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LITERATURE ABSTRACTS

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INDUSTRIAL HYGIENE FOUNDATION

MELLON INSTITUTE

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IN RE: ABRAMS November 1992

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INDUSTRIAL HYGIENE FEATURES

The evaluation of physical tasks in industry is discussed in Abst. No. 836.

Data on chronic disease in former college students are given in Abst. No. 841.

Observations on heart disease among industrial workers are presented in Abst. No. 842.

Abst. No. 864 investigates nitrogen dioxide poisoning due to metal-cutting with the oxyacetylene torch.

The radiochemical determination of metallic mercury vapor in air is described in Abst. No. 867.

A report on the toxicity of triphenyltin is given in Abst. No. 868.

Mouth-to-mouth (resuscitation) transmission of tuberculosis is reported in Abst. Nos. 837 and 838.

See Abst. No. 873 for a description of inhalation studies on chloropentafluoroethane.

Abst. No. 874 presents the prognostic aspects of benzene poisoning.

Details on twins with coal workers' pneumoconiosis are given in Abst. No. 884.

Abst. No. 896 describes a new tape reagent for the determination of hydrogen sulfide in air.

Details on the safe handling and use of ethylene oxide are given in Abst. No. 901.

An apparent association of lung and bladder cancer in cigarette smokers is reported in Abst. No. 849.

FOUNDATION FACTS

A NATIONAL HEALTH CONSERVATION PROGRAM supporting industry's needs as well will be discussed at the Foundation's 31st Annual Management Conference by outstanding speakers from several fields of management. This meeting and subsequent IHF activities are intended to help clarify national health goals and provide a better means of measuring and reporting progress in environmental and occupational health research, and in the application of its fruits in the public interest and in support of continued industrial technological development. The history of the Maurice and Laura Falk Foundation (See page 4, abstract 831, this issue) provides a model for enlightened long-term planning. A clear statement of national environmental and occupational health goals is needed as health conservation is being equilibrated with environmental cleanliness by some federal agencies—a potentially serious error in light of present knowledge. The very real problem of the nation's rising illness costs merits closer attention and study quite apart from our interest in conserving the quality of our environment. In the absence of comprehensive planning, expenditure of additional funds by Government may simply compound confusion and adversely influence scientific perspective. (31st Annual Meeting, Oct. 18-19, Chatham Center, Pittsburgh, Pa.)

STAFF ACTIVITIES: Dr. R. T. P. deTreville attended the September 9 meeting of Industrial Medical Association, Pittsburgh-Cleveland Area which was held at Mellon Institute, and also participated in the Board of Directors meeting the preceding evening. Dr. deTreville also delivered a talk on September 27 at the Fall Management Course in Safety entitled, "Toxicity of Solvents in Industry and Effects in Confined Spaces", sponsored by Western Pennsylvania Safety Council, and assisted Professor David Minard, University of Pittsburgh, Graduate School of Public Health, September 27 and 29, with lectures on "Occupational Disease Control" and "Evaluating Effectiveness of Occupational Health Programs." Dr. Paul Gross and Professor Theodore F. Hatch attended the International Congress on Occupational Health held in Vienna, Austria, September 18-24 where Dr. Gross chaired a session on Occupational Medicine. Dr. Gross also participated in an international Pneumoconiosis Round Table Discussion (at the Institute of Experimental Hygiene, Slovak Academy of Sciences, Bratislava, Czechoslovakia) by presenting to his peers in pulmonary pathology research a paper entitled, "The Alveolar Transport Mechanism."

EXECUTIVE COMMITTEE MEETING: The Foundation's Executive Committee met with the Policy and Planning Committee at IHF headquarters on September 8 to plan the Foundation's program and budget for 1967.

HONORS: Honorary membership of Past Presidents and Officers of the Executive Committee of the British Occupational Hygiene Society was bestowed on Professor Theodore F. Hatch on September 9, 1966.

THRESHOLD LIMIT VALUES FOR 1966 adopted by the American Conference of Governmental Industrial Hygienists at their 28th Annual Meeting in Pittsburgh, Pennsylvania on May 16-17, 1966 appear in this issue of the Digest.

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THRESHOLD LIMIT VALUES FOR 1966

Adopted at the 28th Annual Meeting of the American Conference of Governmental Industrial Hygienists, Pittsburgh, Pennsylvania, May 16 - 17, 1966.

The Threshold Limit Values refer to air-borne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect. Because of wide variation in individual susceptibility, exposure of an occasional individual at or even below the threshold limit may not prevent discomfort, aggravation of a pre-existing condition, or occupational illness.

Threshold limits should be used as guides in the control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations. Exceptions are the substances given in Appendix A and certain of the substances given a "C" listing. The values not given a "C" listing refer to time-weighted average concentrations for a normal workday.

The amount by which these concentrations may be exceeded for short periods without injury to health depends upon a number of factors such as the nature of the contaminant, whether very high concentrations even for short periods produce acute poisoning, whether the effects are cumulative, the frequency with which high concentrations occur, and the duration of such periods. All must be taken into consideration in arriving at a decision as to whether a hazardous situation exists. Enlightened industrial hygiene practice inclines toward controlling exposures below the limit rather than maintenance at the limit.

Threshold limits are based on the best available information from industrial experience, from experimental human and animal studies, and when possible, from a combination of the three. The basis on which the values are established may differ from substance to substance; protection against impairment of health may be the guiding factor for some, whereas reasonable freedom from irritation, narcosis, nuisance or other forms of stress may dominate the basis for others. The Committee holds to the opinion that

limits based on physical irritation should be considered no less binding than those based on physical impairment; growing bodies of evidence indicate that physical irritation may promote and accelerate physical impairment.

Documentation of Threshold Limit Values.

A separate companion piece to the TLVs is issued by ACGIH under this title. This publication gives the pertinent scientific information and data with reference to literature sources, that were used to base each limit. Each documentation also contains a statement defining the type of response against which the limit is safeguarding the worker. For a better understanding of the TLVs it is essential that the Documentation be consulted when the TLVs are being used.

Ceiling vs. Time-Weighted Average Limits.

Although the time-weighted average concentration provides the most satisfactory, practical way of monitoring air-borne agents for compliance with the limits, there are certain substances for which it is inappropriate. In the latter group are substances which are predominantly fast acting and whose threshold limit is more appropriately based on this particular response. Substances with this type of response are best controlled by a ceiling "C" limit that should not be exceeded. It is implicit in these definitions that the manner of sampling to determine compliance with the limits for each group must differ; a single brief sample, that is applicable to a "C" limit, is not appropriate to the time-weighted limit; here, a sufficient number of samples are needed to permit a time-weighted average concentration throughout a complete cycle of operations or throughout the work shift.

Whereas the ceiling limit places a definite boundary which concentrations should not be permitted to exceed, the time-weighted average limit requires an explicit limit to the excursions that are permissible above the listed values. The magnitude of these excursions may be pegged to the magnitude of the threshold limit by an appropriate factor shown in Appendix C. It should be noted that the same factors are used

by the Committee in making a judgment whether to include or exclude a substance for a "C" listing.

"Skin" Notation. Listed substances followed by the designation "Skin" refer to the potential contribution to the over-all exposure by the cutaneous route including mucous membranes and eye, either by air-borne, or more particularly, by direct contact with the substance. Vehicles can alter skin absorption. This attention-calling designation is intended to suggest appropriate measures for the prevention of cutaneous absorption so that the threshold limit is not invalidated.

Mixtures. Special consideration should be given also to the application of these values in assessing the health hazards which may be associated with exposure to mixtures of two or more substances. A brief discussion of basic considerations involved in developing threshold limit values for mixtures, and methods for their development, amplified by specific examples are given in Appendix B.

"Inert" or Nuisance Particulates. A number of dusts or particulates that occur in the working environment ordinarily produce no specific effects upon prolonged inhalation. Some insoluble substances are classed as inert (e.g. iron and steel dusts, cement, silicon carbide, titanium dioxide, cellulose); others may be soluble (starch, soluble oils, calcium carbonate) but are of such a low order of activity that in concentrations ordinarily encountered do not cause physiologic impairment; still others may be rapidly eliminated or destroyed by the body (vegetable oils, glycerine, sucrose). In the case of the insoluble substances, there may be some accumulation in the respiratory passages. In the case of the soluble substances, this accumulation will ordinarily be temporary but may interfere to some extent with respiratory processes. Hence, it is desirable to control the concentrations of such particulates in the air breathed by any individual, in keeping with good industrial hygiene practice.

A threshold limit of $15\text{mg}/\text{m}^3$, or 50 mppcf , whichever is less, is recommended for substances

RECOMMENDED VALUES (In Alphabetical Order)

Substance	ppm*	Mg. M***
Acetaldehyde	200	360
Acetic acid	10	25
Acetic anhydride	5	20
Acetone	1,000	2,400
Acetonitrile	40	70
Acetylene dichloride, see 1,2-Dichloroethylene		
Acetylene tetrabromide	1	14
Acrolein	0.1	0.25
Acrylonitrile-Skin	20	45
Aldrin-Skin	-	0.25
Allyl alcohol-Skin	2	5
Allyl chloride	1	3
Allyl glycidyl ether (AGE)	10	45
Allyl propyl disulfide	2	12
2-Aminoethanol, see Ethanolamine		
Ammonia	50	35
Ammonium sulfate (Ammate)	-	15
n-Amyl acetate	100	525
Aniline-Skin	5	19
+ Anisidine (o, p-isomers)-Skin	-	0.5
Antimony & compounds (as Sb)	-	0.5
ANTU (alpha naphthyl thiourea)	-	0.3
Arsenic & Compounds (as As)	-	0.5
Asine	-	0.2
Barium (soluble compounds)	0.05	0.5
Benzene (benzol)-Skin	25	80
Benzidine-Skin	-	Al
p-Benzquinone, see Quinone		
+ Benzoyl peroxide	-	5
Benzyl chloride	1	5
Beryllium	-	0.002
† Biphenyl, see Diphenyl		
Boron oxide	-	15
C Boron trifluoride	1	3
Bromine	0.1	0.7
Butadiene (1,3-butadiene)	1,000	2,200
Butanethiol, see Butyl mercaptan		
2-Butanone	200	590
2-Butoxy ethanol (Butyl Cellosolve)-Skin	50	240
† Butyl acetate (n-butyl acetate)	-	-
Butyl alcohol	100	300
tert. Butyl alcohol	100	300
C Butylamine-Skin	5	15
C tert. Butyl chromate (as CrO ₃)-Skin	-	0.1
n-Butyl glycidyl ether (BGE)	50	270
Butyl mercaptan	10	35

* Parts of vapor or gas per million parts of air plus vapor by volume at 25°C and 760 mm. Hg pressure.
 ** Approximate milligrams of particulate per cubic meter of air.

A Numbers, See Appendix A

† 1966 Addition

† See Tentative Limits

adversely to increase the toxic response of a substance. Although most threshold limits have built-in safety factors to guard against adverse effects of moderate deviations from normal environments, the safety factors of most substances are not of such a magnitude as to take care of gross deviations. For example, continuous work at temperatures above 90°F or over-time, extending the work-week more than 50%, might be considered gross deviations. In such instances judgment must be exercised in the proper adjustments of the threshold limit values.

These values are reviewed annually by the Committee on Threshold Limits for revision or additions, as further information becomes available.

"Notice of Intent" At the beginning of each year, proposed actions of the Committee for the forthcoming year are issued in the form of a "Notice of Intent." This Notice provides not only an opportunity for comment, but solicits suggestions of substances to be added to the list. The suggestions should be accompanied by substantiating evidence for a tentative limit.

As Legislative Code. The Conference does not consider the Threshold Limit Values appropriate matter for adoption in legislative codes and regulations and recommends against such use. If, however, the list is so used, the intent of the concepts contained in the Preface should be maintained and provisions should be made to keep the list current.

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ces in these categories and for which no specific threshold limits have been assigned. This limit, for a normal work day, does not apply to brief exposures at higher concentrations. Neither does it apply to those substances which may cause physiologic impairment at lower concentrations but for which a threshold limit has not yet been adopted. Some "inert" particulates are given in Appendix D.

Simple Asphyxiants-"Inert" Gases or Vapors.

A number of gases and vapors, when present in high concentrations in air, act primarily as simple asphyxiants without other significant physiologic effects. A TLV may not be recommended for each simple asphyxiant because the limiting factor is the available oxygen. The minimal oxygen content should be 18 percent by volume under normal atmospheric pressure (equivalent to a partial pressure, pO₂, of 135 mm Hg). Atmospheres deficient in O₂ do not provide adequate warning and most simple asphyxiants are odorless. Several simple asphyxiants are listed in Appendix E. Some asphyxiants present an explosion hazard. Account should be taken of this factor in limiting the concentration of the asphyxiant.

These limits are intended for use in the field of industrial hygiene and should be interpreted and applied only by persons trained in this field. They are not intended for use, or for modification for use, (1) as a relative index of toxicity, by making a ratio of two limits, (2) in the evaluation or control of community air pollution or air pollution nuisances, (3) in estimating the toxic potential of continuous uninterrupted exposures, (4) as proof or disproof of an existing disease or physical condition, or (5) for adoption by countries whose working conditions differ from those in the U.S.

Physical Factors. It is recognized that such physical factors as heat, ultraviolet and ionizing radiation, humidity, abnormal pressure and the like may place added stress on the body so that the effects from exposure at a threshold limit may be altered. Most of these stresses act

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Substance	ppm*	Mg/M ¹⁰⁰	Substance	ppm*	Mg/M ¹⁰⁰	Substance	ppm*	Mg/M ¹⁰⁰
p-tert. Butyltoluene	10	60	C o-Dichlorobenzene	50	300	TC Ethylbenzene	—	—
Cadmium oxide fume	—	0.1	p-Dichlorobenzene	75	450	Ethyl bromide	200	890
Calcium arsenate	—	1	Dichlorodifluoromethane	1,000	4,950	Ethyl chloride	1,000	2,600
Calcium oxide	—	5	+ 1,3-Dichloro-5,5-dimethyl hydantoin	—	0.2	Ethyl ether	400	1,200
Camphor	—	2	1,1-Dichloroethane	100	400	Ethyl mercaptan	100	300
+ Carbaryl (Sevin) (R)	—	5	1,2-Dichloroethane	50	200	TC Ethyl silicate	—	—
Carbon dioxide	5,000	9,000	1,2-Dichloroethylene	200	790	Ethylene chlorohydrin-Skin	100	850
Carbon disulfide-Skin	20	60	C Dichloroethyl ether-Skin	15	90	Ethylenediamine	5	16
Carbon monoxide	—	—	Dichloromethane, see Methylenechloride	—	—	Ethylene dibromide, see 1,2-Dibromo-	10	25
Carbon tetrachloride-Skin	10	65	Dichloromono-fluoromethane	1,000	4,200	Ethylene dichloride, see 1,2-Dichloro-	—	—
Chlordane-Skin	—	0.5	C 1,1-Dichloro-1-nitroethane	10	60	ethane	0.2	1.2
Chlorinated camphene, Skin	—	0.5	1,2-Dichloropropane, see Propylene-	—	—	Ethylene glycol dinitrate-Skin	—	—
Chlorinated diphenyl oxide	—	0.5	chloride	—	—	Ethylene glycol monomethyl ether acetate,	—	—
Chlorine	—	—	Dichlorotetrafluoroethane	1,000	7,000	see Methyl cellosolve acetate	—	—
Chlorine dioxide	0.1	0.3	Dieldrin-Skin	25	75	Ethylene imine-Skin	—	—
Chlorine trifluoride	0.1	0.4	Diethylamine	100	860	Ethylene oxide	50	90
Chloroacetaldehyde	1	3	Diethylether, see Ethyl ether	—	—	Ethylidene chloride, see 1,1-Dichloro-	—	—
Chlorobenzene (monochlorobenzene)	75	350	Difluorodibromomethane	0.5	2.8	ethane	—	—
Chlorobromomethane	200	1,050	C Diglycidyl ether (DGE)	50	290	Ferban	—	15
2-Chloro-1,3-butadiene, see Chloroprene	—	—	Dihydroxybenzene, see Hydroquinone	10	35	Ferrocenium dust	—	1
Chlorodiphenyl (42% chlorine)-Skin	—	0.5	Diisobutyl ketone	10	18	Fluoride (as F)	—	2.5
Chlorodiphenyl (54% chlorine)-Skin	—	—	Dimethoxymethane, see Methylal	5	25	Fluorine	0.1	0.2
1-Chloro-2,3-epoxypropane, see	—	—	Dimethyl acetamide-Skin	—	—	Fluorotrichloromethane	1,000	5,600
Epichlorohydrin	—	—	Dimethylamine	10	30	Freon 11, see Fluorotrichloromethane	5	6
2-Chloroethanol, see Ethylene	—	—	Dimethylaminobenzene, see Xylidene	—	—	Freon 12, see Dichlorodifluoromethane	—	—
chlorohydrin	—	—	Dimethylaniline (N-dimethylaniline)-Skin	—	—	Freon 13B1, see Trifluoromono-	—	—
Chloroethylene, see Vinyl chloride	—	—	Dimethylbenzene, see Xylene	—	—	methane	—	—
Chloroform (trichloromethane)	50	240	+ Dimethyl 1,2-dibromo-2,2-dichloroethyl	—	—	Freon 21, see Dichloromono-	—	—
1-Chloro-1-nitropropane	20	100	phosphate, (Dibrom) (R)	—	3	methane	—	—
Chloropicrin	0.1	0.7	+ Dimethylformamide-Skin	10	30	Freon 112, see 1,1,2,2-Tetrachloro-1,2-	—	—
Chloroprene (2-chloro-1,3-butadiene)-Skin	25	90	2,6 Dimethylheptanone, see Diisobutyl	—	—	difluoroethane	—	—
Chromic acid and chromates (as CrO3)	—	0.1	ketone	0.5	1	Freon 113, see 1,1,2-Trichloro, 1,2-	—	—
Cobalt	—	—	1,1-Dimethylhydrazine-Skin	1	5	trifluoroethane	—	—
Copper fume	—	0.1	Dimethylsulfate - Skin	—	—	Freon 114, see Dichlorotetrafluoro-	—	—
Dusts and Mists	—	1.0	Dinitrobenzene (all isomers)-Skin	—	0.2	ethane	—	—
+ Cotton dust (raw)	—	1	Dinitro-o-cresol-Skin	100	360	Furfural-Skin	5	20
Crag (R) herbicide	—	15	Dinitrotoluene-Skin	100	600	Furfuryl alcohol	50	200
Cresol (all isomers)-Skin	5	22	Dioxane (Diethylene dioxide)-Skin	—	—	Gasoline	—	46
Cyanide (as CN)-Skin	—	5	Dipropylene glycol methyl ether-Skin	—	—	Glycidol (2,3-Epoxy-1-propanol)	50	150
Cyclohexane	50	200	+ Di-sec. octyl phthalate (Di-2-ethylhexyl-	—	—	Glycol monoethyl ether, see 2-Ethoxy-	—	—
Cyclohexanol	50	200	phthalate	—	—	ethanol	—	—
Cyclohexanone	75	200	Endrin-Skin	—	—	† Guthion, see Azinphosmethyl	—	—
+ Cyclopentadiene	—	10	EPN-Skin	3	6	Hafnium	—	0.5
2,4-D	—	1	1,2-Epoxypropane, see Propyleneoxide	200	740	Heptachlor-Skin	500	2,000
DDT-Skin	—	1	2,3-Epoxy-1-propanol see Glycidol	100	540	Heptane (n-heptane)	1	10
DDVP-Skin	—	0.05	Ethanethiol, see Ethylmercaptan	400	1,400	Hexachloroethane-Skin	500	1,800
Decaborane-Skin	—	0.3	2 Ethanolamine	25	100	Hexane (n-hexane)	100	410
Demeton (R)-Skin	—	0.1	2 Ethoxyethanol-Skin	1,000	1,900	Hexone	100	410
Diacetone alcohol (4-hydroxy-4-methyl-2-	—	—	-Skin	—	—	sec-Hexyl acetate	50	295
pentanone)	50	240	Ethyl acetate	—	—	Hydrazine-Skin	1	1.3
1,2-Diaminoethane, see Ethylenediamine	0.1	0.1	Ethyl acrylate-Skin	—	—	Hydrogen bromide	3	10
Diborane	—	—	Ethyl alcohol (ethanol)	—	—			
† 1,2-Dibromoethane (ethylene dibromide)-	—	—	† Ethylamine	—	—			

