundred to 8,000 feet, approximately, below surface. The primary products of the underground group are gold, silver, cobalt, copper, nickel, iron, talc, fluorspar and gypsum.

There are a few open-pit mines. These are temporary in type because, as the outcrops are removed, the mining is done below surface. Primary products of the open pits are asbestos, copper, nickel, iron, magnesium and nepheline syenite.

Daily production of ore ranges from less than 100 to 15,000 tons though it is considerably more at some open pits. The ore is crushed, screened and treated by appropriate metallurgical processes, to recover the valuable constituents.

The risk of silicosis obtains mainly in underground operations and in crushing and screening plants on surface.

This general picture may be concluded by referring to four parts of The Mining Act of Ontario that are appended hereto. The essence of them is that the law requires wet mining methods underground, and suitable ventilation to avoid exposure to harmful dusts and gases. These legal precautions, and compensation for silicosis, were requested by the mining industry many years ago and have contributed in no small measure to achievements in the prevention of this disease.

Organization to Prevent and Suppress Dust

The organization for dust prevention and suppression throughout the industry as a whole—in fact, for all aspects of the prevention of silicosis—is guided in a general way by a voluntary arrangement under auspices of the Mines Accident Prevention Association of Ontario. The word "voluntary" is emphasized. So, too, is the fact that silicosis cannot be prevented solely by

laws and expenditures of moneys. It's the old story: "You can lead a horse to water, but you can't make him drink." Our legislators merit compliments for their foresight in this respect.

Overall efforts are directed by seven mine managers, or their appointees, who constitute the committee on silicosis. The members of the committee, representing various mining districts, are appointed by the Board of Directors. Each serves at least three years. They elect their own chairman annually. The committee meets for one day three times a year at present; is represented on the directorate of the Accident Prevention Association; and publishes an annual report and such others as circumstances demand. Minutes of meetings are recorded. The records of this committee and of its predecessor, the Technical Silicosis Research Committee of the Ontario Mining Association, date back to 1934.

The committee on silicosis employs a chief engineer and two ventilation engineers, all of whom have graduated from a recognized university of this province and are members of the Association of Professional Engineers of Ontario. The chief engineer acts as the committee's secretary and is the Accident Prevention Association's safety director. Located in a principal mining district, Porcupine, they cover all mining and metallurgical operations of Ontario.

The larger mines maintain ventilation engineers on their staffs. But, what of the smaller mines? This difficulty—this limiting factor—was solved in part by groups of smaller mines jointly employing engineers for this purpose. Most of the dust control and ventilation at these properties is designed by mine personnel. Engineers of the Mines Accident Prevention Association train and assist mine personnel as occasion demands; keep in close contact with them; and help to solve their problems, as need arises. Thus, another limiting factor was met and solved.

When the work in silicosis was consolidated in 1934, as indicated, the mining companies generously offered to cooperate in every way—by admitting the committee's engineers to their properties, permitting them to survey air conditions at operations underground and on surface, making available to them data in this regard, and by doing or participating in various research projects. This voluntary arrangement has continued throughout the years without any interruption, whatever. It has been the means of overcoming numerous limiting factors in dust control and ventilation.

As the committee's engineers gained experience, they offered advice and made recommendations. One result of these and other endeavors is that today most of their time is devoted to the design of systems to control dust and ventilate mines, crushing plants, assay offices, et cetera. Similarly, the committee itself has accumulated such a back-log of experience that it now holds a position of eminence and trust throughout the industry and the governmental departments associated therewith.

Almost all work done at mines by the committee's engineers now stems from requests by management; this is indeed an encouraging situation. All reports on operations at mines, or designs for same, are confidential. Complete copies are provided to the management of the company concerned, the committee on silicosis and the secretary of this association.

Until lately, there was no fee for service by the committee's engineers, the costs being borne by the industry as a whole. Since August, 1953, there has been a modest charge for designs. As in the past, however, no fees are collected for surveys of an exploratory nature nor for consultations of any kind.

There are innumerable examples to show that this service has done much good. It alleviates and removes deficiencies that in effect are limiting factors in dust control and ventilation.