† See Tentative Limits

+ 1966 Addition

† See Tentative Limits

Substance	ppm*	Mg/M ¹⁰⁰	Substance	ppm*	Mg/M ¹⁰⁰	Substance	ppm*	Mg/M ¹⁰⁰
C Hydrogen chloride	5	7	+ Methyl methacrylate	100	410	Phosphorus (yellow)	—	0.1
Hydrogen cyanide-Skin	10	11	Methyl propyl ketone, see 2-Pentanone	100	480	Phosphorus pentachloride	—	1
Hydrogen fluoride	3	2	C Methyl styrene	0.02	0.2	Phosphorus pentasulfide	—	1
Hydrogen peroxide, 90%	1	1.4	C Methylene bisphenyl isocyanate (MDI)	500	1,740	Phosphorus trichloride	0.5	3
Hydrogen selenide	0.05	0.2	Methylene chloride (dichloromethane)	—	5	+ Phthalic anhydride	2	12
+ Hydrogen sulfide	10	15	Molybdenum (soluble compounds)	—	15	Picric acid-Skin	—	0.1
Hydroquinone	0.1	1	(insoluble compounds)	—	15	Platinum (Soluble Salts)	—	0.002
C Iodine	—	—	Monomethyl aniline-Skin	2	9	Polytetrafluoroethylene decomposition products	—	A ⁴
Iron oxide fume	—	—	Morpholine-Skin	20	70	Propane	1,000	1,800
Isoamyl alcohol	100	360	Naphtha (coal tar)	200	800	+ Propyne, see Methylacetylene	—	A ⁵
Isophorone	25	140	Naphtha (petroleum)	500	2,000	β-Propiolactone	200	840
Isopropyl alcohol	400	980	+ Naphthalene	10	50	n-Propyl acetate	25	110
Isopropylamine	5	12	β-Naphthylamine	—	A ⁴	n-Propyl nitrate	75	350
Isopropylether	500	2,100	Nickel carbonyl	0.001	0.007	Propylene dichloride	—	—
Isopropyl glycidyl ether (IGE)	50	240	+ Nickel, metal and soluble compounds	—	1	Propylene imine-Skin	100	240
Ketene	0.5	0.9	Nicotine-Skin	2	5	Propylene oxide	—	—
Lead	—	—	Nitric acid	1	6	Pyrethrum	—	5
Lead arsenate	—	0.15	p-Nitroaniline-Skin	1	5	Pyridine	5	15
Lindane-Skin	—	0.5	Nitrobenzene-Skin	1	1	Quinone	0.1	0.4
Lithium hydride	—	0.025	+ p-Nitrochloro-benzene-Skin	100	310	Rotenone (commercial)	—	5
+ L.P.G. (Liquified petroleum gas)	1,000	1,800	C Nitroethane	5	9	+ Selenium compounds (as Se)	—	0.2
Magnesium oxide fume	—	15	+ Nitrogen dioxide	10	29	+ Silver, metal and soluble compounds	—	0.01
Malathion-Skin	—	15	C Nitrogen trifluoride	0.2	2	Sodium fluoroacetate (1080) - Skin	—	0.05
Manganese	—	5	Nitromethane	25	90	Sodium hydroxide	—	2
Mercury-Skin	—	0.1	1-Nitropropane	25	90	Stibine	0.1	0.5
Mercury (organic compounds)-Skin	—	0.01	2-Nitropropane	—	—	Stoddard solvent	500	2,900
Mesityl oxide	25	100	N-Nitrosodimethyl-amine (Di-methyl-nitrosoamine)-Skin	—	A ³	Styrene	—	0.15
Methanethiol, see Methyl mercaptan	—	—	Nitrobenzene-Skin	5	30	Styrene monomer (phenylethylene)	100	420
Methoxychlor	—	15	Nitrochloromethane, see Chloropicrin	—	—	Sulfur dioxide	5	13
2-Methoxyethanol, see Methyl cellosolve	—	—	Octane	500	2,350	Sulfur hexafluoride	1,000	6,000
Methyl acetate	200	610	Oil mist (mineral)	—	5	Sulfuric acid	—	1
Methyl acetylene (propyne)	1,000	1,650	Osmium tetroxide	—	0.002	Sulfur monochloride	1	6
+ Methyl acetylene-propadiene mixture (MAPP)	1,000	1,800	Ozone	0.05	0.1	Sulfur pentafluoride	0.025	0.25
Methyl acrylate-Skin	10	35	+ Oxygen difluoride	0.1	0.2	Sulfuryl fluoride	5	20
Methylal (dimethoxymethane)	1,000	3,100	Parathion-Skin	—	0.1	Systox, see Demeton	—	10
Methyl alcohol (methanol)	200	260	Pentaborane	—	0.005	Tantalum	—	5
Methyl amyl alcohol, see Methyl isobutyl carbinol	—	—	Pentachloronaphthalene-Skin	—	0.01	TEDP - Skin	—	A ⁴
C Methyl bromide-Skin	20	80	Pentachlorophenol-Skin	—	0.5	Teflon (R) decomposition products	—	0.1
Methyl butyl ketone, see 2-Hexanone	25	80	Pentane	1,000	2,950	TEPP - Skin	—	0.05
Methyl cellosolve-Skin	25	120	2-Pentanone	200	700	+ 1,1,1,2-Tetrachloro-2,2-difluoroethane	500	4,170
Methyl cellosolve acetate-Skin	100	210	Perchloroethylene	100	670	1,1,2,2-Tetrachloro-1,2-difluoroethane	500	4,170
Methyl chloride	350	1,900	Perchloromethyl mercaptan	0.1	0.8	1,1,2,2-Tetrachloroethane-Skin	5	35
Methyl chloroform	500	2,000	Perchloryl fluoride	3	13.5	Tetrachloroethylene, see Perchloroethylene	—	—
Methylcyclohexane	100	470	Phenol-Skin	—	0.1	Tetrachloromethane, see Carbon tetrachloride	—	—
Methylcyclohexanol	100	460	+ p-Phenylene diamine-Skin	50	310	Tetraethyl lead (as Pb) - Skin	200	590
o-Methylcyclohexanone-Skin	100	250	Phenylacetylene, see Styrene	—	22	Tetrahydrofuran	1	8
Methyl ethyl ketone (MEK), see 2-Butanone	100	250	Phenyl glycidyl ether (PGE)	—	0.1	Tetranitromethane	—	—
Methyl formalde	25	100	Phenylhydrazine-Skin	0.1	0.4	Tetlyl (2,4,6-trinitrophenyl)methylinitramine) - Skin	—	1.5
Methyl isobutyl carbinol-Skin	10	20	Phosgene (Mevingphos) (R)-Skin	—	0.3			
Methyl isobutyl ketone, see Hexone	—	—	Phosphine	—	0.4			
+ Methyl mercaptan	—	—	Phosphoric acid	—	1			

+ 1966 Addition

† See Tentative Limits

+ 1966 Addition

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Substance ppm* Mg M***

Thallium (soluble compounds) - Skin	-	0.1
Thiam	-	5
Tin (inorganic cmpds, except oxide)	-	2
Tin (organic cmpds)	-	0.1
Titanium dioxide	-	15
Toluene (toluol)	200	750
C Toluene-2, 4-disocyanate	0.02	0.14
o-Toluidine - Skin	5	22
Toxaphene, see Chlorinated Camphene		
1,1,1-Trichloroethane, see Methyl chloroform		
Trichloroethylene	100	535
Trichloromethane, see Chloroform		
Trichloronaphthalene - Skin	-	5
1,2,3-Trichloropropane	50	300
1,1,2 Trichloro 1,2,2-trifluoroethane	1,000	7,600
Triethylamine	25	100
Trifluoromethanethane	1,000	6,100
2,4,6-Trinitrophenol see Picric acid		
2,4,6-Trinitrophenyl/methylnitramine, see Tettyl		
Trinitrotoluene - Skin	-	1.5
Triorthocresyl phosphate	-	0.1
Triphenyl phosphate	-	3
Turpentine	100	560
Uranium (soluble compounds)	-	0.05
Uranium (insoluble compounds)	-	0.25
C Vanadium (V2O5 dust)	-	0.1
Vanadium (V4O5 fume)	-	0.1
Vinyl benzene, see Styrene		
C Vinyl chloride	500	1,300
Vinylcyanide, see Acrylonitrile		
Vinyl toluene	100	480
Walrafen	-	0.1
Xylene (xylol)	-	0.1
Xylidine - Skin	5	25
+ Yttrium	-	1
Zinc oxide fume	-	5
Zirconium compounds (as Zr)	-	5

Radioactivity: For permissible concentrations of radioisotopes in air, see U.S. Department of Commerce, National Bureau of Standards, Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," June 5, 1959. Also see U.S. Department of Commerce National Bureau of Standards Handbook 59, "Permissible Dose from External Sources of Ionizing Radiation," September 24, 1954, and addendum of April 15, 1958.

* Parts of vapor or gas per million parts of air plus vapor by volume at 25°C and 760 mm. Hg pressure.

** Approximate milligrams of particulate per cubic meter of air.

A Numbers, See Appendix A

† See Tentative Limits

RESPIRABLE DUSTS EVALUATED BY COUNT

Substance	m. p. c. f.*
SILICA	
Crystalline	
Quartz, Threshold Limit calculated from the formula	250 **
Cristobalite	**
Amorphous, including natural diatomaceous earth	20

SILICATES (less than 1% crystalline silica)	
Asbestos	5
Mica	20
Soapstone	20
Talc	20
Portland Cement	50
GRAPHITE (natural)	15
"Inert" or Nuisance Particulates	50 (or 15 mg m ⁻³ whichever is the smaller)
see Appendix D	

Conversion factors
mppct x 35.3 = million particles per cubic meter
= particles per c. c.

TENTATIVE VALUES

These substances, with their corresponding tentative limits, comprise those for which a limit has been assigned for the first time or for which a change in the 'Recommended' listing has been made. In both cases, the assigned limits should be considered trial values that will remain in the tentative listing for a period of at least two years, during which time definitive evidence and experience is sought. If acceptable at the end of two years, these substances and values will be moved to the RECOMMENDED list. Documentation for tentative values are available for each of these substances.

Substance	ppm*	Mg M***
Acrylamide - Skin	-	0.3
2-Aminopyridine	0.5	2
sec-Amyl acetate	125	650
Azinphos-methyl-Skin	-	0.2
Bromoform-Skin	0.5	5
n-Butyl acetate	150	710
sec-Butyl acetate	200	950
tert-Butyl acetate	200	950
sec-Butyl alcohol	150	450
Cadmium (Metal dust and soluble salts)	-	0.2
Carbon black	-	3.5
Carbon monoxide	50	55
†† α-Chloroacetophenone (phenacetylchloride)	0.05	0.3
†† α-Chlorobenzylidene malononitrile (OCBM)	0.05	0.4
C Chlorine	1	3
†† Chromium, sol. chromic, chromous salts, as Cr	-	0.5
Metallic & insol. salts	-	1
Coal tar pitch volatiles (benzene soluble fraction) (anthracene, BaP, phenanthrene, acridine, chrysene, pyrene)	-	0.2
†† Cobalt, Metal fume & dust	-	0.1
Crotonaldehyde	2	6
Cumene - Skin	50	245
Cyclohexane	300	1,050
Cyclohexene	300	1,015
Diazomethane	0.2	0.4
C 1,2-Dibromo-ethane-Skin	25	190
† Dibutyl phosphate	1	5
† Dibutylphthalate	1	5
Diethylamino ethanol-Skin	10	50
†† Diisopropylamine-Skin	5	20

* Parts of vapor or gas per million parts of air plus vapor by volume at 25°C and 760 mm. Hg pressure.

** Approximate milligrams of particulate per cubic meter of air.

† 1966 Revision

†† 1966 Additions

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Appendix A

Substance	ppm*	Mg/M***
++ Dimethylphthalate	0.2	5.
++ Diphenyl	10.	1.
Ethylamine	18.	18.
Ethyl sec-aryl ketone (5-methyl-3-heptanone)	25.	130.
Ethyl benzene	100.	435.
Ethyl butyl ketone (3-Heptanone)	50.	230.
+ C Ethylene glycol dinitrate &/or nitroglycerin-Skin	0.02 †	0.1 †
Ethylene imine-Skin	0.5	1.
C Ethyl mercaptan	10.	25.
N-Ethylmorpholine-Skin	20.	94.
Fibrous glass	5.	5.
Formic acid	5.	9.
++ Gasoline	50.	300.
sec-Hexyl acetate	—	0.2
++ Hexachloronaphthalene - Skin	—	10.
Iron oxide fume	100.	525.
Isoamyl acetate	150.	700.
++ Isobutyl alcohol	100.	300.
Isopropyl acetate	250.	950.
+ Maleic anhydride	0.25	1.
Methylamine	10.	12.
Methyl (n-aryl) ketone (2-Heptanone)	100.	465.
Methyl iodide - Skin	5.	28.
Methyl isocyanate - Skin	0.02	0.05
C Monomethyl hydrazine - Skin	0.2	0.35
Naphtha (coal tar)	100.	400.
++ Nitric oxide	25.	30.
++ Octachloronaphthalene - Skin	—	0.1
Oxalic acid	—	1.
Parquat - Skin	—	0.5
Phenyl ether (vapor)	1.	7.
Phenyl ether-Biphenyl mixture (vapor)	1.	7.
Phenyl glycidyl ether (PGE)	10.	62.
+ Pival (2-Pivalyl-1,3-indandione)	—	0.1
++ Propyl alcohol	200.	450.
Propylene imine - Skin	2.	5.
Rhodium, Metal fume and dusts	—	0.1
Soluble salts	—	0.001
Ronnel	—	15.
Selenium hexafluoride	0.05	0.4
Tellurium hexafluoride	0.02	0.2
+C Terphenyls	1.	9.4
++ Tetrachloronaphthalene - Skin	—	2.
Tetramethyl lead (TML) (as lead) - Skin	—	0.075
Tetramethyl succinonitrile - Skin	—	3.
Tremolite	0.5	5 mppcf
Tributyl phosphate	10.	45.
++ 1,1,2-Trichloroethane - Skin	100.	435.
Xylene	—	1.
++ Zinc chloride	—	—

+ 1966 Revision

++ 1966 Additions

† For intermittent exposure only

be considered as additive. That is, if the sum of the following fractions,

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_n}{T_n}$$

exceeds unity, then the threshold limit of the mixture should be considered as being exceeded. C_1 indicates the observed atmospheric concentration, and T_1 the corresponding threshold limit, (See Example 1A.a.).

Exceptions to the above rule may be made when there is good reason to believe that the chief effects of the different harmful substances are not in fact additive, but independent as when purely local effects on different organs of the body are produced by the various components of the mixture. In such cases the threshold limit ordinarily is exceeded only when at least one member of the series $\frac{C_1}{T_1}$ or $\frac{C_2}{T_2}$ etc.) itself has a value exceeding unity, (See Example 1A.b.)

Antagonistic action or potentiation may occur with some combinations of atmospheric contaminants. Such cases at present must be determined individually. Potentiating or antagonistic agents are not necessarily harmful by themselves. Potentiating effects of exposure to such agents by routes other than that of inhalation is also possible, e.g. imbibed alcohol and inhaled narcotic (trichloroethylene). Potentiation is characteristically exhibited at high concentrations, less probably at low.

When a given operation or process characteristically emits a number of harmful dusts, fumes, vapors or gases, it will frequently be only feasible to attempt to evaluate the hazard by measurement of a single substance. In such cases, the threshold limit used for this substance should be reduced by a suitable factor, the magnitude of which will depend on the number, toxicity and relative quantity of the other contaminants ordinarily present.

Examples of processes which are typically associated with two or more harmful atmospheric contaminants are welding, automobile repair, blasting, painting, lacquering, certain foundry operations, diesel exhausts, etc. (Example 2.)

A¹ Benzidine Because of high incidence of bladder tumors in man, any exposure, including skin, is extremely hazardous.

A² β-Naphthylamine. Because of the extremely high incidence of bladder tumors in workers handling this compound and the inability to control exposures, β-naphthylamine has been prohibited from manufacture, use and other activities that involve human contact by the State of Pennsylvania.

A³ N-Nitrosodimethylamine Because of extremely high toxicity and presumed carcinogenic potential of this compound, contact by any route should not be permitted.

A⁴ Polytetrafluoroethylene* decomposition products. Thermal decomposition of the fluorocarbon chain in air leads to the formation of oxidized products containing carbon, fluorine and oxygen. Because these products decompose by hydrolysis in alkaline solution, they can be quantitatively determined in air as fluoride to provide an index of exposure. No TLV is recommended pending determination of the toxicity of the products, but air concentrations should be minimal.

A⁵ β-Propiolactone Because of high acute toxicity and demonstrated skin tumor production in animals, contact by any route should be avoided.

A⁶ Gasoline. The composition of gasoline varies greatly and thus a single TLV for all types of gasoline is no longer applicable. In general, the aromatic hydrocarbon content will determine what TLV applies. Consequently the content of benzene, other aromatics and additives should be determined to arrive at the appropriate TLV (Elkins, et al. A.I.H.A.J. 24, 99, 1963).

* Trade Names: Algiflon, Fluon, Halon, Teflon, Tetran

Appendix B

B.1 THRESHOLD LIMIT VALUES FOR

MIXTURES

When two or more hazardous substances are present, their combined effect, rather than that of either individually, should be given primary consideration. In the absence of information to the contrary, the effects of the different hazards should

THRESHOLD LIMIT VALUES FOR MIXTURES EXAMPLES

1A. General case, where air is analyzed for each component.

a. ADDITIVE EFFECTS

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_3}{T_3} + \dots + \frac{C_N}{T_N} = 1$$

Air contains 5 ppm of carbon tetrachloride (TLV, 10), 20 ppm of ethylene dichloride (TLV, 50) and 10 ppm of ethylene dibromide, (TLV, 25).

$$\frac{5}{10} + \frac{20}{50} + \frac{10}{25} = \frac{65}{50} = 1.3$$

Threshold limit is exceeded.

b. INDEPENDENT EFFECTS

Air contains 0.15 mg/m³ of lead (TLV, 0.2) and 0.7 mg/m³ of sulfuric acid (TLV, 1).

$$\frac{0.15}{0.20} = 0.75; \quad \frac{0.7}{1} = 0.7$$

Threshold limit is not exceeded.

1B. Special case when source of contaminant is a mixture and atmospheric composition is assumed similar to that of original material, i.e. vapor pressure of each component is the same at the observed temperature.

a. ADDITIVE EFFECTS, approximate solution.

1. A mixture of equal parts (1) trichloroethylene (TLV, 100), and (2) methyl chloroform (TLV, 350).

$$\frac{C_1}{100} + \frac{C_2}{350} = \frac{C_m}{T_m}$$

Solution applicable to "spot" solvent mixture usage, where all or nearly all, solvent evaporates.

$$C_1 = C_2 = \frac{1}{2} C_m$$

$$\frac{C_1}{100} + \frac{C_1}{350} = \frac{2C_1}{T_m}$$

$$\frac{7C_1 + 2C_1}{700} = \frac{2C_1}{T_m}$$

$$T_m = 700 \times \frac{2}{9} = 155 \text{ ppm}$$

1B. b. General Exact Solution for Mixtures of N Components With Additive Effects and Different Vapor Pressures.

$$(1) \frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_N}{T_N} = 1;$$

$$(2) C_1 + C_2 + \dots + C_N = T;$$

$$(2.1) \frac{C_1}{T} + \frac{C_2}{T} + \dots + \frac{C_N}{T} = 1.$$

By the Law of Partial Pressures,

$$(3) C_1 = ap_1.$$

And by Raoult's Law,

$$(4) p_1 = F_1 p_1^o.$$

Combine (3) and (4) to obtain

$$(5) C_1 = aF_1 p_1^o.$$

Combining (1), (2, 1) and (5), we obtain

$$(6) \frac{F_1 p_1^o}{T_1} + \frac{F_2 p_2^o}{T_2} + \dots + \frac{F_N p_N^o}{T_N} = 1$$

$$\frac{F_1 p_1^o}{T_1} + \frac{F_2 p_2^o}{T_2} + \dots + \frac{F_N p_N^o}{T_N}$$

and solving for T,

$$(6.1) T = \frac{F_1 p_1^o + F_2 p_2^o + \dots + F_N p_N^o}{\frac{F_1 p_1^o}{T_1} + \frac{F_2 p_2^o}{T_2} + \dots + \frac{F_N p_N^o}{T_N}}$$

$$\text{or } \sum_{i=1}^n \frac{F_i p_i^o}{T_i} = n$$

$$\text{or } \sum_{i=1}^n \frac{F_i p_i^o}{T_i} = 1$$

$$(6.2) T = \frac{1}{\sum_{i=1}^n \frac{F_i p_i^o}{T_i}}$$

T = Threshold Limit Value in ppm.

C = Vapor concentration in ppm.

p = Vapor pressure of component in solution.

p^o = Vapor pressure of pure component.
F = Mol fraction of component in solution.

a = A constant of proportionality. Subscripts 1, 2, . . . n relate the above quantities to components 1, 2, . . . n, respectively. Subscript i refers to an arbitrary component from 1 to n. Absence of subscript relates the quantity to the mixture.

Solution to be applied when there is a reservoir of the solvent mixture whose composition does not change appreciably by evaporation.

Exact Arithmetic Solution of Specific Mixture

Mol. wt.	Density	T ^o at 25°C	Mol fraction in half-and-half solution by volume	
Trichloroethylene (1)	131.4	1.46 g/ml	100	73mm Hg 0.527
Methylchloroform (2)	133.42	1.33 g/ml	350	125mm Hg 0.473

Trichloroethylene (1) 131.4 1.46 g/ml 100 73mm Hg 0.527

Methylchloroform (2) 133.42 1.33 g/ml 350 125mm Hg 0.473

$$F_1 p_1^o = (0.527) (73) = 38.2$$

$$F_2 p_2^o = (0.473) (125) = 59.2$$

$$T = \frac{38.2 + 59.2}{\frac{38.2}{100} + \frac{59.2}{350}} = \frac{(97.4) (350)}{133.8 + 59.2} = \frac{(97.4) (350)}{193.0} = 177$$

T = 177 ppm (Note difference in T, L, V, when account is taken of vapor pressure and mol fraction in comparison with above example where such account is not taken).

2. A mixture of one part of (1) parathion (TLV, 0.1) and two parts of (2) EPN (TLV, 0.5).

Appendix C

BASES FOR ASSIGNING LIMITING "C" VALUES

By definition in the Preface, a listed value bearing a "C" designation refers to 'ceiling' value that should not be exceeded; all values should fluctuate below the listed value. In general the bases for assigning or not assigning a "C" value rest on whether excursions of concentration above a proposed limit for periods up to 15 minutes may result in a) intolerable irritation, b) chronic, or irreversible tissue change, or c) narcosis of sufficient degree to increase accident proneness, impair self rescue or materially reduce work efficiency.

In order for the Committee to decide whether a substance is a candidate for a "C" listing, some guidelines must be formulated on the permissive fluctuation above the limit in terms of the seriousness of the response in the categories a, b, c, given above. For this the factors given in the table below have been used by the Committee. For both technical and practical reasons, the factors have been pegged to the concentration in an inverse manner. It will be noted that as the magnitude of the T. L. V. increases a correspondingly decreased range of fluctuation is permitted; not to decrease the factor for T. L. V. s of increasing magnitude would permit exposures to large absolute quantities, an undesirable condition, a condition that is minimized at low T. L. V. s. Moreover, larger factors at the lower T. L. V. s are consistent with the difficulties in analyzing and controlling trace quantities.

For another mixture of 25% quartz 25% amorphous silica and 50% talc:

$$TLV = \frac{1}{\frac{0.25}{2.5} + \frac{0.25}{20} + \frac{0.5}{20}} = 7.3 \text{ mppcf}$$

The limit for 25% quartz approximates 8 mppcf.

$$\frac{C_1 + C_2}{0.1 \quad 0.5} = \frac{C_m}{T_m} \quad C_2 = 2C_1$$

$$C_m = 3C_1$$

$$\frac{C_1 + 2C_1}{0.1 \quad 0.5} = \frac{3C_1}{T_m}$$

$$\frac{3C_1}{0.5} = \frac{3C_1}{T_m}$$

$$T_m = \frac{1.5}{7} = 0.21 \text{ mg/m}^3$$

1C. T. L. V. for Mixtures of Mineral Dusts.

For mixtures of biologically active mineral dusts the general formula for mixtures may be used. With the exception of asbestos, pure minerals are assigned TLV of 2.5, 20 or 50.

For a mixture containing 80% talc and 20% quartz, the TLV for 100% of the mixture "C" is given by:

$$TLV = \frac{1}{\frac{0.8}{20} + \frac{0.2}{2.5}} = 8.4 \text{ mppcf}$$

Essentially the same result will be obtained if the limit of the more (most) toxic component is used provided the effects are additive. In the above example the limit for 20% quartz is 10 mppcf.

T.L.V. RANGE ppm* or mg/m ³	Test T.L.V. Factor	Examples
10 + to 100	1.5	Methyl styrene-T. L. V. 100 if encountered at levels of 150 ppm will prove intensely irritating. "C" listing recommended on category a.
100 + to 1000	1.25	Methyl chloroform-T. L. V. 350ppm, at 438 ppm for periods not exceeding 15 minutes is not expected to result in untoward effects relating to category c. No "C" listing recommended.

* Whichever unit is applicable

PERMISSIBLE EXCURSIONS FOR TIME-WEIGHTED AVERAGE (TWA) LIMITS

As stated in the preface, the same factors may be used as guides for reasonable excursions above the limit for substances to which the time-weighted average applies. The time-weighted average implies that each excursion above the limit is compensated by a comparable excursion below the limit. Thus, a value of 6-ppm HF is permissible for periods not exceeding 15 minutes, provided an equivalent decrease below the limit of 3-ppm obtains.

Appendix D

Some "Inert" or Nuisance Particulates*

Alundum (Al ₂ O ₃)	Limestone
Calcium carbonate	Magnesite
Cellulose	Marble
Portland Cement	Plaster of Paris
Corundum (Al ₂ O ₃)	Rouge
Emery	Silicon Carbide
Glycerine Mist	Starch
Graphite (synthetic)	Sucrose
Gypsum	Tin Oxide
Vegetable oil mists (except castor, cashew nut, or similar irritant oils)	Titanium Dioxide

*When toxic impurities are not present.

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Appendix E

Some Simple Asphyxiants - "Inert" Gases and Vapors.

Acetylene	Hydrogen
Argon	Methane
Ethane	Neon
Ethylene	Nitrogen
Helium	Nitrous Oxide

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Single Copies - 30 cents

The 2nd edition of the Documentation of Threshold Limit Values, rewritten and greatly enlarged to include the approximately 400 substances in the list, is available and may be purchased from the Secretary-Treasurer. The Documentation should be consulted when using the Threshold Limit Values herein.

E. J. Baier	Harold N. MacFarland, Ph.D., Consultant
Allan L. Coleman	E. Mastromatteo, M.D.
Hervey B. Elkins, Ph.D.	Russel G. Scovill
W. G. Fredrick, Ph.D.	Ralph G. Smith, Ph.D.
Bernard Grabois, P.E.	George W. Wright, M.D.
Paul Gross, M.D.	Consultant
Wayland J. Hayes, Jr. M.D.	Mitchell R. Zavon, M.D.
	Herbert E. Stokinger, Ph.D., Chairman

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INDUSTRIAL HYGIENE DIGEST
Literature and News

NEWS ITEMS

819 Information System on Toxic Chemicals.

The Manufacturing Chemists' Association (MCA) wants to help the Government set up its information system on toxic chemicals. In a letter to the Secretary of Health, Education, and Welfare (HEW), General G.H. Decker (U.S.A. -Ret.) president of the Manufacturing Chemists' Association, asks for a meeting with HEW representatives to discuss MCA's role in developing the computer-based file of information on the toxic effect of chemicals on people that was recently proposed by President Johnson. General Decker points out that MCA has detailed toxicological information on more than 100 chemicals and is working closely with the National Academy of Sciences in developing the Food Chemicals Codex.

-- Chem. Eng. News 44, 33 (July 11, 1966)

820 American Association of Poison Control Centers.

The Ninth Annual Meeting of the American Association of Poison Control Centers will be held October 24, 1966 at the Palmer House, Chicago, Illinois. The morning will be devoted to business sessions and the afternoon to presentation of papers on research, clinical and public health aspects of acute poisoning. Inquiries should be sent to Matilda S. McIntire, M.D., Secretary, The American Association of Poison Control Centers, 44th and Dewey Avenue, Omaha, Nebraska 68105.

-- Am. Ind. Hyg. Assn. J. 27, A-4 (May-June, 1966)

821 American Public Health Association.

On October 31-November 2, 1966 the Occupational Health Section of the American Public Health Association will present a varied program of papers relating to occupational health during the annual meeting in San Francisco, California. Information on program and arrangements may be secured from Victoria M. Trasko, Division of Occupational Health, Public Health Service, Washington, D.C. 20201.

-- Am. Ind. Hyg. Assn. J. 27, A-4 (May-June, 1966)

822 Hygienic Guide Series.

The following additional Hygienic Guide Series are now available: Pentaborane-9, and Mercury and Its Inorganic Compounds. They are given in the May-June AIHA Journal page 307-313 and can be obtained from the American Industrial Hygiene Association, 14125 Prevost, Detroit, Michigan 48227, at 50 cents each. -- Am. Ind. Hyg. Assn. J. 27, 307-313 (May-June, 1966)

COMING EVENTS

- 823 Oct. 3-5 American Oil Chemists' Society, Fall Meeting, Philadelphia, Pa.
Oct. 3-7 Conference on Trace Characterization, Chemical and Physical, National Bureau of Standards Institute for Materials Research, Gaithersburg, Md.
Oct. 9-14 Electrochemical Society, Fall Meeting, Philadelphia, Pa.
Oct. 10 Academy of Pharmaceutical Sciences, Midwest Regional Meeting, Chicago, Ill.
Oct. 10-12 American Society for Testing and Materials, 5th Annual Meeting on the Practice of Gas Chromatography, Atlantic City, N.J.
Oct. 10-13 Association of Official Analytical Chemists, 80th Annual Meeting, Washington, D.C.
Oct. 10-13 Clay Minerals Society, 3rd Meeting and 15th North American Clay Minerals Conference, Mellon Institute, Pittsburgh, Pa.
Oct. 13-14 11th Annual Symposium on Advances in Tracer Methodology, Boston, Mass.
Oct. 17-18 American Coke and Coal Chemicals Institute, Annual Meeting, White Sulphur Springs, West Va.
Oct. 17-19 National Academy of Sciences, Autumn Meeting, Durham, N.C.
Oct. 17-22 American Council of Independent Laboratories, Annual Meeting, Detroit, Mich.
Oct. 18-19 Industrial Hygiene Foundation, 31st Annual Meeting, Chatham Center, Pittsburgh, Pa.
Oct. 20-22 Drug, Chemical and Allied Trades Association, 76th Annual Meeting, Hollywood, Florida

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- Oct. 23-26 Canadian Manufacturers of Chemical Specialties Association, Toronto, Ont.
Oct. 24 American Association of Poison Control Centers, 9th Annual Meeting, Chicago, Illinois
Oct. 24 American Society of Safety Engineers, 5th Annual Conference, Chicago, Ill.
Oct. 24-27 National Safety Council, National Safety Congress and Exposition, Chicago, Ill.
Oct. 25-28 American Dietetic Association, 49th Annual Meeting and Exhibition, Boston, Massachusetts
Oct. 26-28 American Society for Microbiology, 6th Interscience Conference on Antimicrobial Agents and Chemotherapy, Philadelphia, Pa.
Oct. 30-Nov. 1 American Nuclear Society, Winter Meeting, Pittsburgh, Pa.
Oct. 31-Nov. 2 American Public Health Association, 9th Annual Meeting, San Francisco, Calif.

LEGAL DEVELOPMENTS

824 Maryland Clinical Lab Regulations Approved.

Maryland has become the third state in as many years to adopt controls for clinical laboratories that perform tests on materials from the human body. Acting on a law passed earlier this year by the General Assembly, the State Board of Health and Mental Hygiene has approved detailed regulations prepared by the Bureau of Laboratories with the cooperation of the American Chemical Society and other interested groups. The new Maryland regulations are similar to laws adopted in Illinois and New York during 1964-65, and also are like the pending government proposal for certifying independent laboratories under medicare. Permits will be issued to labs which qualify in terms of personnel and facilities. Reflecting Society policy, the new regulations recognize specialty training in clinical chemistry, microbiology, and other laboratory sciences for supervisory purposes. Directors will be required to be M. D. 's or else to have earned doctorates in one of the biological or chemical sciences. However, present directors below the doctor level who have been in business for seven consecutive years prior to June 1, 1966, will also be acceptable. One aspect of the new law and its accompanying regulations is still up in the air. This relates to an amendment of the enabling bill, generally conceded to have been adopted at the request of the medical profession, which prohibits laboratories from soliciting business. The American Chemical Society opposed this, contending that for effective patient care, physicians need to know the range of services offered by different laboratories. Privately, Maryland health officials indicate enforcement will be difficult and say they plan to refer reported violations to the attorney general rather than acting on them directly.

-- Chem. Eng. News 44, 152 (Aug. 8, 1966)

825 Proposed Regulations on Food Supplements.

FDA's proposed regulations on food supplements are drawing fire from a wide range of sources, from industrialists (as expected) to academic and government nutritionists, whose support FDA expected. The most abrasive point is the philosophy behind the Food and Drug Administration's labeling regulation. FDA would require all vitamin and mineral supplement products to carry labels stating that people get what they need from the food they eat. Critics contend, however, that Americans are unselective eaters and that almost half the population is deficient in one or more nutrients. One unexpected attack came from Dr. W. H. Sebrell of Columbia University, chairman of the National Academy of Sciences' Food and Nutrition Board, which, ironically, FDA mentions as the authority behind the regulation's thesis. FDA and NAS representatives will meet shortly to coordinate points of view.