As most students of hydraulics and allied subjects will recall, the mechanics of ventilation may be confusing. Large companies have enough work on dust and ventilation to keep at least one engineer busy and practiced in this field. Smaller operations do not, and, unless the latter jointly employ an engineer for this, duties in this regard must be delegated to persons on the staffs having, as a rule, other primary interests. There is therefore a handicap to be overcome.

The solution effected by the mining industry of Ontario—that is, the provision of engineering services—is a logical remedy. It benefits all employers in many ways, yet leaves responsibility where it belongs; namely, with the operator. A service of

this kind might hold advantages in other industries.

First Things Come First

"Stop the dispersal of dust and you remove the cause of silicosis." This admonition is as valid today as it was when first voiced many years ago. Dust control—that is, ability to restrict the amount of dust allowed to escape into the atmosphere surrounding a given operation—determines the extent of ventilation required to maintain a low risk from this disease.

Three factors may be considered in this connection: the man, the machine, or process, and management. If workmen are taught to do things properly, and are provided the means to do so, exposure will be a minimum. Generally speaking, the less that it is necessary to rely on precautions to be taken by the individual, the more success will be enjoyed in dust control. The fact remains, however, that there are numerous simple but important practices which those engaged in any process can and should apply, to minimize the risk to themselves and others. The main one in mining pertains to the use of water. Constant attention to procedures of the individual is a basic requirement in the prevention of silicosis and it should be the duty of every supervisor to see that they are the proper ones.

The machine or process is an important consideration. The tempo of industry is increasing year by year; drills are drilling faster; the methods of mining and moving muck are being speeded up; new and improved processes are being used in plants. The purpose is, of course, to raise productivity and decrease costs. It bears emphasis, however, that increased exposure to dust may be a costly by-product—one that may be difficult, if not impossible, to correct later—unless measures to guard against this outcome are dealt with in the planning stage.

The remedy for this kind of limiting factor in dust control and ventilation starts on the drafting board. In the main, three parties are involved: the manufacturer of equipment; those who design and consult on processes, including mining; and the user—that is, management.

It seems logical to presume that the maker of a piece of equipment whose operation entails a hazard to health should be interested in the correction of same; yet, this does not seem to be so in many instances. One would expect, also, that the maker of such a piece of equipment is in a better position to devise and publicize remedial measures for the hazards involved in the use of his equipment than anyone else. Some manufacturers lag in these respects.

The designers of mining and other processes, and the consultants retained in these respects, have an obvious part to play in this problem. There are many examples to show that they did their jobs well. On the other hand, there are many to show that insofar as dust is concerned they fell down—in the designs that they did or did not undertake for this purpose, and in the provision of certain features of construction that would facilitate subsequent application of good dust control and ventilation. Too often these aspects are an afterthought, cast in the lap of the ventilation engineer. He could do much more good at the outset, and at less cost.

The third factor, the attitude of management, is a most important one because it is management that decides policy. It calls the shot, so to speak; and it should, for the problem is its responsibility.

The outcome of any program to control exposure to dust hinges on the attitude of management. If this attitude is a live desire to have good air conditions, there will be freedom from exposure to the extent that is practicable. If it is not, undesirable and unnecessary exposures will be experienced.

Management in many instances has done much to stop the dispersal of dust in given operations and processes. It is suggested that progress in these respects would be enhanced if every operator,

1. Insisted that suppliers take more interest in the reduction of exposure incident to the operation of equipment produced by them.

2. Required that those who design and consult on layouts for processes—mining and other—heed the voice of experience.

3. Pursued at all times good practices in his own operations.

The mining industry of Ontario has had minor success in respect of Item One and fair success in regard to Items Two and Three. It is a joy to see a company planning its dust control and ventilation before a shaft is sunk, a new orebody attacked, a crushing plant erected. We in Ontario are well into that stage, particularly in the

1954 TRANSACTIONS VOLUME 1

GENERAL SESSIONS

42nd National Safety Congress

(Index to Transactions of all Sections)

NATIONAL SAFETY COUNCIL • 425 North Michigan Avenue • Chicago 11, Ill.