-- Chem. Eng. News 44, 35 (July 25, 1966)

826 Generic-Name Drugs for Prescriptions.

Generic-name drugs would have to be used to fill prescriptions written under the medicare program if Congress approves a bill sponsored by Senator Russell Long (D. -La.) and two other Senators. S. 3614 would forbid the use of brand-name drugs in medicare programs or any state programs where federal financial assistance is involved if an equivalent nonproprietary or generic-name drug is available. Regardless of how a prescription is written, the druggist would be required to fill it on a generic basis. The bill would close a loophole which could send drug costs under medicare to astronomical heights, Senator Long says.

-- Chem. Eng. News 44, 35 (July 25, 1966)

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BOOKS, PAMPHLETS AND NOTICES

- 827 Hearing Loss. J. Sataloff. 404 pp. (Aug. 1966). AVAILABLE FROM: J.B. Lippincott Co., East Washington Square, Philadelphia, Pa. 19105. PRICE: \$14.00.

In this book, an outstanding otologist presents in practical but comprehensive form the principles and procedures for determining the presence and causes of hearing loss. Clinicians in every field of medicine can use this book as authoritative guide needed for the everyday diagnosis and appraisal of hearing loss—one of the most common chronic physical impairments in the United States. Included in the introductory part of the book are descriptions of hearing loss classification; proper methods of diagnosing with a tuning fork; outlines for tests which may be used and conclusions which may be drawn from these tests are pointed out; test evaluations concerning their place in every day practice; description of proper techniques for reading and interpreting an audiogram. Following chapters discuss types of hearing loss; diagnostic criteria for determining the dysfunction; detailed discussion of possible etiologies and analysis program; and tinnitus and vertigo as symptoms in a wide variety of hearing disorders. A series of tables summarizing the information necessary for confident differential diagnosis is presented. The logical and systematic methods of otologic history are covered—using an otologic examination which provides the most valuable information for diagnosis and prognosis. There is a group of chapters on the theory and administration of hearing tests prefaced by essential information on the physics of sound and its electronic measurement. Standard methods for performing audiometric examination are presented along with aids for avoiding common pitfalls in audiometry. There is discussion of masking and bone conduction tests, special tests, including the measurement and interpretation of recruitment, diplacusis, tone decay, functional losses, and others; handicapping effects of hearing loss; effects of the condition on other areas of performance such as speech development; modern advances in rehabilitation. The final sections of the book deal with recognition and prevention of occupational hearing loss and hearing loss in children. This book is an invaluable guide to the understanding and diagnosis of hearing impairments for all clinicians. It will allow every physician to provide his patients with the benefits of modern progress in the management of hearing loss.

- 828 Emphysema in Industry. Industrial Hygiene Foundation of America, Inc. Medical Series Bull. No. 10. 127 pp. (July, 1966). AVAILABLE FROM: Industrial Hygiene Foundation of America, Inc., 4400 Fifth Avenue, Pittsburgh, Pa. 15213. PRICE: \$2.50 to members; \$5.00 to non-members.

Emphysema and chronic bronchitis involve the population as a whole, and there is reason to believe that neither disease is peculiar to industry alone. For this reason, factors common to the general population must continue to be studied as potential causes or aggravants of these diseases. Why should industry be actively interested in the problem? First, with respect to chronic bronchitis, there are strong suggestions that pollutants in respired air influence and perhaps play a causal role in this disease. With respect to emphysema, such an association has less support at this time. Second, the socio-economic consequences of these two diseases are borne by industry. They are a multibillion dollar burden with incalculable costs in terms of the loss of individual and family rights to freedom from the burden of avoidable illness. Third, some of the needed studies of both a retrospective and prospective or longitudinal nature require populations and conditions that exist virtually only in industry. Some method must be found whereby the personnel of representative industries can be made the subject of repeated long-term observation at the same time that adequate records as to factors that are potentially suspect as influencing health can be kept. It would be of great help to be able to compare populations who have been exposed in various ways as for example in the foundries, chemical works, the handling of vegetable materials such as cotton processing and grain handling, etc., in regard to certain clinical manifestations and physiologic measurements in order to learn whether or not any particular kind of environment is prone to be associated with a greater or lesser incidence of evidences of chronic diffuse airway obstruction and chronic bronchitis. For such purposes, studies at one point in time are useful. Of equal importance would be to observe the same individuals under the same environmental conditions over a long period of time in order to learn whether or not such persons change in an abnormal fashion with the passage of time each man acting as his own control. Such studies gain in value if one is able to follow the cohorts who leave the industry, perhaps because of some specific health problem of importance. In most instances industry confines its attention in terms of monitoring the air to those substances known to be toxic. When one is dealing with diseases as poorly understood as chronic bronchitis and emphysema, it becomes necessary to monitor things that we may think are innocent, because it is only with time and study that one learns whether or not these materials are in fact innocent. One of the great costs of doing thorough research lies in the accumulation of a great deal of information which ultimately is shown to be irrelevant. Just as it is necessary to study large

numbers of men in order to discover those who ultimately become abnormal, it is also essential that meticulous study of various air pollutants be carried out over a long period of time even though it might be at great cost. Some individual companies already have programs which with very slight alteration and reinforcement might well be made to serve the purposes mentioned above.

-- Cond. from Summary

- 829 Management of Chronic Obstructive Lung Disease. Conclusions of 8th Aspen Emphysema Conference. Aspen, Colorado, June 10-13, 1965. U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Occupational Health, PHS Publication No. 1457. 66 pp. (May, 1966). AVAILABLE FROM: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. PRICE: 30 cents.

Treatment and prevention of obstructive pulmonary diseases involve not only the complete prevention of the condition, but also the control of the disease once it is present to prevent progression and to avoid acute exacerbations; however, completely rational programs for the treatment and prevention of obstructive lung disease require a more complete knowledge of etiology, pathogenesis, and natural history than we now have. The management of the life-threatening episodes (characterized by hypoxia, hypercapnia, and congestive heart failure) are critically reviewed and summarized. Subjects are covered under: Definitions in Chronic Obstructive Lung Disease; Respiratory Failure; Management of Right Heart Failure and Pulmonary Hypertension; Antibiotics and Infections; Home and Clinic Care; Pharmacologic Agents; and Surgery. An Appraisal and Reflections on the Conference are also presented, along with the Program and Abstracts of Conference Papers. The conclusions of the Eighth Aspen Conference are intended for free distribution among the majority of American physicians, as containing the latest knowledge for the relief and control of emphysema-bronchitis; those concerned with programs of health conservation will also find it a useful reference. In the words of Dr. John H. McClement, Columbia University, "we need observations on subjects followed prospectively from a much earlier time in the course of the disease or ideally even from before an injury has occurred."

- 830 Respiratory Function Tests in Pneumoconioses. International Labour Organisation. Report and Related Papers of a Meeting of Experts. Geneva, Sept. 20-28, 1965. International Labour Office, Geneva. Occupational Safety and Health Series No. 6. 173 pp. (1966). AVAILABLE FROM: International Labour Office, Geneva. PRICE: Free of charge.

A Meeting of Experts on Respiratory Function Tests in Pneumoconioses was held in Geneva from 20 to 28 September 1965, and the following subjects appeared on the agenda: Pneumoconioses and respiratory function, (a) disorders which may be evaluated by respiratory function tests and (b) classification of pneumoconioses according to the type of respiratory disorder which is prevalent; review of the respiratory function tests used in the examination of persons suffering from pneumoconiosis; tests to be recommended internationally for the assessment of the respiratory function in pneumoconioses and the technique for carrying out such tests; and criteria to be adopted for the interpretation of the results of these tests with a view to their international comparability. In addition to the Report of the Meeting of Experts on Respiratory Function Tests in Pneumoconioses, the following working papers are included: (1) A. E. Sartorelli—Assessment of Lung Function in Pneumoconiosis; (2) J. E. Cotes—Tests of Lung Function in Current Use: Proposals for their Standardisation; (3) M. El Batawi—Ventilatory Capacity in Field Investigation of Respiratory Diseases Resulting from Exposure to Textile Dusts; and (4) Lia G. Ohnianskaia—Respiratory Function Tests to Determine the Effect on Human Beings of Various Industrial Dusts. This report which appears in outline form, will be of general interest to those who have interest in, or responsibility for, prevention of disability from Chronic Respiratory Disease in industrial populations.

- 831 The Maurice and Laura Falk Foundation. A Private Fortune—A Public Trust. Agnes Lynch Starrett. 306pp. (1966). AVAILABLE FROM: The Historical Society of Western Pennsylvania, Pittsburgh, Pa. PRICE: \$2.00.

This history of one man's gift to his fellow men begins with statements of purpose and faith in the integrity and justice of the law and of those to whom he entrusted his accumulated wealth. Subsequent chapters deal with grants—(1) to research in economics (including the Brookings Institution and the American Law Institute) (2) to political education (the Reed Survey) and to (3) education (4) medicine and (5) cultural welfare and organized charities. This record of the outstanding accomplishments resulting from the imaginative and effective implementation by J. Steele Gow, the Foundation's Executive Director, over the entire 35 year period, of Maurice Falk's worthy ideals provides a valuable model against which to measure the effectiveness of

other similar efforts, in private philanthropy. In a larger sense, it should also help guide more extensive governmental programs in the public interest. In this regard, an important new concept—"Creative Federalism" is now being developed under the U.S. Department of Health, Education and Welfare's (HEW) Secretary John Gardiner (on "open ended leave" as president of Carnegie Corp.) HEW's 11.7 billion dollar allotment—33% over last year's and 485% over 1953's first HEW budget (Newsweek, Feb. 28, 1966, p. 22) already dwarfs all private philanthropic efforts in comparison and will undoubtedly continue to grow. These budgetary funds are certainly no less a public trust than was Mr. Falk's wealth, and their wise use demands the enlightened foresight, long term dedication and sound management which typified Mr. Gow's direction of the Falk Foundation. This will require clear statements of goals and principles, and ability to measure and report progress.

-- RTP deT

INDUSTRIAL MEDICAL PRACTICE

- 832 Medical Illustration—A Requisite for All Medical Journals. G. P. Hodge. J. Occ. Med. 8, 295-300 (June, 1966).

In the education of the medical scientist, art plays a vital role. There is not a phase of medical education that does not lend itself to teaching with visual materials. If the challenges of the medical illustrator are to be met, it will be necessary for the medical writer, publisher, and artist to continue their cooperative efforts.

-- Author's summary

Further information regarding medical illustration as a career and a list of the locations of the teaching departments may be obtained by writing to the Corresponding Secretary of the Association of Medical Illustrators: Miss Charlotte Holt, 738 Keystone Avenue, River Forest, Ill. 60345.

- 833 Quantitative Studies on Fabrics as Disseminators of Viruses. II. Persistence of Poliomyelitis Virus on Cotton and Wool Fabrics. G. J. Dixon, R. W. Sidwell, and Ethel McNeil. Appl. Microbiol. 14, 183-188 (March, 1966).

The length of time that polio-virus could be recovered from wool gabardine and blanket, and from cotton sheeting, terry cloth, and knit jersey fabrics was determined under conditions of controlled temperature and humidity (25°C. in 35% and 78% relative humidities). Three types of exposure of the fabrics to viruses were used: direct contact, aerosol, and virus-containing household dust having a high content of textile fibers. Generally, virus titers on cotton fabrics, held in both relative humidities, decreased exponentially to an undetectable level. The method of exposure to virus had a definite effect on the duration of viral persistence on a given fabric. Virus contained in household dust was least stable. There are 13 references.-- Public Health Eng. Absts.

- 834 Microbiological Hazards in Dairy Products and Their Determination. A. R. Brazis and R. B. Read, Jr. Develop. Ind. Microbiol. 7, 263-267 (1966).

Although many studies have been directed toward control or elimination of microbiological hazards in dairy products, several public health problems still require resolution. Significant advances have been made in laboratory techniques for identification of staphylococcal enterotoxins, serological identification of botulinal toxins, assay of aflatoxins, and electron microscopy for identification of virus-like particles in milk. Further research is needed to improve methods for the isolation of atypical mycobacteria from dairy products and to establish the significance of these organisms as causes of human disease. Control or eradication of public health hazards must also include prevention of microbial contamination at the homes of consumers. There are 24 references.

-- Public Health Eng. Absts.

- 835 Health Aspects of Food Additives. P. E. Johnson. Am. J. Public Health 56, 948-951 (June, 1966).

The benefits to public health resulting from use of food additives are great and stem primarily from the role of these chemicals in increasing food production, in conserving foods in storage, and in making foods continuously available in acceptable form through processing. The benefits greatly outweigh any hazard detected by present methods of toxicology and safety evaluation. That hazards not detected by present methods might exist is recognized, and continuing reevaluation of the safety of each use in light of new information or new technology is necessary. Five references are given.

-- Author's summary

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- 836 The Evaluation of Physical Tasks in Industry. S.H. Snook and C.H. Irvine.
Am. Ind. Hyg. Assn. J. 27, 228-233 (May-June, 1966).

The evaluation of physical tasks in terms of fatigue has often been based on their effect on the "average man," thus serving to protect only half of the population from excessive fatigue. The concept of group work capacity is proposed as a technique for task evaluation which includes the entire population. It is defined as the percentage of workers that can perform a task without showing physiological signs of fatigue. An experiment that investigates 30 different lifting tasks is described. Thirty subjects were used, and group work capacity was estimated for each task by three different methods. The application of the results to industrial situations is discussed.

-- Authors' abst.

- 837 Primary Cutaneous Tuberculosis Resulting from Mouth-to-Mouth Respiration: Report of a Case. K.M. Heilman and C. Muschenheim. New Engl. J. Med. 273, 1035-1036 (Nov. 4, 1965).

A case of primary cutaneous tuberculosis is reported that presents an interesting problem in differential diagnosis and treatment. It also serves as a warning of some of the hazards of mouth-to-mouth resuscitation. A tuberculin-negative intern gave mouth-to-mouth resuscitation to a patient with respiratory arrest. Postmortem examination of the patient subsequently disclosed active pulmonary tuberculosis. Six weeks after this episode the intern had a strongly positive reaction to first-strength PPD. Approximately eight weeks after contact two ulcerative lesions gradually developed near the left nasolabial fold with submaxillary adenopathy. Biopsy of the lesion showed granulomatous inflammation. The culture was subsequently positive for acid-fast bacilli. After two months of therapy with isoniazid, the lesions involuted. After 12 months, treatment was terminated without evidence of recurrence. This case also illustrates the need for readily accessible pulmonary-resuscitation apparatus.

-- Am. Rev. Resp. Dis. Absts.

- 838 Risk in Mouth-to-Mouth Respiration. Anon. New Engl. J. Med. 273, 1049 (Nov. 4, 1965).

A report of primary cutaneous tuberculosis that confronted the authors with an interesting problem in differential diagnosis is presented as a warning of some of the hazards of mouth-to-mouth resuscitation. The nature of the lesion was obscure, and the rarity of its occurrence, added to the difficulty in recognizing it, is the basis of a plea for readily accessible pulmonary resuscitation apparatus in emergency rooms and on the wards of hospitals. The authors emphasize the importance of training the house staff in the use of such equipment to obviate the need for mouth-to-mouth resuscitation. Such apparatus should indeed be made available, and the supporting personnel, especially nurses, orderlies, and porters, should receive instruction in its use. Ambulances should be similarly equipped, and those who ride them should receive such instruction also. Another recent but unreported episode is of interest in this regard. A prominent Boston physician had a similar experience. However, he took isoniazid and, as far as is known, did not acquire infection from this heavy exposure. Although this cannot be taken as proof of the effectiveness of the prophylaxis, it appeared to be the wiser and safer course to recommend. The entire question of the value of mouth-to-mouth respiration in relation to other methods of resuscitation deserves further study. In any event, its use should be applied with some consideration of the risks involved.

-- Am. Rev. Resp. Dis. Absts.

- 839 Chronic Bronchitis in Forest Workers in Finland. H. Poppius, M. Lehtinen, and J. Patiala. Ann. Med. Internae Fenniae 54, (1) 1-12 (1965).

The following factors associated with the incidence of chronic bronchitis, are considered to be of etiologic significance: age, smoking, and especially cigarette smoking, air pollution (chronic bronchitis is more common in towns and industrial communities than in rural districts), asthmatic dispositions, and social status. The current study deals with the occurrence of respiratory symptoms associated with chronic bronchitis in a group of 975 forest workers and 329 non-forest workers of a rural male population in Finland. In addition, the peak expiratory flow-rate was measured and a chest radiograph was taken. The following observations were made: Forest workers had a higher incidence of respiratory symptoms than the control group. The incidence of respiratory symptoms in the forest worker group rose with age and the consumption of tobacco. The forest workers were heavy smokers, using more tobacco than the controls. After standardizing the two groups with regard to age and smoking habits, only an indistinct trend towards a higher incidence of phlegm production and no difference in the peak expiratory flow-rate, were demonstrable in the forest worker groups as compared with the control group. The question is raised whether these findings may not be partially due to the circumstance that a relatively high proportion of the persons meeting the fairly strict criteria of the test were incapacitated for forest work and thus eliminated from participation in that group but would not have been so considered in the control

group. In the study, the chronic bronchitis combination, is taken as including cough, phlegm production, and a chest illness at least once in the course of the last three years. A comparison of the incidence found in this study with those reported from rural or small town areas of other countries indicated chronic bronchitis symptoms to be more numerous in this study than in a Danish study and about the same as in Scottish and Welsh ones. The incidence, as was to be expected, was considerably lower than that found in London. -- APCA Absts.

- 840 Immunologic Defect in Patients Recovered from Sarcoidosis. H. L. Israel and M. Sones. New Engl. J. Med. 273, 1003-1006 (Nov. 4, 1965).

Insensitivity to tuberculin has long been recognized as a cardinal feature of sarcoidosis. Recently, in the course of another investigation, tuberculin tests were given patients who had recovered from sarcoidosis. Nearly all had no reaction. This unexpected finding led to a detailed examination of the behavior of the tuberculin reaction in patients under prolonged observation in a sarcoidosis clinic. The results of serial tuberculin tests in 170 patients with sarcoidosis over a mean interval of six years are reported. Tests in 60 who recovered from sarcoidosis showed that tuberculin anergy persisted after disappearance of all residual of the disease. Eleven patients who recovered received BCG vaccinations. Transient, weak tuberculin reactions developed in four patients; only one patient maintained tuberculin sensitivity three months after vaccination. The immunologic defect thus demonstrated may be the result of the disease, but evidence is adduced to support the alternative hypothesis that inability to develop and maintain delayed hypersensitivity is a constitutional defect that is prerequisite to the development of sarcoidosis.-- Am. Rev. Resp. Dis. Absts.