PLAINTIFF'S EXHIBIT NSC-71

The Big Picture . . .

What's the big picture in the field of safety?

Each edition of the National Safety Congress Transactions is a comprehensive collection of the ideas and experiences of many of the country's top safety men. These ideas and experiences form the big picture.

In the pages of the Transactions may be found new methods, new devices, answers to both old and new problems, and suggested improvements of some of our standard safety procedures. Progressive safety people everywhere have found the contents of the Transactions to be useful in their accident prevention programs.

The Congress Transactions are published in volumes, each covering a phase of the safety picture, along with a General Sessions and Detailed Index to all volumes. The 30 volumes of the 1954 Congress Transactions are listed on the last page of this volume.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

National Safety Council

1413-B

OFFICERS

Chairman, Board of Directors: E. F. DU PONT, Director, Employee Relations Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

President: NED H. DEARBORN, President, National Safety Council, Chicago.

Vice-President For Farms: GUY L. NOBLE, Managing Director, National Committee on Boys and Girls Club Work, Chicago.

Vice-President For Finance and Treasurer: WILLIAM H. LOWE, Treasurer, Inland Steel Co., Chicago.

Vice-President for Homes: W. A. STEWART, President, American Optical Co., Southbridge, Mass.

Vice-President for Industry: H. J. SPOERER, Director of Industrial Relations, The Youngstown Sheet & Tube Co., Youngstown, Ohio.

Vice-President for Local Safety Organizations: ROBERT R. SNODGRASS, President, Atlas Auto Finance Co., Atlanta, Ga.

Vice-President for Membership: ROBERT T. ROSS, Manager, Employee Service, Industrial Relations, Ford Motor Co., Dearborn, Mich.

Vice-President for Public Information: BOYD LEWIS, Vice-President and Executive Editor, *NEA Service, Inc.*, New York.

Vice-President for Schools and Colleges: DR. LOWELL B. FISHER, State Chairman, North Central Association of Colleges and Secondary Schools, University of Illinois, Urbana, Ill.

Vice-President for Traffic and Transportation: FRANKLIN M. KREML, Director, Traffic Division, International Association of Chiefs of Police, Evanston, Ill.

Vice-President for Women's Activities: MISS MARION E. MARTIN, Commissioner of Labor and Industry, State of Maine, Augusta, Me.

General Manager: GEORGE C. STEWART, General Manager, National Safety Council, Chicago, Ill.

Secretary: R. L. FORNEY, Secretary, National Safety Council, Chicago, Ill.

Assistant Treasurers: BUFORD B. MCCULLOCH, President, Bureau of Safety, Inc., Chicago, Ill.

H. H. GREENWALD, Director, Accounting Division, National Safety Council, Chicago, Ill.

National Safety Council

TRUSTEES

Chairman of the Trustees: W. S. S Rodgers, Former Chairman, The Texas Co., New York, N. Y.

Vice-Chairman of the Trustees: John Stilwell, Yonkers, N. Y.

Secretary of the Trustees: Ned H. Dearborn, President, National Safety Council, Chicago, Ill.

Members

Melvin H. Baker, Chairman of the Board, National Gypsum Co., Buffalo, N. Y.

Cason J. Callaway, Blue Spring Farms, Hamilton, Ga.

Cleo F. Craig, President, American Telephone & Telegraph Co., New York, N. Y.

Frederick G. Crawford, Chairman, Thompson Products, Inc., Cleveland, Ohio.

Richard R. Deupree, Chairman, Board of Directors, Procter & Gamble Co., Cincinnati, Ohio.

Gustav Metzman, Chairman, American Railway Car Institute, New York, N. Y.

Thomas I. Parkinson, Chairman, Equitable Life Assurance Society of the United States, New York, N. Y.

Dr. John F. Thompson, Chairman, International Nickel Co. of Canada, Ltd., New York, N. Y.

C. E. Wilson, The Secretary of Defense, Washington, D. C.

James B. Black, President, Pacific Gas & Electric Co., San Francisco, Calif.

S. Bruce Black, President, Liberty Mutual Insurance Co., Boston, Mass.

Morgan B. Brainard, President, Aetna Life Insurance Co., Hartford, Conn.

John W. Carpenter, Chairman, Board of Directors, Texas Power & Light Co., Dallas, Tex.

William G. Chandler, President, Scripps-Howard Supply Co., New York, N. Y.

National Safety Council

(Trustees, continued)

WALTER J. CUMMINGS, Chairman, Board of Directors, Continental Illinois National Bank and Trust Co., Chicago, Ill.

HARLOW H. CURTICE, President, General Motors Corp., Detroit, Mich.

NED H. DEARBORN, President, National Safety Council, Chicago, Ill. *Ex Officio.*

E. F. DU PONT, Director, Employee Relations Dept., E. I. du Pont de Nemours & Co., Wilmington, Del. *Ex Officio.*

BENJAMIN B. FAIRLESS, Chairman, Board of Directors, United States Steel Corp., Pittsburgh, Pa.

CALVIN FENTRESS, JR., President, Allstate Insurance Co., Skokie, Ill.

FRANCIS J. GAVIN, Chairman, Board of Directors, Great Northern Railway Co., St. Paul, Minn.

E. ROLAND HARRIMAN, Brown Bros. Harriman & Co., New York, N. Y.

LEE WARREN JAMES, Old Brookville, L. I., New York.

JOSEPH L. LANIER, President, West Point Manufacturing Co., West Point, Ga.

GEORGE E. LEIGHTY, President, Railway Labor Executives' Assn., Washington, D. C.

GWILYM A. PRICE, President, Westinghouse Electric Corp., Pittsburgh, Pa.

WALTER P. REUTHER, President, Congress of Industrial Organizations, Washington, D. C.

W. S. S. ROGERS, Former Chairman, The Texas Co., New York, N. Y.

HERBERT E. SMITH, Member, Board of Directors and Former Chairman, United States Rubber Co., New York, N. Y.

JOHN STILWELL, Yonkers, N. Y.

ARTHUR F. STODDARD, President, Union Pacific Railroad Co., Omaha, Neb.

JUAN T. TRIPPE, President, Pan-American World Airways System, New York, N. Y.

THOMAS J. WATSON, Chairman, Board of Directors, International Business Machines Corp., New York, N. Y.

ROBERT W. WOODRUFF, Chairman, Executive Committee, The Coca-Cola Co., Atlanta, Ga.

National Safety Council

BOARD OF DIRECTORS

Chairman, Board of Directors: E. F. DU PONT, Director, Employee Relations Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.

Vice-Chairman, Board of Directors: KIRK FOX, Editor, *Successful Farming*, Meredith Publishing Co., Des Moines, Iowa.

Members

MRS. ALMER ARMSTRONG, Director, Home Department, Indiana Farm Bureau Cooperative Association, Inc., Indianapolis, Ind.

J. JAMES ASHTON, Manager, Delaware Safety Council, Wilmington, Del.

WILLIAM B. BARTON, General Counsel, Chamber of Commerce of the United States, Washington, D. C.

T. N. BOATE, Manager, Accident Prevention Department, Association of Casualty & Surety Cos., New York, N. Y.

NORMAN E. BORGERSON, Deputy Superintendent, State Dept. of Public Instruction, Lansing, Mich.

W. E. BROWN, Safety Director, Consolidated Edison Co. of New York, Inc., New York.

E. J. BUHNER, Chairman of the Board, Silver Fleet Motor Express, Inc., Louisville, Ky.

ARTHUR C. BUTLER, Director, National Highway Users Conference, Washington, D. C.

RAY CARR, Advertising Counsel, Portland, Ore.

JESSE CLARK, Grand President, Brotherhood of Railroad Signalmen of America, Chicago, Ill.

DR. ZENAS R. CLARK, Administrative Assistant, Wilmington Public Schools, Wilmington, Del.

REGINALD M. CLEVELAND, President, Greater New York Safety Council, New York, N. Y.

JOHN M. CONVERY, Employee Relations Div., National Association of Manufacturers, New York, N. Y.

CHARLES R. COX, President, Kennecott Copper Corp., New York, N. Y.