- 841 Chronic Disease in Former College Students. II. Methods of Study and Observations on Mortality From Coronary Heart Disease. R. S. Paffenbarger, Jr., et al. Am. J. Public Health 56, 962-971 (June, 1966).

Over 45,000 former students of the University of Pennsylvania and of Harvard University are under study for the kinds and amounts of chronic diseases that have developed in their later life. Physical, social, and psychological data recorded during college years are correlated with later health status as measured through self-administered questionnaires, physical examinations, and death certificates. College records from 1921 through 1950 contain precursive and causative factors of subsequent chronic disease. Observations on coronary heart disease were limited to the first 590 male former students known to have died from this cause. They were contrasted with 1,180 randomly chosen classmates of equivalent age who were known to be still alive. Analyses of college case-taking and other records of these subjects identified nine precursors of fatal coronary heart disease: heavy cigarette smoking, higher levels of blood pressure, increased body weight, shortness of body height, early parental death, absence of siblings, nonparticipation in varsity athletics, higher emotional index, and scarlet fever in childhood. Some precursors correlated only with early death from coronary disease and some with death throughout the range of ages afforded for study. Heavy cigarette smoking early in life was associated with a marked increase in risk of coronary mortality. Higher levels of blood pressure, as measured on both systolic and diastolic scales, and a higher emotional index, as self-assessed by students, also showed a preponderance in those who later died of coronary heart disease. In contrast, participation in varsity athletics was associated with a substantial sparing effect. Although some of these characteristics may be changed later in life, it is of interest that early precursors can be recognized and quantified years before overt evidence of coronary heart disease. The study benefits from the use of predocumented data on young adults, drawing on records made years in advance of clinical recognition of chronic diseases that develop later in life. Advantages include: (1) availability of a large population, (2) uniformity of records, (3) focus on susceptible age groups and their characteristics precursive of chronic disease, and (4) the utilization of invaluable help from university sources. -- Cond. from authors' summary

- 842 Heart Disease Among Industrial Workers. J. B. Tauber and A. Ciocco. J. Occ. Med. 8, 317-325 (June, 1966).

A group of 3,359 male nonsalaried employees of a steel plant, presumably free of heart disease, was observed by means of repeated medical examinations for an average of 3.6 years. The following findings were noteworthy: (1) For the period of the follow-up, 1% of the men 40 years of age and over acquired heart disease annually, while still actively employed; the rate was 1 per 1,000 among men under 40 years of age. Approximately one-half of the new cases were considered to be of acquired myocardial infarction. (2) Men with relatively higher diastolic blood pressure and weight-height ratio demonstrated a higher risk of acquiring heart disease. Preliminary analysis of the data indicates that further clarification of this association may be obtained

through study of changes in blood pressure, weight-height ratio, and subsequent disease manifestation. (3) The experience of the study demonstrated clearly that a research project of this kind can be integrated with the routine operations of a medical department at a minimal cost without disturbing such operations or the relationship between the employees and the medical department. However, necessary conditions are the existence of an adequate medical plant program and the cooperation of the staff. Certain compromises must be made with respect to diagnostic procedures, sampling, study subjects, and follow-up outside the plant. While strikes, lay-offs, and other aspects of in-plant operations are factors that must be considered carefully in the planning of longitudinal studies, the ease with which repeated observations can be made in a plant situation is in sharp contrast to the difficulties inherent in community studies. There are eight references.

-- Authors' summary

- 843 Serial Electrocardiograms Recorded on One Subject Over a Period of 42 Years (1923-1965). H.N. Segall. *Can. Med. Assn. J.* 95, 31-33 (July 2, 1966).

A longitudinal study of the range of normal in the electrocardiogram was carried out, using the author as the subject: 18 records were made in the course of 42 years (1923-1965). Only minor differences were demonstrated which are believed to represent differences in posture or in relation to meals, because the electrocardiograms were not recorded under standard basal conditions. The QRS was wider in the precordial than in the limb leads. The amplitude of T-waves varied within a range of 1-11.5 mv.

-- Author's abst.

- 844 A Common Source Multi-Household Outbreak of Chimpanzee-Associated Hepatitis in Humans. F.M. Davenport, et al. *Am. J. Epidemiology* 83, 146-151 (Jan. 1966).

An episode of chimpanzee-associated hepatitis involving five human cases in four households is described. A 10-month-old male chimpanzee was the source of infection. Of eight persons who handled the animal, five developed infectious hepatitis. Of the three who remained well, one had experienced jaundice at an earlier time. Four of the five human cases had contact with the source chimpanzee only during a two-day interval. The maximum possible incubation periods for these four persons were: 25, 26, 28, and 36 days. Of the five cases, one was subclinical and symptomatic for only a few days; the remaining four had mild, but typical infectious hepatitis.

-- Public Health Eng. Absts.

- 845 Implications of Foodborne Infectious Hepatitis. D.O. Cliver. *Public Health Repts.* 81, 159-165 (Feb. 1966).

A review of 22 food-associated outbreaks of infectious hepatitis, which occurred from 1943 to 1964, included seven in which shellfish were incriminated as the vehicle of transmission; the rest were attributed to a variety of other foods. A majority of the foods implicated had not been cooked. The virus, however, is sufficiently stable to withstand limited heating, and a greater number of cooked foods might have been included if more investigations had been conducted with this in mind. Reports of what is known of the virus of infectious hepatitis indicate that most of the properties of this agent, which may apply to transmission in foods, have also been described for other viruses infectious for man. This information may, therefore, serve as a model for the study of outbreaks of other foodborne virus diseases. There are 41 references.

-- Public Health Eng. Absts.

- 846 On Hazards of Cancer from Ultraviolet Light. H.F. Blum. *Am. Ind. Hyg. Assn. J.* 27, 299-302 (May-June, 1966).

Direct quantitative comparison cannot be drawn between experimental induction of cancer in laboratory animals with ultraviolet light and the hazard of skin cancer in man resulting from this agent. Reasons for this are: (1) the very different optics in the two cases, ultraviolet light penetrating to deeper tissues in mice than in man and hence producing different types of cancer; (2) quantitatively indeterminable biologic differences between man and experimental animals; (3) the fact that reliable statistics permitting comparison of incidence of skin cancer with incidence of exposure to ultraviolet B of sunlight are sparse and difficult to obtain. The cumulative carcinogenic effect of repeated doses, clearly shown in animal experiments, makes it important to consider this hazard in terms of repeated exposure, whether to sunlight or to artificial sources of ultraviolet light or to a combination of both, rather than in terms of the magnitude of single doses.

-- Author's abst.

03122237

- 847 Breaking the Cigarette Habit. S. Ford, Jr., and F. Ederer.
J. Am. Med. Assn. 194, 139-142 (Oct. 11, 1965).

No single therapeutic method for terminating the cigarette habit has proved strikingly effective. The long-term results from smokers' clinics have been particularly disappointing. Psychological and social factors have been dealt with to a limited degree in most smokers' treatment clinics. If high relapse rates are to be avoided, the habit of "not smoking" must be reinforced over a period of at least two years.

-- Am. Rev. Resp. Dis. Absts.

- 848 First Year's Experience in Anti-Smoking Clinic. K. P. Bau, B. J. Kirby, and C. Bogen.
Brit. Med. J. 1, 1651-1653 (June 26, 1965).

Among 92 patients attending an antismoking clinic, 62 (67%) stopped smoking at the end of seven weeks. Thirty patients (33%) continued to smoke. At the end of one year, however, only 25 patients (33%) of 75 who had stayed with the study group remained non smokers.

-- Am. Rev. Resp. Dis. Absts.

- 849 Cigarette Smoking and Cancer of the Lungs and of the Bladder. A. J. Lea.
Lancet 1, 590-591 (March 12, 1966).

A positive correlation between death-rates from lung cancer and cancer of the bladder is to be expected, and such a correlation was found for 20 countries. The probability that this correlation was due to chance, for both sexes taken together, is much less than 1 in 1,000. The only known etiological factor common to neoplasms in these two sites is cigarette smoking.

-- Public Health Eng. Absts.

- 850 Differences in Effects of Cigar and Cigarette Smoking on Free Fatty Acid Mobilization and Catecholamine Excretion. A. Kershbaum, et al.
J. Am. Med. Assn. 195, 1095-1098 (March 28, 1966).

A study was made of the comparative effect of cigar and cigarette smoking on the mobilization of free fatty acids (FFA) and the excretion of catecholamines. There was a greater increase in FFA concentration in the serum with cigarette than with cigar smoking. Urinary catecholamine excretion increased during smoking, significantly more with cigarettes than with cigars. The differences observed with the two forms of smoking probably result from the tendency to inhale with cigarette and not with cigar smoking and from the effect of this on nicotine absorption. There are 20 references.

-- Public Health Eng. Absts.

- 851 Polonium 210 in Tobacco, Cigarette Smoke, and Selected Human Organs. Esther S. Ferri and E. J. Baratta. Public Health Repts. 81, 121-127 (Feb. 1966).

A study was made to determine if Po-210 may be implicated in the origin of lung cancer. Tests indicated that Pb-210 is deposited in the tobacco independently of Ra-226 and its daughter Bi-210. Values for Po-210 in inhaled smoke ranged from 11 to 35.7% of that in the total cigarette. Average dosages to the lungs of a person smoking two packages of cigarettes were calculated to be far below the MPC for Po-210 in air per person in the general population. In a study of distribution of Po-210 in selected tissues and organs of the human body, tests indicated higher levels of Po-210 in the organs of smokers. There are 12 references.

-- Public Health Eng. Absts.

- 852 Lung Cancer in the Channel Islands. G. Dean. Brit. J. Cancer 19, 661-680 (Dec. 1965).

The author reports on an investigation of the place of birth and smoking habits of all men and women who died from lung cancer in the Channel Islands from 1952 to 1961. The population of these islands in the lung cancer age contains two major groups: those born in the Channel Islands, who have had relatively little exposure to air pollution, and those born in the United Kingdom, many of whom have experienced considerably greater exposure to air pollution. The difference between the lung cancer mortality rate of the two groups was not significant.

-- Public Health Eng. Absts.

- 853 Pasteurella multocida Infections in 16 Persons in Oregon. M. A. Holmes and G. Brandon.
Public Health Repts. 80, 1107-1112 (Dec. 1965).

A total of 16 human cases of *Pasteurella multocida* were diagnosed in Oregon between September 1962 and April 1965. Of these 16 cases, five resulted from cat bites, one from an ear infection with source unknown, three from dog bites, three from combined cat bites and scratches, and

three from cat scratches only; in one case there was a history of chronic bronchitis. In spite of intensive therapy in some of these cases, the wound infections persisted. They remained painful, hot, red, and swollen and frequently contained a dark and heavy, ill-smelling pus. Most patients recovered uneventfully and suffered no severe permanent damage from the infections. In only two instances was bacteremia or septicemia noted. There was no damage to the bony tissue beneath the wounds. There are 15 references. -- Public Health Eng. Absts.

- 854 Bird Breeder's (Fancier's) Lung. F.E. Hargreave, et al. *Lancet* 1, 445-449 (Feb. 26, 1966).

Pigeon and budgerigar breeders or fanciers may develop a pulmonary disease that resembles farmer's lung and affects the peripheral gas-exchanging tissues. The disease is caused by inhalation of the antigens in the avian excreta. A strong immunological response, consisting of the appearance of precipitins, results from the entry of the organic avian antigens through the respiratory tract, and the evidence suggests that the clinical manifestations are the result of a precipitin-mediated hypersensitivity reaction. Nine references are given.

-- Public Health Eng. Absts.

- 855 Leptospire Isolated From Frog Kidneys. S.L. Diesch, et al. *Nature* 209, 939-940 (Feb. 26, 1966).

In the summer of 1964, cases of leptospirosis developed in man as a result of swimming in a farm creek. During epidemiological studies, six leopard frogs (*Rana pipiens*) were collected from these waters. Observations of the frog isolate by electron microscopy indicated that the organisms were morphologically characteristic of the genus *Leptospira*. Although the isolate was cultured from the kidney of the frog, the role of the unidentified leptospire has not been defined as either a pathogen or a saprophyte. There are 13 references.

-- Public Health Eng. Absts.

- 856 Q Fever Studies in Maryland. D.J. Wagstaff, et al. *Public Health Repts.* 80, 1095-1099 (Dec. 1965).

Q fever studies in Maryland in 1963 revealed that a major source of possible human infection was infected dairy cattle. Of 2,065 herd milk samples tested, 72.4% were CA positive. Seven isolations of *Coxiella burnetii* were made from these samples. Serologic evidence of exposure was obtained from a survey of farm residents exposed to infected cattle, in which 15.3% of 124 people tested were CF positive, and a survey of the general population of the state, in which 0.35% of 23,283 serums tested were CF positive. Serologic reaction appeared to be related to residence or employment in the vicinity of infected dairy cattle. No acute illness attributable to Q fever was reported by any of the serologically positive people who were interviewed. An isolation *C. burnetii* was made from a person with no reported acute illness, suggesting that asymptomatic infections may have occurred. There are 13 references. -- Public Health Eng. Absts.

- 857 Epidemiology of Q Fever in Queensland: A Seven-Year Survey. D.W. Johnson. *Med. J. Australia* 1, 121-125 (Jan. 22, 1966).

The history of Q fever in Queensland is reviewed. The extension of the disease to the sheep industry in 1958 led to the identification of Q fever in kangaroos and in kangaroo ticks (*A. tritatum*). This tick can infest sheep, horses, and dogs as well as man, and has been found in all Australian states except Victoria and Tasmania. A seven-year survey of Q fever in Queensland is reported. The number of patients established as having Q fever was 1,412. Patients became ill in most parts of the state, but the highest rates were found in districts devoted to sheep raising, dairying, and meat production. Most of the patients were males engaged in work that brought them into association with cattle or sheep or products of these animals. Meat workers, shearers, and dairy farmers are most at risk.

-- Public Health Eng. Absts.

- 858 Gel Electrophoresis in the Study of Pneumoconioses. A.L. Reeves, Elizabeth K. Busby, and Lucille Scotti. *Am. Ind. Hyg. Assn. J.* 27, 278-287 (May-June, 1966).

Proteins as well as other macromolecular constituents of biological tissue may be separated by electrophoresis on starch gel, and the resulting gel samples may be stained for a variety of substances including protein, mucoid, and enzymes such as esterases, phosphatases, and dehydrogenases. The variability of these patterns from serum, erythrocyte, lung, and lymph node specimens is correlatable to previous inhalation exposure of the host to toxic substances such as beryllium compounds, as well as to aerosols of radioisotopes. General urban air pollution, when compared to filtered air, caused no consistent effect. Development of pulmonary pathology sustained in response to such exposures is evidenced by disappearance or *de novo* appearance of certain isozyme bands. Applicability of the method to the study of the pathogenesis, toxicological mechanism, and diagnosis of the pneumoconioses appears to have considerable potential.

-- Authors' abst.

- 859 Bronchiolar Emphysema. D. Bryk and K. Mori.
Am. J. Roentgenol, Radium Therapy Nuclear Med. 94, 660-664 (July, 1965).

Bronchiolar emphysema is an unusual type of diffuse pulmonary disease characterized by progressive respiratory insufficiency. Other terms used for this entity are muscular cirrhosis of the lungs, bronchiolectasis, and cystic pulmonary cirrhosis. Pathologically, the entity is fairly clear-cut. The roentgen picture is that of fine diffuse uniform infiltrations with intervening small uniform cysts. This picture is not specific for this entity, but in a patient with a slowly progressive interstitial pulmonary process with these features, the diagnosis of bronchiolar emphysema should be considered. An additional case of bronchiolar emphysema is reported.

-- Am. Rev. Resp. Dis. Absts.

SKIN DISEASES AND BURNS

- 860 Human Infection Due to the Hedgehog Fungus, Trichophyton mentagrophytes var. erinacei. R.A. Quaife. J. Clin. Pathol. 19, 177-178 (March, 1966).

Three human cases of skin infection caused by Trichophyton mentagrophytes var. erinacei are recorded. The work on the incidence and ecology of T. mentagrophytes var. erinacei in hedgehogs and hedgehogs as a source of human infection is reviewed. It is suggested that a true increase in human infections is occurring. A description of the colonial and microscopical appearance of the fungus and their variance with other T. mentagrophytes varieties is discussed. The name Trichophyton erinacei is proposed as being taxonomically more correct. There are nine references.

-- Public Health Eng. Absts.

CHEMICAL HAZARDS

- 861 Effect of Intratracheal Injection of Benzo(a) Pyrene on Ducks. R.H. Rigdon and J. Neal. Texas Rept. Biol. Med. 23, (2) 494-506 (1965).

A variety of pulmonary tumors developed in the respiratory tract of white Pekin ducks following intratracheal injection of methylcholanthrene. However, only one microscopic tumor, a questionable carcinoma, occurred in a group of nine ducks given 200 mg. of benzo(a) pyrene crystals intratracheally. Chronic inflammation and metaplasia did occur. No pulmonary tumors were present in the respiratory tract of ducks given an intratracheal injection of carbon black or carbon black with benzo(a) pyrene adsorbed. A chronic reaction frequently occurred in the lungs when carbon black was injected intratracheally. Two ducks injected intratracheally with 200 mg. of benzo(a) pyrene developed multiple cysts in the retroperitoneal region. Since no other ducks have been observed with similar cysts, it is suggested that they developed as the result of this carcinogen.

-- APCA Absts.

- 862 Comparison of Field Methods for Estimating Carbon Monoxide Hemoglobin Percentages. P.A. Breysse, H.H. Bovee, and L.F. Gabay. Am. Ind. Hyg. Assn. J. 27, 256-259 (May-June, 1966).

Field methods utilizing expired air for estimating carbon monoxide hemoglobin (COHb) levels provide a reasonable correlation with blood specimens. These methods are convenient and simple, and when performed immediately after the expired air has been collected the results are comparable to those obtained with blood. Therefore, except under the most rigorous conditions, the expired air methods for determining COHb levels can be substituted for the blood techniques. Any field instrument that supplies reliable carbon monoxide measurements may be used for estimating COHb%. There are five references.

-- Authors' conclusions

- 863 Contamination of the Atmosphere by Fluorine. W. Oelschläger. Staub 25, 528-532 (Dec. 1965). German.

The main sources of fluorine are from industries producing hydrofluoric acid, aluminum, superphosphate, and enamel, also from brickworks, metallurgical works, and industries consuming large amounts of low quality coal. Fluorine content of raw materials, emissions from different processes, and the harmful effects on animals and plants are reported. Measures to be taken to reduce fluorine emissions are discussed. There are 31 references.

-- APCA Absts.

- 864 Nitrogen Dioxide Poisoning Due to Metal-Cutting With Oxyacetylene Torch. W.D. Norwood, et al. *J. Occ. Med.* 8, 301-306 (June, 1966).

Several hours after the use of an acetylene torch for metal-cutting in a poorly ventilated water main, a worker became so short of breath that he could not sleep. He reported to the plant physician 18 hours after the exposure and an x-ray film revealed pulmonary edema. Re-enactment of the event produced a level of nitrogen dioxide of 90 ppm in 40 minutes, the total oxides of nitrogen being in excess of 300 ppm. Such a level might well be expected to produce pulmonary edema. The accident was typical of the insidious action of nitrogen dioxide, which can so easily occur under some conditions and may cause death. Recognition of the latent period between exposure and the development of pulmonary edema, timely treatment with bed rest, and, if necessary, the administration of oxygen under pressure can be life-saving. A greater awareness of the sources and toxicity of nitrogen dioxide is also needed to prevent unnecessary exposure. Eight references are listed.

-- Authors' summary

- 865 Abnormal Trace Metals in Man: Arsenic. H.A. Schroeder and J.J. Balassa. *J. Chronic Diseases* 19, 85-106 (Jan. 1966).

The biological activities of pentavalent and trivalent arsenic differ markedly. Pentavalent arsenic as arsenate is nontoxic in normal concentrations, is excreted rapidly, largely through the kidneys, probably does not accumulate in human tissues, is a normal constituent of food, and may perform some unknown physiological function. Trivalent arsenic as arsenite, the principal form produced commercially, is toxic, chelating with dithiol groups and inhibiting those enzymes dependent thereon. It accumulates in the mammalian body, is excreted largely from intestine, is a contaminant of soils and foods through its use in herbicides and pesticides, and performs no known physiological function. Sea foods and a few other foods and waters consumed by man often exceed the allowable limit of arsenic concentration imposed by government agencies of the United States and Great Britain, attempting to limit residues of arsenites. The bad reputation of arsenic as a poison is due to the toxicity of the commercial trivalent form and is undeserved in the case of the natural pentavalent form. There are 66 references. -- Public Health Eng. Absts.

- 866 Determination of Bismuth and Tellurium in Tissues by Atomic Absorption Spectrophotometry. R.E. Kinser. *Am. Ind. Hyg. Assn. J.* 27, 260-265 (May-June, 1966).

An atomic absorption method for the determination of bismuth and tellurium in animal tissue is described. Samples were wet-ashed with nitric acid. A hydrochloric acid solution containing 4 mg. of tissue ash per milliliter of solution, is used for the determination of bismuth and tellurium. No chemical separations are used. Effects of total salt concentration on the determination, recovery data from spiked samples, and precision of the method are discussed. Concentrations as low as 1.5 micrograms of bismuth and 2.0 micrograms of tellurium can be determined in 1 gm. of animal tissue. There are 13 references.

-- Author's abstr.

- 867 Radiochemical Determination of Metallic Mercury Vapour in Air. L. Magos. *Brit. J. Ind. Med.* 23, 230-236 (July, 1966).

A radiochemical method has been developed for the estimation of atmospheric mercury. When air containing mercury is passed through a solution of Hg-203-mercuric acetate and potassium chloride, isotope exchange takes place so that the issuing air contains the same concentration of mercury, but labeled and with the same specific activity as the reagent solution. The Hg-203 is absorbed on hopcalite and estimated by gamma scintillation counting. The standard deviation of the method is 0.004 microgram Hg/liter in concentrations up to 0.2 microgram Hg/liter, and is 0.075 microgram Hg/liter in the range 0.2-1.2 micrograms Hg/liter concentration. The method is simple and can be used for snap or long-run sampling, and with continuous recording.

-- Author's abstr.

- 868 Toxicity of Triphenyltin. H.B. Stoner. *Brit. J. Ind. Med.* 23, 222-229 (July, 1966).

The introduction of triphenyltin into agricultural practice has led to a consideration of the hazards which might arise, particularly as the related compound triethyltin is known to be very toxic to both man and animals. In the present investigation the toxicity of triphenyltin has been determined after its acute and oral intraperitoneal administration in rats, guinea pigs, rabbits, mice, and hens, after feeding it to rats and guinea pigs, and after its application to the skin of guinea pigs. The guinea pig was the most sensitive species and its growth was inhibited by as little as 1 ppm triphenyltin acetate in the diet. With higher concentrations in the diet the relationships between the dose and the survival time and between the amount consumed and the acute

oral LD₅₀ indicated that triphenyltin accumulated in the guinea pig. Compared with those of triethyltin, the effects of triphenyltin appeared relatively non-specific, but there was evidence of an action on the central nervous system although cerebral edema did not occur. The effects of triphenyltin were quite different from those of diphenyltin which acted mainly as an irritant. Triphenyltin did not readily penetrate unbroken skin. The use of triphenyltin as an agricultural fungicide is considered in the discussion.

- 869 The Distribution of Lead After Intravenous Injection in the Tissues of the Rabbit, and in Tumour Bearing Mice. G. Causey. Brit. J. Cancer 19, 867-870 (Dec. 1965).

This investigation was undertaken to see if intravenous colloidal lead was tolerated by mice and rabbits in doses large enough to allow for the demonstration of lead in the tissues, and then whether the claim that such lead is concentrated in neoplastic tissues could be substantiated at electron microscopic level. In these short-term experiments, the particulate lead appears to be concentrated in the reticulo-endothelial cells, whether fixed or free, in the liver, spleen, and bone marrow. Eight references are given.

-- Public Health Eng. Absts.

- 870 Biliary Excretion of Lead in the Rat. N. Castellino, P. Lamanna, and B. Grieco. Brit. J. Ind. Med. 23, 237-239 (July, 1966).

Studies have been made in the rat of the elimination of Pb-210 in the bile after the intravenous injection of 100 micrograms of lead. Four groups of rats were used: in two the bile was drained by cannulation of the bile duct, and in the other two the bile flow to the duodenum was interrupted by ligation or division of the bile duct. The radioactivity of the bile, of the intestinal walls, and of the intestinal contents and feces was determined. The results showed that lead is eliminated from the liver mainly by the bile, thus excluding passage through the intestinal walls into the feces as important under these conditions.

-- Authors' absts.

- 871 Substantiation of the Daily Average Maximum Permissible Concentration of Acrolein in the Atmosphere. M.I. Gusev, et al. Gigiena i Sanit. 31, No. 1, 9-13 (1966). Russian.

In albino rats, a 24-hour poisoning with acrolein vapors at a concentration of 1.52 mg./cu.m. for a period of two months produced a fall in weight, changes of conditioned reflex activity, a decrease of cholinesterase activity of whole blood, a fall of coproporphyrin excretion in the urine, and an increase in the number of luminescent leucocytes in the blood. Acrolein at a concentration of 0.15 mg./cu.m. caused only a rise in the number of luminescent leucocytes in the blood. The daily average maximum permissible concentration of acrolein in the atmosphere is set at a level of 0.1 mg./cu.m.

-- Public Health Eng. Absts.

- 872 Peripheral Neuropathy in Rats Produced by Acrylamide. Pamela M. Fullerton and J.M. Barnes. Brit. J. Ind. Med. 23, 210-221 (July, 1966).

Acrylamide ($\text{CH}_2=\text{CHCONH}_2$) has a number of commercial uses, one of which involves pumping solutions containing acrylamide into soil during mining and tunneling operations in order to render the soil waterproof. It seemed possible that under these conditions men might be seriously exposed to the substance. Tests for its toxicity to experimental animals were therefore undertaken. It was found that acrylamide produces ataxia and limb weakness in rats when given in repeated oral doses of 25 to 100 mg./kg. at various intervals or mixed with the diet in concentrations of 100 to 400 ppm. An electrophysiological and histological study of peripheral nerves has been carried out in chronically poisoned rats. In animals with severe clinical abnormalities, motor nerve conduction velocity in the fibers supplying the small muscles of the hind paw was reduced to approximately 80% of the control value. Histologically, degeneration of axis cylinders and myelin sheaths was found in peripheral nerves, affecting predominantly the distal parts of the longest fibers. When paralyzed animals were no longer given acrylamide, they recovered clinically, conduction velocity returned to the normal range, and there was histological evidence of regeneration of nerve fibers.

- 873 Inhalation Studies on Chloropentafluoroethane. J.W. Clayton, Jr., et al. Am. Ind. Hyg. Assn. J. 27, 234-238 (May-June, 1966).

Dogs, rats, mice, and rabbits were exposed to an atmosphere of 10% chloropentafluoroethane (FREON 115) for 90 exposures of six hours each. Body weight and clinical condition of rodents were unaffected. Rat and dog blood, urine analyses, and urinary fluoride analyses revealed no significant changes. Dog weight gain, temperature, respiration, and pulse were normal. Gross examination, histology, and organ weights of all species revealed no effects attributable to chloropentafluoroethane. An industrial hygienist standard of 1,000 ppm as an eight-hour time-weighted average is suggested. Six references are given.

-- Authors' absts.

- 874 Prognostic Aspects of Benzene Poisoning. S. Hernberg, et al.
Brit. J. Ind. Med. 23, 204-209 (July, 1966).

In 1955, a benzene mass-poisoning was detected in a shoe factory in Finland. One hundred and forty-seven persons were heavily exposed, and more than 100 had abnormal blood counts. One died and ten required hospital treatment. This paper deals with a re-examination of the involved workers nine years later. One hundred and twenty-five persons attended for re-examination. Eight had died, two refused, and 11 could not be located. The possibility of death due to benzene poisoning having occurred among these persons was ruled out by checking the national death register. Each of the subjects underwent a hematological examination which included the hemoglobin value and the erythrocyte, reticulocyte, leucocyte, and thrombocyte counts. A differential count of the leucocytes was also made. A randomly chosen group of 86 persons served as a control group. The thrombocytes of the whole patient group and the erythrocytes of the men were significantly lower than those of the controls, whereas the leucocytes of the whole group and the erythrocytes of the women failed to show any statistical difference. In a multiple discriminant function analysis, considering all three counts at the same time, only the men differed slightly from the controls at the re-examination. The analysis also showed that the prognosis of the severe cases did not differ from that of the mild ones, provided the acute stage had been passed. Some illustrative case reports are added. One patient developed leukemia after a latency of seven years, whereas most of the others—chosen because of grave symptoms in the initial stage—have recovered. The results are discussed from the point of view of prognosis.

-- Authors' abst.

- 875 Detection of 1,1-Dimethylhydrazine by Frustrated Multiple Internal Reflection Spectroscopy. M.J. Prager. Am. Ind. Hyg. Assn. J. 27, 272-277 (May-June, 1966).

The detection of vapors, especially of missile propellant fuel, 1,1-dimethylhydrazine, by frustrated multiple internal reflection (FMIR) spectroscopy was studied. This method is most sensitive to substances with high boiling points; however, it can be used to detect microgram quantities of substances with relatively low boiling points by coating the FMIR plate with a thin adsorptive film or by dissolving the samples in a suitable solvent. Five references are given. -- Author's abst.

- 876 Directory of Pesticides. Anon. Pest Control 34, 53-74 (17pp.) (March, 1966).

A directory of pesticides is given that lists products under their common or trade mark name. The basic manufacturer or advertising formulator is listed for each product along with an index of their addresses.

-- Public Health Eng. Absts.

INDUSTRIAL DUSTS

- 877 Notes on the Modification and Use of a Cascade Impactor for Sampling in Ducts. R. A. Gussman and D. Gordon. Am. Ind. Hyg. Assn. J. 27, 252-255 (May-June, 1966).

Although the cascade impactor has been widely applied to the sampling of gently moving air streams as found in mine shafts or in the open atmosphere, only limited use has been made of it in ducts and stacks. An earlier duct probe design for the cascade impactor has been redeveloped, and a method has been found to prevent deposition of aerosol on the first stage prior to the actual sampling period. A control system has been devised which permits reproducible sampling periods as brief as 0.6 second.

-- Authors' abst.

- 878 Ultrasonic Microscreening. E. Ioos. Staub 25, 540-543 (Dec. 1965). German.

A method for ultrasonic microscreening is reported and a device is described which makes it possible to carry out particle size analyses down to five millimicrons by sieves arranged vertically above one another. A comparison of the results of this particle size analysis with those obtained by sedimentation analysis by Andreasen, and with microphotographs, shows that ultrasonic microscreening permits dust to be investigated or fractionated with regard to its fineness.--APCA Absts.

- 879 Alveolar Clearance: Its Relation to Lesions of the Respiratory Bronchiole. P. Gross, E. A. Pfitzer, and T. F. Hatch. Am. Rev. Resp. Dis. 94, 10-19 (July, 1966).
Reprints Available from Industrial Hygiene Foundation Upon Request.

This paper was presented at the British Occupational Hygiene Society's symposium on "Inhaled Particles and Vapours" at Cambridge, England, September 26-October 1, 1965. The proximal portion of the pulmonary racemus is the most vulnerable portion of the lung inasmuch as the initial attack of irritants seems to concentrate at that site. (In rats, the proximal portion of the pulmonary racemus is composed of the respiratory bronchiole and adjoining alveolar ducts.)

Although this vulnerability was first observed with solid irritants, gaseous, as well as liquid irritants, have also demonstrated a proclivity to localize their primary damage in the proximal portion of the racemus. Because dust deposition and clearance normally take place simultaneously, it is difficult under the usual experimental conditions of inhalation exposure to determine whether dust particles visible on the alveolar surface in the proximal portion of the racemus were deposited there during inhalation or later. Therefore, it is necessary to segregate as completely as possible the clearance process from the deposition of the dust burden. A short-term study of the clearance of various lung dust burdens was conducted in rats, using the inhalation and the intratracheal injection techniques for loading the lungs. Four kinds of dust were used: antimony trioxide, ferric oxide, quartz, and coesite, the last being a crystalline variety of silica different from quartz. It was demonstrated that the proximal portion of the racemus, consisting (in the rat) of the respiratory bronchiole and adjoining alveolar ducts, had a greater concentration of dust, initially, than the more distal regions. At that deposition the dust was situated predominantly upon the surface; but within three to four days, the dust upon the surface of the proximal portion of the racemus had largely disappeared, presumably having been transported to the ciliated epithelium. At the same time, the evaginating alveoli of this region became filled with a considerably greater amount of dust than was present in this region initially. Simultaneously, the dust in the peripheral alveoli became scantier. Stasis in the evaginating alveoli of the proximal part of the racemus may be related to the fact that the respiratory bronchiole is similar to the small end of a large funnel with a possible ratio of surface area to the area drained as small as 1:500. This concept explains the greater vulnerability of the proximal portion of the racemus to inhaled irritants—whether they be solids, gaseous, or liquid.

- 880 Prevalence of Byssinosis and Dust Levels in Flax Preparers in Northern Ireland. P.C. Elwood, et al. *Brit. J. Ind. Med.* 23, 188-193 (July, 1966).

The association between the prevalence of both byssinosis and chronic bronchitis and the level of airborne dust was examined in workers in preparing departments in flax mills in Northern Ireland. A weak association between the dust level and byssinosis was found but not between the dust level and chronic bronchitis. It is suggested that the disparity of these associations may have arisen because the diagnosis of byssinosis, as in most recent published studies, was based on relatively acute and reversible symptoms which are more likely to be closely related to the current dust levels than the slowly developing symptoms on which the diagnosis of chronic bronchitis was based. Furthermore, an association between chronic bronchitis and the dust levels is likely to be obscured to some extent by the effects of other non-industrial respiratory irritants such as tobacco smoke. Some hypotheses of the basic etiology of byssinosis are discussed.

-- Authors' abst.

- 881 Relevance of Respiratory Symptoms and Signs to Ventilatory Capacity Changes After Exposure to Grain Dust and Phosphate Rock Dust. B. Gandevia and B. Ritchie. *Brit. J. Ind. Med.* 23, 181-187 (July, 1966).

Ventilatory capacity was measured before and after exposure to high concentrations of wheat dust in 24 men, 18 of whom were similarly studied while working with calcium phosphate rock. Changes in ventilatory capacity were examined in relation to respiratory symptoms as commonly elicited in occupational surveys, and to the presence or absence of a productive cough on request and under observation. A significant decrease in the forced expiratory volume at one second was observed within half an hour of beginning work in the wheat dust, and this decrease was maintained throughout the work shift. A smaller significant decrease was found on exposure to phosphate rock over several hours, no significant change occurring within the first half-hour. Greater or more consistent decreases were recorded in those men who gave a history of persistent cough and sputum, and more particularly in those who had a productive cough on request, than in those without these features. A history of symptoms on exposure failed to define a group showing any more severe ventilatory reaction on exposure to wheat dust than the average. Some of the factors influencing the history of symptoms in occupational populations are reviewed, and the advantage of an objective sign, as provided by a deliberate cough, is indicated in defining an "abnormal" group within such a population.

-- Authors' abst.

- 882 Pine Pollen Pneumoconiosis in the Rat and Its Relation to Sarcoidosis. C. Göthe. *Acta. Med. Scand.* 178, 375-383 (Sept. 1965).