ERNEST G. COX, Chief, Section of Safety, Bureau of Motor Carriers, Interstate Commerce Commission, Washington, D. C.

National Safety Council

(Board of Directors, continued)

NED H. DEARBORN, President, National Safety Council, Chicago, Ill.

E. F. DU PONT, Director, Employee Relations Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.

WALLACE FALVEY, President, Massachusetts Bonding and Insurance Co., Boston, Mass.

R. H. FERGUSON, Assistant Director, Industrial Relations, Republic Steel Corp., Cleveland, Ohio.

DR. LOWELL B. FISHER, State Chairman, North Central Association of Colleges and Secondary Schools, University of Illinois, Urbana, Ill.

KIRK FOX, Editor, *Successful Farming*, Meredith Publishing Co., Des Moines, Ia.

PAUL E. GURSKE, Director, Bureau of Labor Standards, U. S. Dept. of Labor, Washington, D. C.

LEONARD HAEGER, Director, Technical Service and Research Dept., National Association of Home Builders, Washington, D. C.

O. R. HARTWIG, Consulting Safety Engineer, Crown Zellerbach Corp. and other companies, Portland, Ore.

DAN HOLLINGSWORTH, Manager, Oklahoma City Safety Council, Oklahoma City, Okla.

DR. HAROLD K. JACK, Supervisor, Health and Physical Education, Safety and Recreation, State Board of Education, Richmond, Va.

GEORGE A. JACOBY, Director of Personnel Services, General Motors Corp., Detroit, Mich.

JOSEPH M. KAPLAN, Secretary-Manager, Greater Los Angeles Chapter, National Safety Council, Los Angeles, Calif.

E. W. KEMPTON, Assistant Vice President, Industrial Relations, United States Steel Co., Pittsburgh, Pa.

MRS. FRED W. KNIGHT, Cartersville, Ga.

MERWYN A. KRAFT, Director, Dept. of Personnel and Accident Prevention, American Transit Assn., New York, N. Y.

FRANKLIN M. KREML, Director, Traffic Div., International Assn. of Chiefs of Police, Evanston, Ill.

WALTER G. LEGGE, President, Walter G. Legge Co., New York, N. Y.

(Board of Directors, continued)

BOYD LEWIS, Vice President and Executive Editor, *NEA Service, Inc.*, New York, N. Y.

WILLIAM H. LOWE, Treasurer, Inland Steel Co., Chicago, Ill.

E. C. MCFADDEN, Vice-President, Texas Employers' Insurance Assn., Dallas, Texas.

MISS MARION E. MARTIN, Commissioner of Labor and Industry, State of Maine, Augusta, Me.

T. M. MARTIN, President, Lion Oil Co., El Dorado, Ark.

I. W. MILLARD, Chairman of the Board, Industrial Gloves Co., Danville, Ill.

WALTER E. MONTGOMERY, Safety Director, Quebec Asbestos Mining Assn., Montreal, Quebec, Canada.

HARRY M. MOSES, President, Bituminous Coal Operators Assn., Washington, D. C.

D. E. MUMFORD, Manager of Safety, New York Central System, New York, N. Y.

GUY L. NOBLE, Managing Director, National Committee on Boys and Girls Club Work, Chicago, Ill.

HENRY E. NORTH, Vice-President, Metropolitan Life Insurance Co., San Francisco, Calif.

WESLEY I. NUNN, Manager, Advertising Dept., Standard Oil Co. (Indiana), Chicago, Ill.

CLIFTON W. PHALEN, President, Michigan Bell Telephone Co., Detroit, Mich.

HARRY L. POWELL, Manager, Manufacturers Sales, Goodyear Tire & Rubber Co., Milwaukee, Wis.

MRS. IVY BAKER PRIEST, Treasurer of the United States, Washington, D. C.

HARRY READ, Executive Assistant to the Secretary-Treasurer, Congress of Industrial Organizations, Washington, D. C.

MRS. JEAN WADE RINDLAUB, Vice-President, Batten, Barton, Durstine & Osborn, New York, N. Y.

A. V. ROHWEDER, Supervisor of Safety and Welfare, Duluth, Missabe & Iron Range Railway Co., Duluth, Minn.