Female albino rats were injected intratracheally with 20 mg. of ground pine pollen (*Pinus sylvestris*) suspended in 1 ml. of physiologic saline. The animals were sacrificed at 1, 2, 4, and 6 months after administration of the pollen. The weight and the hydroxyproline contents of the lungs were determined, and the tissue reactions in the lungs, and the hilar and paratracheal lymph nodes

were studied. These reactions were characterized by granulomatous changes without significant fibrosis, in which an abundance of Langhans' giant cells and some "foreign-body" giant cells were observed. There was no necrosis. The tissue reaction culminated after one to two months and then gradually decreased. The general condition of the experimental animals was unaffected. Thus, pine pollen pneumoconiosis in rats displayed both morphologic and clinical similarities with human sarcoidosis. It is improbable that a positive connection exists between pine pollen exposure and sarcoidosis. Pine pollen grains, like pollen grains of other coniferous species, are much too large (about 30 by 40 by 70 microns) to penetrate through the bronchioli into the alveoli in quantities that would give rise to a diffuse and significant dissemination of epithelioid cell granulomas in the pulmonary parenchyma and the hilar lymph nodes. The pollen grains of conifers are highly resistant to mechanical damage, desiccation, and other physical influences. However, it is possible that this factor can be disseminated together with pollen grains, e.g., through adhesion to their surfaces. The nature of this hypothetical mechanism is obscure. However, the relation between pollen and fungi is emphasized. Sarcoidosis occurs also in areas that are devoid of coniferous forest vegetation, although the frequency of sarcoidosis appears to be especially high in temperature zones where conifers are dominant in forests. Investigations now in progress show that colonies of fungi of various types can almost regularly be cultivated from newly collected pine pollen.

-- Am. Rev. Resp. Dis. Absts.

- 883 Determination of Coal in Formalin-Fixed Pneumoconiotic Lungs. I. Bergman.
Anal. Chem. 38, 441-444 (March, 1966).

Treatment with hot, glacial acetic acid containing ammonium acetate is a convenient method of digesting formalin-fixed lung tissue. A short treatment with formic acid completes the digestion. This procedure forms the basis of a new method for the quantitative isolation of coal from pneumoconiotic lungs. Even the reactive bituminous coals are recovered in good yield. Minerals such as kaolin and mica are recovered in good crystallographic state; calcifications and iron deposits are removed. Eight references are given.

-- Public Health Eng. Absts.

- 884 Twins With Coal Workers' Pneumoconiosis. J. E. M. Hutchinson.
Brit. J. Ind. Med. 23, 240-244 (July, 1966).

As the tuberculous hypothesis of coal workers' progressive massive fibrosis (PMF) is not so strongly held nowadays the possible importance of genetic factors should be explored. Twins with pneumoconiosis should provide helpful information. Details are given of two pairs of twins; one pair is considered to be monozygotic and the other dizygotic. Blood grouping, secretor state, and Rose Waaler reactions were carried out as the results may help in any comparison with twins with coal workers' pneumoconiosis discovered elsewhere. The brothers resemble each other in having a similar type of pneumoconiosis. The monozygotic pair have a relatively benign type of pneumoconiosis with early PMF which has remained unchanged for eight years; the dizygotic pair show a nodular type of pneumoconiosis which has shown definite progression with an increase in the extent of PMF. As a younger brother of the dizygotic pair also has pneumoconiosis details are included.

-- Author's absts.

- 885 Biochemical Studies of Experimental Lung Fibrosis. I. The Effect of Aerosol Inhalations of Sulfuric Acid on the Course of Experimental Silicosis of Rats. J. Tuma, J. Vyskocil, and M. Dluhos. Scripta Med. Fac. Med. Univ. Brun. Olomuc. 38, (2-3) 85-106 (1965).

Silicosis was produced experimentally in groups of white rats in the course of inhalation of quartz dust, with and without simultaneous exposure to sulfuric acid inhalation. The sulfuric acid was a 50% solution, 80% of the aerosol particles were under 1.4 microns. Histochemical studies were made of the lungs of the animals, at autopsy at unstated periods following inhalation experiments, in relation to changes in the content of connective tissue, concentration of hydroxyproline in the water soluble fraction of proteins, concentration of hexosamine, content of silica and the rate of collagen synthesis. The results of tissue free hydroxyproline in the lungs of the rats at the end of the experiment indicated that its concentration in the group of quartz and aerosol exposed animals was not affected. In the two different groups of rats, either exposed to both dust and aerosol or to aerosol alone, a higher concentration of the tissue free proline was found in comparison with the control group of animals. The effects of aerosol inhalations of sulfuric acid on the course of experimental silicosis, and the mechanism of the synthesis of collagen protein and its localization in the connective tissue structures in the course of lung fibrosis are discussed in some detail.

-- APCA Absts.

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- 886 Cancer of the Lungs and Other Diseases After Exposure to Asbestos Dust. K.F.W. Hinson. Brit. J. Diseases Chest 59, 121-129 (July, 1965).

That exposure to the fibers of asbestos may cause a disabling and fatal fibrosis of the lungs has been recognized for many years. That patients with an established fibrosis (asbestosis) have a high incidence of bronchial carcinoma is also known. During the last few years there has been an accumulation of evidence to suggest that certain pleural or peritoneal tumors may be associated with a slight, and therefore possibly unrecognized, exposure to these minerals. The world production of asbestos has been increasing rapidly since 1959 and its industrial uses are becoming more varied. Three varieties of asbestos are most often used industrially: chrysotile (white asbestos) crocidolite (blue asbestos), and amosite. In Great Britain, exposure to asbestos dust might be to any or all three of the above kinds of asbestos; on the North American Continent it would probably be to chrysotile because of the huge native deposits found in Canada. The author discusses briefly the pathogenesis of asbestos, but dwells much more on the possible relationship of asbestos exposure and pleural tumors and tumors of the peritoneum. He also reviews the literature concerning the probable association between asbestosis and carcinoma of the lungs. Mentioned are the findings of J.G. Thomson and his co-workers (Industrial Hygiene Digest, Abst. 663, July 1963) of the high incidence (26.4%) of asbestos bodies found in the lung fluid of 500 consecutive autopsy subjects in South Africa. One of the authors of the paper on those findings is said to consider that the incidence in Miami, Florida, would be even higher.

-- APCA Absts.

- 887 Asbestos Related Disease. H.L. Hardy. Am. J. Med. Sci. 250, 381-389 (Oct. 1965).

Four cases of asbestos related disease have been briefly described. Together with past and presently accumulating evidence, epidemiologic and experimental, these cases illustrate the potential hazard posed by asbestos exposure to both worker and neighbor. The purpose of this report is to interest clinicians in the harmful biologic effects of asbestos already documented. Evidence is impressive that asbestos exposure, often delayed in effect, will in the future be responsible for an important amount of pulmonary disease, especially chest tumors. In addition new evidence points to asbestos exposure as being significantly associated with abdominal tumors as well.

-- APCA Absts.

- 888 Chemical Studies of Asbestos. J.S. Harington. Ann. N.Y. Acad. Sci. 132, 31-47 (Dec. 31, 1965).

Further chemical studies of the three main types of asbestos, crocidolite, amosite, and chrysotile have been made. The origin of the primary oils associated with crocidolite and amosite has been discussed. By suitable methods 0.32% of extractable material can be removed from crocidolite and 0.28% from amosite. A sample of commercial amosite known to be carcinogenic yielded 0.76% of extractable material. Chemical investigations have been made of the oils from crocidolite and amosite by various techniques. Low levels of polycyclic aromatic hydrocarbons were detected. In addition to the primary oils, asbestos may contain secondary oils derived from contamination or from the intentional application of oil during processing in industry. Up to 80% of the jute oil in the jute bags used for storing asbestos may be absorbed by the asbestos fiber. This could explain why chrysotile, which apparently has no primary oils, may contain, after milling and other industrial treatment, yields of from 0.1 to 0.4%. Insulation materials also contain significant amounts of extractable material. Finally, studies have been made to assess wherever possible, the part which metals and metal complexes may play in the carcinogenic action. --APCA Absts.

- 889 Some Observations of the Dust Content and Composition in Lungs With Asbestosis, Made During Work on Coal Miner's Pneumoconiosis. G. Nagelschmidt. Ann. N.Y. Acad. Sci. 132, 64-76 (Dec. 31, 1965).

In the conclusion of this paper it is said that the most interesting result of this study of lung tissue from asbestosis sufferers, was that in over half the lung tissue samples from Great Britain and South Africa practically no asbestos at all was found irrespective of the grade of fibrosis. It is unlikely that this was due to faulty technique although further study of the technique of recovery of asbestos, especially of chrysotile, from lungs is undoubtedly required. It is likely that this effect—the disappearance of asbestos from the lungs—is real and needs to be explained. The most likely explanation is that asbestos does get dissolved in the lungs. The process of dissolution is likely to start with a removal of the cations, magnesium, sodium, iron, and aluminum, which would leave a skeleton of hydrated silica or polysilicic acid. On physiochemical and structural reasoning one would expect chrysotile to be most easily attacked, crocidolite to be intermediate, and amosite to be the most resistant form. The finding of amosite only in some of the lung residues would be in agreement with such reasoning. The most prevalent type of fibrosis seen in asbestos is a diffuse interstitial fibrosis, in contrast to focal or nodular lesions

found initially in most other forms of pneumoconiosis. At a later stage massive lesions may develop. A theory linking this contrast with lung dust studies has been advanced (Nagelschmidt, 1960). According to this theory the dust remaining in the lungs causes the fibrosis in coal workers and similar forms of pneumoconiosis, and a positive correlation between amount of dust and severity of fibrosis or x-ray category of simple pneumoconiosis is found. The amounts of dust in the lungs are large and may average 50gm. for advanced stages of coal workers pneumoconiosis. In diffuse interstitial fibrosis, as seen mainly in aluminosis and asbestosis, this does not seem to be the case; the amounts of asbestos found in the lung are very small and are not clearly related to grade of fibrosis; dissolution of the dust is the most likely explanation. Similar views with regard to the action of chrysotile have already been expressed. Further research is obviously required before the mechanism by which asbestosis is produced can be said to be known.

-- APCA Absts.

- 890 Asbestos Dust Deposition and Retention in Rats. J.C. Wagner and J.W. Skidmore. Ann. N.Y. Acad. Sci. 132, 77-86 (Dec. 31, 1965).

A method of producing asbestos dust clouds has been devised and an animal inhalation experiment carried out to test it. Observations on the histological distribution of the dusts in the lungs of the rats have shown that the dusts tend to accumulate in the alveoli arising directly from the respiratory bronchioles. The weights of the asbestos dusts found in the lungs of the rats at the end of exposure were found to differ considerably, but the subsequently determined elimination rates indicated that the weights of dust deposited were in a constant ratio with the weights of dust collected by the size-selective sampler. To deposit an equal amount of a nonfibrous dust, allowance must be made for the reduced efficiency of the upper respiratory tract in preventing the penetration of the compact dust particles to the alveolar regions. The elimination rate of Rhodesian chrysotile has been found to be three times greater than that of amosite and crocidolite, which suggests an explanation for the previously observed reduced fibrogenicity of this dust. The reason for the difference in the elimination rate remains to be determined.

-- APCA Absts.

- 891 Experimental Asbestosis With Four Types of Fibers. Importance of Small Particles. P.F. Holt, J. Mills, and D.K. Young. Ann. N.Y. Acad. Sci. 132, 87-97 (Dec. 31, 1965).

The guinea pig lung reacts immediately to inhalation of asbestos dust. There is a bronchiolitis with extension of the inflammatory reaction to the adjacent alveoli. At a later stage there is a widespread and progressive fibrosis of the lung, adenoid proliferation of the bronchiolar epithelium, and reticulosis and fibrosis of the tracheal lymph glands. The inhaled dust early becomes coated with an iron-containing protein to form asbestos bodies. These have been recognized within seven days of exposure to the dust. Fine dust particles, too small to be seen under the light microscope, will produce asbestosis in the guinea pig. The difficulty of controlling the spread of dust has been demonstrated.

-- APCA Absts.

- 892 Quantitative Determination of Chrysotile, Amosite and Crocidolite by X-ray Diffraction. J.V. Crable. Am. Ind. Hyg. Assn. J. 27, 293-298 (May-June, 1966).

The determination of asbestos by x-ray diffraction in environmental samples is described. Evenly distributed mats of asbestos samples on molecular membrane filters are prepared for x-ray diffraction examination. Each asbestos mineral has its characteristic x-ray diffraction pattern. A qualitative scan of a mounted filtered sample identifies the crystalline substances present including the asbestos minerals. A quantitative determination of a given type of asbestos is made by measuring the area under its major diffraction peak and comparing this area with that of a known quantity of an external standard.

-- Author's abst.

RADIOACTIVITY AND X-RADIATION

- 893 Radiation—A Look at the Past and the Present. I.L. Beauchamp. J. Occ. Med. 8, 329-337 (June, 1966).

The 300 years prior to the discovery of x-rays and natural radioactivity were punctuated with scientific breakthroughs that brought the state of scientific knowledge to the point where x-rays were observed by an alert scientist. Following Roentgen's discovery of x-rays and the discovery of radioactivity by Becquerel, the use of radiation expanded rapidly in research and medicine. Many scientists, physicians, and patients were injured because the need for protection and dosimetry was unrecognized. No satisfactory theory had been advanced at the time to explain the nature of x-rays and radioactivity. Several writers surveyed the literature in that early

period and summarized the reported cases of radiation injury. Later, long-term effects of radiation began to appear. Cases of leukemia, aplastic anemia, and cancer, and reduced life spans have been reported within the past three decades. Standards of radiation protection have been promulgated and techniques of dosimetry have been greatly improved. The rate of radiation injury today is significantly less than in the first five years following Roentgen's discovery. Injury rates of the present period have been compared with those of the early period following the discovery of x-rays and radioactivity. It is evident, however, that further progress in the areas of radiation protection, standards of exposure, and dosimetry is required. There are 64 references. -- Author's summary

- 894 Measurement of the Performance of Film Badge Services. D.E. Barber.
Am. Ind. Hyg. Assn. J. 27, 243-251 (May-June, 1966).

A film badge performance test has been devised to generate data sufficiently broad in scope to serve as a basis for control limits to be applied in the periodic examination of film badge services. Irradiation procedures, dosimetry, and a measure of film badge accuracy appropriate to the practical use of film badges are discussed. Approximately 2,000 film badges were irradiated with various types and energies of radiation. Exposures ranged from 2 milliroentgens to 497 roentgens. Private, industrial, and federal suppliers of film badge services (1) helped design the test procedures, (2) submitted badges for exposure (3) reported exposure interpretations, and (4) assisted in determining provisional performance control limits. -- Author's abst.

- 895 A Portable Monitor for the Estimation of Tritium in Aqueous Samples. T.S. Iyengar, et al.
Am. Ind. Hyg. Assn. J. 27, 288-292 (May-June, 1966).

A portable instrument utilizing an ionization chamber for the estimation of tritium in aqueous samples is described. The ionization chamber is filled with acetylene from the test specimen by simple displacement of air. The ionization current resulting from the beta disintegrations of tritium is measured by a sensitive electrometer. The instrument, which is highly useful in field work for checking spot samples of irradiated heavy water, coldstrip air samples, etc., has a fairly linear response over a wide range of specific activity values. The lowest limit of estimation is 0.16mCi/liter, corresponding to a current of 1×10^{-13} ampere. -- Authors' abst.

ENVIRONMENTAL MEASUREMENTS

- 896 A New Tape Reagent for the Determination of Hydrogen Sulfide in Air. J.P. Pare.
J. Air Poll. Control Assn. 16, 325-327 (June, 1966).

The lead acetate paper tape reagent method for the estimation of hydrogen sulfide in air has been reviewed with the conclusions that the colored spots on which the quantitative estimation is based are not stable and do not lend by themselves to accurate results. Although it may be retained for grab sampling work, the lead acetate paper tape reagent is not acceptable as a stoichiometric reagent in any case where long duration sampling periods are concerned like in air pollution studies. A new mercuric chloride paper tape reagent has been developed as a substitute. Due to the fact that the colored spots resulting from the action of hydrogen sulfide on mercuric chloride are sensitive and very stable, this new paper tape reagent is proposed as an adequate and reliable analytical tool for the estimation of hydrogen sulfide in air. Also, a more comprehensive application of the paper tape analytical system is proposed throughout a suitable control of the factor tape retention capacity vs sampling rate which imposes some restrictions in the selection of the practical working range of concentrations. Nevertheless this working range is still wide enough to encompass all the hydrogen sulfide concentrations normally encountered in the city atmosphere. -- Author's abst.

- 897 Limitations of the Lead Acetate Impregnated Paper Tape Method for Hydrogen Sulfide.
H.P. Sanderson, R. Thomas, and M. Katz. J. Air Poll. Control Assn. 16, 328-330 (June, 1966).

Field experience with the lead acetate impregnated paper tape sampler has indicated that large errors may arise in this method due to fading of the color of the precipitated lead sulfide spots. This fading is due to the action of light, sulfur dioxide, ozone, or other substances capable of oxidizing lead sulfide. The moisture content or relative humidity of the air sample must be maintained at an appropriate level to ensure reaction with the impregnated paper tape. The effects of the factors have been investigated in laboratory experiments with known concentrations of hydrogen sulfide. A number of antioxidants were studied in relation to the stability of the resultant spots to light and oxidation. Orthophenyl phenol was found to be the most effective antioxidant for this purpose. A number of necessary precautions to be employed in the use of the lead acetate method are recommended and the limitations are discussed. There are 10 references.

-- Authors' abst.

- 898 A Sampling Anomaly in the Determination of Atmospheric Sulfate Concentration. R.E. Lee, Jr., and J. Wagman. *Am. Ind. Hyg. Assn. J.* 27, 266-271 (May-June, 1966).

Average particulate sulfate concentrations in air as measured from serial short-term samples collected on glass-fiber filters were consistently and significantly higher than those from single long-term samples. In investigating this anomaly, the authors found that significant amounts of extraneous sulfate can be formed on glass-fiber filters, presumably by oxidation of atmospheric sulfur dioxide, thus leading to highly inflated values for particulate sulfate as determined from short-term samples. The discrepancy is reduced with longer-term samples because the formation of sulfate from sulfur dioxide is surface-limited and reaches a saturation level. Four references are given. -- Authors' abst.

- 899 Dynamic Calibration of an Acid Aerosol Analyzer. F.P. Scaringelli, R.E. Boone, and G.A. Jutze. *J. Air Poll. Control Assn.* 16, 310-313 (June, 1966).

A method is described for dynamic calibration of an acid aerosol analyzer based on a commercial modification of the Thomas Autometer and manufactured by the Instrument Development Company. This automated instrument removes acid aerosol from an air stream by sonic impaction, and the sulfuric acid collected is determined conductometrically. An all-glass aerosol generator based on the reaction of water vapor with sulfur trioxide vapor released from fuming sulfuric acid was built for the calibration. Air samples were withdrawn for instrument calibration before and after the concentration of the acid aerosol was determined by titration. The apparent particle size as determined by an Andersen sampler ranged from 2.0 microns to less than 0.68 micron and exhibited a sharp peak with mass median diameter at 1.3 micron in the distribution curve. The size of the aerosol, within certain limits, could be controlled by humidity. Data indicated a linear response with an aerosol collection efficiency of 80% in the important respirable size range. -- Authors' abst.

- 900 Quantitative Determination of Formaldehyde in Gross Impure Mixtures Containing Other Carbonyl Compounds. R.E. Leonard and J.E. Kiefer. *J. Gas Chromatog.* 4, 142-143 (April, 1966).

The increasingly important role of low-boiling carbonyl compounds in the studies of air pollution, vegetable flavoring, cigarette smoke and other gross impure mixtures has emphasized the need for determining these compounds in trace quantities. A new gas chromatographic method for the quantitative determination of formaldehyde is described. It is based on the fact that the relationship of peak height to concentration is linear over a wide range of concentrations for the 2,4-dinitrophenylhydrazine derivative. The method is useful for determining trace amounts of formaldehyde in a gross impure mixture containing low-boiling carbonyl compounds.

-- APCA Absts.

PREVENTIVE ENGINEERING

- 901 Safe Handling and Use of Ethylene Oxide. F.S. Hill, Jr. *J. Am. Soc. Safety Eng.* 11, 11-16 (Aug. 1966).

Safety considerations in the design and operation of a plant using ethylene oxide as a raw material are described in various references in the literature. Most of these references, although very excellent, provide only partial consideration of this problem. This paper is an effort to present a concise, yet complete set of guidelines for handling and use of this large volume organic chemical. The safe use of ethylene oxide is predicated to a large degree upon the engineering and operating skill of personnel. It is dependent upon the observance of safety precautions and adherence to operating and design conditions. The greatest single factor from the standpoint of continuous successful operation over a period of years, however, is thought to be thorough preventative plant maintenance of all equipment, instruments, and accessories. The vigorous application of the following principles of safety control should provide a reliable operation for those using ethylene oxide: Provide equipment and safety accessories that conform to specifications of accepted code authorities. Isolate ethylene oxide operations and eliminate sources of ignition in this area. Outdoor installations are recommended using fire resisting construction with pressurized ventilation and adequate explosion venting for control houses. Avoid explosive mixtures inside all equipment by use of inert gas, and proper control of temperature and pressure. Regularly test and inspect all equipment, instruments, and piping. Corrosion on outside of refrigerated vessels and piping can be serious. Provide diked tank areas, adequate drainage, automatic sprinklers, fire alarms, and sprinkler systems for all storage tank and processing equipment. Educate personnel as to the hazards of ethylene oxide and thoroughly train operators with specific job instructions for processing, handling, and storage of ethylene oxide. Establish

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adequate exits and safe guards for personnel. A dependable operation with completely automatic pressure, temperature, liquid level, and flow control should be provided. Continuous multi-point gas analyzers are recommended for a system of any size. Maintain an efficient fire brigade. This article has not covered personal protective equipment, first aid procedures, shipping regulations and unloading instructions for tank cars or other containers. The Manufacturing Chemists' Association has published manuals which provide adequate information on these facets of operation. Unloading instructions are also available from Chemical Manufacturers, shipping regulations as described in T. C. George's Tariff regulations.

- 902 The Measurement of Leakage of Respirators. J.M. White and R.J. Beal.
Am. Ind. Hyg. Assn. J. 27, 239-242 (May-June, 1966).

Four types of respirators used at Chalk River Nuclear Laboratories were tested for leakage on personnel who frequently wear them during their work. The method involves wearing the respirator in an atmosphere containing submicron particles of sodium chloride then measuring, by means of a flame photometer, the sodium content of the exhaled breath. About 60 full-face and 100 oronasal filter respirators were tested. Smaller numbers of supplied-air masks and the facepieces of self-contained breathing apparatus were also checked. Results indicated that some subjects wearing full-face respirators which they fitted themselves experienced leakage around the facepieces amounting to as much as 5% of the inspired air. Facepiece leakage with oronasal respirators exceeded 20% of the inspired air in some instances. Neither type of air-supplied device leaked significantly as long as the air supply was adequate. -- Authors' abst.

- 903 Determination of Air Flow Into Welding Hoods. J.S. McKarns, et al.
Am. Ind. Hyg. Assn. J. 27, 305-306 (May-June, 1966).

Several methods for determining the air flow into Ruemelin welding hoods were investigated. For most situations, a static probe inserted past the ball joint into the extension will provide a static pressure which can be used for the appropriate coefficient of entry to yield a good approximation of the flow rate. Coefficients of entry were obtained in these studies for a freely suspended hood, that is, the hood was not resting on a table. -- Authors' abst.

- 904 Air Flow Induced in Enclosed Inclined Chutes of Material Handling Systems. C.W. Kruse and W.O. Bianconi. Am. Ind. Hyg. Assn. J. 27, 220-227 (May-June, 1966).

Air entrained within enclosed inclined chutes conveying solid materials may contribute, unless exhausted, to the dispersion of dust in work areas. Quantities of air induced calculated from equations developed from the dynamics of free-falling particles do not compare well with field measurements. A modified form of the theoretical equation including an efficiency factor derived from the geometry of the chute system gives fairly good agreement between computed and observed rates of air flow. A nomogram solution is given to aid the engineer in determining where exhaust will be required and what volume need be exhausted to achieve dust control. -- Authors' abst.

- 905 Design Factors and Use of Ear Protection. C.G. Rice and R.R.A. Coles.
Brit. J. Ind. Med. 23, 194-203 (July, 1966).

The problems of protecting the ear against hazardous noise are the subject of a general review, supported where relevant by data from the authors' own researches. Ear protectors are classified into two main types—plugs and muffs—and the general principles of their function and limitations are stated. Examples of representative ear protectors are given in more detail, with particular respect to their relative merits and pure-tone attenuation characteristics. The effects of ear-plugs on speech communication are considered, and the relationships between pure-tone attenuation and protection against continuous noise are discussed in some detail. The results of temporary threshold shift (TTS) reduction studies of the efficiency of V. 51R and Selectone-K earplugs in protecting against reverberant and non-reverberant impulsive noises are presented. The design requirements of ear protectors and some of the problems created by them are also outlined. -- Authors' abst.

- 906 Long-Distance Pipelines—Shouldn't They Be Safer? F.C. Price.
Chem. Eng. 72, 131-138 (Nov. 22, 1965).

This survey includes irregularities in the construction of a long-distance gasoline pipeline, safety regulations that prevail in natural-gas and products pipe lining industry, and lack of control over pipelines exerted by governmental agencies; what seems to be responsible for several recent failures is the corrosion condition that can develop over a long time period and is difficult to detect; the B-31 code for pressure piping instructs pipeline designers to use a factor for corrosion if corrosion materials are to be handled, but the majority of products transported are judged to be noncorrosive so that no allowance is made. -- J. Am. Soc. Safety Eng. Absts. (modified)

- 907 Second Look at Safety. R. T. H. Wiffin. Grinding & Finishing 11, 38-40 (Oct. 1965).

This paper describes the nature of the grinding wheel; the power and speed, what the grinding machine and grinding wheel manufacturers and operators and their employers must do to assure the safe use of grinding wheels; some important features which must be constantly checked on machine equipment are also discussed. -- J. Am. Soc. Safety Eng. Absts. (modified)

- 908 How to Improve Grinding Wheel Safety. R. T. H. Wiffin. Machinery, N. Y. 72, 77-80 (Dec. 1965).

The author discusses why grinding wheels break; the effect of wheel hole size and three basic reasons why large-hole grinding wheels require much more care in mounting than small-hole wheels; breakage is minimized by correct wheel mounting; the importance of wheel-hole tolerances is stressed; procedures are recommended for establishing regular inspection program to minimize the breakage of grinding wheels. -- J. Am. Soc. Safety Eng. Absts. (modified)

COMMUNITY AIR HYGIENE

- 909 The Air Resource Management Concept. A. N. Heller, J. J. Schueneman, and J. D. Williams. J. Air Poll. Control Assn. 16, 307-309 (June, 1966).

The air resource management concept is an operating principle, feasible in an age of science, that is needed because of the complexities of our communities. This concept is dedicated to obtaining the highest beneficial use of the limited air resource in which we live and work; thus, the optimum degree of air purity for the promotion of the public health and the adequate protection of the welfare and property of the people is assured. This concept also provides a base for organization of tasks so that program directors can perform them with system, purpose, understanding, and a reasonable probability of accomplishment. It endeavors to develop a point of view to identify approaches for finding what should be done, and to describe how to go about doing it. In this way it is hoped that the steps required to achieve and maintain desired air quality for the nation will be taken expeditiously and in an equitable manner. -- Authors' conclusion

- 910 An Air Quality Study in the Vicinity of Lewiston, Idaho, and Clarkston, Washington. D. F. Adams and R. K. Koppe. J. Air Poll. Control Assn. 16, 314-316 (June, 1966).

Average suspended particulate values in downtown Lewiston and Clarkston were approximately 1.6 times above the average suspended particulate loadings in a complex of commercial-industrial-suburban activity of North Lewiston. At the same time the hydrogen sulfide values were usually higher in North Lewiston than at the downtown sites. Dustfall ranged from 7.4 to 315.4 tons/sq. mile per month above background. Distribution of the dustfall components indicated a multiplicity of dust sources, including high background levels attributed to airborne soil particles from adjacent farm land. The heavy dustfall in the downtown commercial areas of Lewiston and Clarkston contained a high percentage of self-generated material not related to a specific industrial source. Conversely, greater quantities of sodium and sulfate were found in the North Lewiston dustfall than elsewhere and were probably related to pulp production. Substantially higher levels of suspended particulates and dustfall (loss on ignition fraction) were found during the heating season. The lead peroxide candle "sulfation" rate showed that a significant part of the sulfur content of the air came from multiple community sources including comfort heating, vehicular travel, and waste disposal. Two weather conditions were associated with increased ground-level concentrations of pollutants—low-level nocturnal inversions and synoptic, stagnating air masses. Increased air stagnation also contributed to the higher gaseous and particulate levels during the heating season. -- Cond. from authors' summary

- 911 Characterization and Estimation of n-Alkanes in Airborne Particulates. S. P. McPherson, E. Sawicki, and F. T. Fox. J. Gas Chromatog. 4, 156-159 (April, 1966).

The materials and methods for the collection of airborne particulates, extraction and benzene-soluble fractions from the particulates, and separation of aliphatic fractions from these benzene-solubles have been described. A system for the characterization and analysis of atmospheric n-alkanes, C₁₅ to C₂₈ is presented. Several atmospheric samples obtained from Nashville were analyzed for these compounds. Their importance is derived from their reported co-carcinogenicity. The carcinogenic activity of polycyclic hydrocarbons in the atmosphere may be enhanced by the presence of airborne n-alkanes, and such relations have been drawn for tobacco smoke. -- APCA Absts.

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- 912 Contaminants in Flue Gases—And Methods for Removal. E.K. Diehl and E.A. Zawadzki. Coal Age 70, 70-74 (Dec. 1965).

Some of the products formed from the combustion of coal are harmless and of no concern as atmospheric pollutants; others are of immediate concern, particularly oxides of sulfur; three promising dry processes for removal of sulfur from flue gases are under investigation; explanations and schematics of processes are included. -- J. Am. Soc. Safety Eng. Absts.

- 913 Control of Photochemical Smog by Alteration of Initial Reactant Ratios. W.J. Hamming and Janet E. Dickinson. J. Air Poll. Control Assn. 16, 317-323 (June, 1966).

This paper is an endeavor to show how several experimenters have quite closely equaled the results of the other, and how the results from these various laboratories can, by a change of coordinate system, be related to each other in a systematic manner. Only after demonstrating where the Los Angeles Civic Center atmosphere is in relation to these coordinates and the contours, or gradients of these various effects, eye irritation and oxidant, is it possible to predict the photochemical effect of a reduction of olefins (hydrocarbons) or the reduction of nitric oxide. In addition, a study of the variation in eye irritation with irradiation time, demonstrates that the time at which eye irritation measurements are taken is important in understanding the entire photochemical mechanism underlying the "smog" problem in the summertime in Los Angeles. There are 23 references. -- Authors' abst.

- 914 Air Pollution in Alberta. S.L. Dobko. Can. J. Public Health 57, 84-86 (Feb. 1966).

Industrial expansion that increased the pollution levels, especially in the oil and gas industry, brought about the need to formulate regulations to control air pollution. These regulations state that all new industry must submit plans and specifications that affect contaminants. The submissions are reviewed as to the emissions and written approval is given when all standards are met. Follow-up assessments are made by actual measurements of emissions. Monitoring for smoke, hydrogen sulfide, and sulfur dioxide, dustfall, and suspended particulates is carried out, and yearly reports are compiled on the complete network of stations. --Public Health Eng. Absts.

- 915 Air Pollution Abatement in the Ceramic Industry. M. Bozsini. J. Air Poll. Control Assn. 16, 332-333 (June, 1966).

Air pollution abatement has been a constant concern for the ceramic industry over the last four decades. The multiplicity of materials involved, numbering in the hundreds of fluxes and refractories for the manufacture of many different types of glasses, results in gaseous as well as particulate reaction products. Methods of abatement through various means have been developed and are in use in the United States and world-wide today. -- Author's abst.

- 916 Prospects for Reducing Particulate Emissions from Large Incinerators. E.R. Kaiser. J. Air Poll. Control Assn. 16, 324 (June, 1966).

Conventional types of municipal incinerators generate enormous quantities of stack gas because of high excess air and high temperatures. Under these conditions the size and cost of equipment to clean the flue gas to low dust contents are large. By burning the refuse in boiler furnaces at low excess air, and generating steam, the volume of flue gas to be cleaned is reduced to a minimum. Where high efficiency of flue-dust collection is required, steam generation from refuse firing permits a major saving on the cost of dust collection. -- Author's abst.

MANAGEMENT ASPECTS

- 917 Legal Aspects of Industrial Immunization Programs. J.S. Felton and D.P. Discher. J. Occ. Med. 8, 307-312 (June, 1966).

The administration of immunizing injections is a practice common to most occupational health services, although the number and the variety of such injections and the rationale for such a program will vary. A review of pertinent cases points to a legal consensus of compensability for injury or death, subsequent to the receipt of an injection provided by the employer, irrespective of the voluntary nature of the program, the waiving of prospective claims by inoculated employees, or the absence of a formal employer-employee contractual agreement in regard to hiring. Undergoing possible change is authoritative opinion relative to employer action in compliance with state law requiring inoculations of certain employees. The belief is offered that these cases will not

be adjudicated differently in the future from the present system of ruling on injuries resulting from other immunizing injections. Extreme care should be exercised in the technique of inoculation and in the preinjection determination of the employee's sensitivity to specific biologic agents. Physicians and nurses in the occupational health field must re-examine and select the indications they use for conducting immunization programs—the exercise of general or special public health practice or the prevention of morbidity in workers occupationally exposed to communicable disease, and at greater risk than the public at large. There are 18 references.

-- Authors' summary

- 918 The Nature of Loss Prevention. E.E. Adams. J. Am. Soc. Safety Eng. 11, 17, 20 (Aug. 1966).

In business there are two basic sets of circumstances out of which losses can arise, the circumstances of uncertainty and the circumstances of risk. The circumstances of uncertainty are entered as a result of conscious management decision in the pursuit of profit, but always involving the possibility of loss. Uncertainty is characterized by a complete inability to forecast what will happen regardless of the amount of past experience. The classic example is the introduction of a new product. Risk bearing, out of which losses also arise, differs radically from uncertainty bearing. Unlike uncertainty, the results of risk are predictable. This predictability renders risk insurable. If enough risk bearers pool their funds, there will be sufficient available to cover the losses of the one in the group who experiences the incident. Risk can be reduced to certainty by pooling experience, uncertainty cannot and is therefore uninsurable. Risk is always borne involuntarily and it offers no hope of gain to anyone involved. The most common results of risk are broadly referred to as accidents, although other types, such as employee dishonesty, do occur. The general term accident would include fires and explosions, vehicle accidents, personal accidents, error situations resulting in equipment damage, and even such natural phenomena as tornadoes, floods and earthquakes. Loss prevention is specifically directed toward the elimination and reduction of risk to the maximum degree and by the most positive means economically justifiable. This involves problems in risk identification. In this, the plant safety committees, supervisors' injury investigations and accident reports, the engineering services of insurance carriers, and even individual employee suggestions are all important. Inspection and investigation are key techniques. Evaluation is often a more difficult problem than identification. How great is the risk and how urgent is the need for taking action? These are management considerations. Sometimes consideration is postponed in the optimistic belief that it "can't happen here." Through accident statistics and analyses it can not only be shown that it can happen, it is happening. Evaluation is frequently a critical problem for the loss prevention specialist. The often-heard complaint that management is not interested has its roots in this area. If the energy that has been devoted over the years to the preparation of articles, and giving of speeches, on the need for management support, had been directed instead to the problem of proper evaluation, the entire loss control effort would be much further advanced.

ACCIDENTS AND PREVENTION

- 919 The Safety of Physically Disabled Drivers. L. Ysander. Brit. J. Ind. Med. 23, 173-180 (July, 1966).

Four hundred and ninety-four disabled drivers, the majority with loss of function in the legs usually as the result of poliomyelitis or amputations, have been studied with respect to the frequency of traffic accidents and serious traffic offenses during a ten-year period. Traffic accidents which may have been caused by their disability occurred in only three (0.6%) of the total number of drivers investigated. In all three cases the driver had loss of function in the right leg. A comparison was made between the investigation series and a control series identical as regards sex, age, and license-holding period but with a shorter exposure to traffic than the investigation series. The frequency of traffic accidents amounted to 7.1% in both series, and the frequency of serious traffic offenses was 12.2% in the investigation series and 14.8% in the control series. Disabled drivers are not an increased hazard in traffic. The compensatory technical modifications to the vehicle which are generally adopted appeared to be adequate. However, there was a relatively increased frequency of accidents among drivers with loss of function in the right leg or right arm. An improvement of the technical modifications applied in these cases might result in a further reduction of the road-safety risks.

-- Author's abst.

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