



# **HYDROCARBONS AND AIR POLLUTION: AN ANNOTATED BIBLIOGRAPHY**

**Part II. Categories F to M and Indexes**

**U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
Public Health Service  
Environmental Health Service**

# **HYDROCARBONS AND AIR POLLUTION:**

## **AN ANNOTATED BIBLIOGRAPHY**

### **PART II**

Office of Technical Information and Publications  
Air Pollution Technical Information Center

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
Public Health Service  
Environmental Health Service  
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The AP series of reports is issued by the National Air Pollution Control Administration to report the results of scientific and engineering studies, and information of general interest in the field of air pollution. Information reported in this series includes coverage of NAPCA intramural activities and of cooperative studies conducted in conjunction with state and local agencies, research institutes, and industrial organizations. Copies of AP reports may be obtained upon request, as supplies permit, from the Office of Technical Information and Publications, National Air Pollution Control Administration, 1033 Wade Avenue, Raleigh, North Carolina 27605.

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## F. EFFECTS - HUMAN HEALTH

00084

G.J. Doyle, N. Endow, J.L. Jones

SULFUR DIOXIDE ROLE IN EYE IRRITATION. Arch. Environ. Health, Vol. 3:657-667, Dec. 1961.

An eye-irritation panel was exposed to steady-state reaction mixtures generated in a 520 cu. ft. irradiated stirred-flow Reaction chamber. The reactants for one set of exposures were usually 0.2 to 2.0 ppm by volume of olefins and NO<sub>2</sub> in purified air. Reaction residence times ranged from 1 to 2 hrs. SO<sub>2</sub> was used as an additional reactant (at a concentration of about 0.1 ppm) in a comparable set of experiments. The reacting mixtures were evaluated for relative eye-irritating ability, with and without SO<sub>2</sub>. Aerosols derived from the co-photo-oxidation of SO<sub>2</sub> and from SO<sub>2</sub> itself probably have little effect on the eye-irritating ability of irradiated reaction mixtures. The net effect of the addition of SO<sub>2</sub> to the olefin reaction mixtures is a slight decrease in eye irritation accompanied by the appearance of an aerosol. Trace concentrations of branched internal olefins, specifically 2-methyl-2-butene, and of a cyclic olefin, cyclohexene, can produce significant amounts of irritants other than formaldehyde and acrolein. While no conclusions on the identity of these irritants can be drawn from the data, it is speculated that they may be compounds of the PAN type and/or reactive or unstable reaction intermediates. The use of dynamic (stirred-flow) conditions considerably enhances the sensitivity of subjects to the irritants. Indications are that small changes in the flow field about a subject's eyes may have large effects on response to the irritants in the flowing air. Adding isobutane, a branched-chain paraffin having a tertiary hydrogen atom, to a photooxidizing isobutylene-NO<sub>2</sub> mixture produced no significant effect, either on the course of the reaction or on the eye irritation. This finding held true both with and without SO<sub>2</sub>. A small decrease in eye irritation was experimentally observed, but there are not sufficient data to demonstrate that this effect is statistically significant. The rate of response to an eye irritant is a function of the chemical nature of the irritant or irritants. Ethylene and propylene, olefins important in auto exhaust, can produce significant eye irritation at realistic atmospheric concentrations.##

00096

K.C. Back, A.A. Thomas, C. Sandage

DEVELOPMENT OF SPACE CABIN TOLERANCE CRITERIA TO TRACE CONTAMINANTS. Biomedical Lab., Wright-Patterson AFB,

Ohio, and Midwest Research Inst., Kansas City, MO. (MRL Memorandum M-3.) (Presented at the 33rd Annual Meeting, Aerospace Medical Association, Atlantic City, N.J., April 1962.) 9pp.

CFSTI, DDC: AD 276202

This report reviews the problems encountered when attempting to establish criteria for space cabin environments. Space cabin engineers have used speculative figures derived from Industrial Threshold Limit Values (TLV for tolerable contaminant concentration levels. Values of 10ppm (by vol.) are cited for CO, H<sub>2</sub>, CH<sub>4</sub> and paracresol; 50 ppm are cited for H<sub>2</sub>S, indole, skatole, NH<sub>3</sub> and methyl mercaptan. The TLV criteria were designed for use for 8 hr. exposures for a 5-day work week over a 30-yr. span and extrapolation for longer continuous exposure is not necessarily valid. To test the validity of such extrapolations, the physiological changes in animals have been studied during 90-day continuous exposures to the various toxic vapors and gases listed: Results have proven that the TLV criteria cannot be used for long term exposure. There are apparently physiological actions and interactions between different contaminants which may be categorized as additive, synergistic or possibly antagonistic. Also, some animals appear to have a tolerance for these contaminants.##

00174

H. Heimann (Ed.)

AIR POLLUTION RESEARCH PLANNING SEMINAR (PROCEEDINGS).  
Public Health Service, Cincinnati, Ohio, Division of Air  
Pollution. Dec. 20, 1956. 183 pp.

This document contains discussions of various participants in the seminar which reviewed the trends of air pollution research. Research results, interpretations, theories, and programs are discussed.##

00176

B. M. Abel and R. B. Talbot

IN VITRO PULMONARY COMPLIANCE AND PHYSIOPATHOLOGY OF GUINEA PIG LUNGS EXPOSED IN VIVO TO GADOLINIUM OXIDE DUST. Iowa State Univ. of Science and Tech. Ames, Coll. of Veterinary Medicine. Inst. for Atomic Research (Rept. No. COO-1170-7.) June 1965. 77 pp.

Seventy-two guinea pigs were divided into three groups of twenty-four each. Each group consisted of twelve control guinea pigs, and twelve pigs exposed to an aerosol of 20 mg. of gadolinium oxide per cu M of air for periods of 240, 480, and 820 exposure hours. After the exposure period, the lungs were removed and compliance measurements made. Analysis of the data by a three-way factorial analysis revealed a significant interaction

between the treatment and duration of exposure factors. Further analysis for trend disclosed a highly significant linear trend with time in the exposed groups. Histopathological changes in the exposed groups, and the amount of deviation from control lung tissue presuppose a difference in functional ability between the two groups. The histopathological changes included alveolar cell hypertrophy, septal cell thickening, lymphoid hyperplasia, and macrophage formation. (Authors' abstract)##

00195

P. Kotin and H. L. Falk

ATMOSPHERIC CARCINOGENS. Southern California Univ., Los Angeles, School of Medicine. 1966. 6 pp.

A critical review of the data relating to the role of carcinogenic polycyclic aromatic hydrocarbons reflects virtual unanimity that within the limits of current knowledge these agents alone are unlikely to be the exclusive or necessarily the primary factors in the initiation of bronchogenic carcinoma. This presentation, therefore, will attempt to cover a broader area. The discussion of carcinogenic agents in polluted air as distinct chemical and physical entities is perhaps proper, but from a biological viewpoint it is a misleading oversimplification to assume that their potential effect is independent of the action of numerous exogenous and endogenous factors. While the remarks will be limited to atmospheric carcinogens because of the theme of this conference, it will be emphasized that the principles developed during the discussion, if valid, should be applicable to several environmental sources suspected of being etiologically concerned with lung cancer. (Author)##

00210

A. S. Josephson

IMMUNOLOGIC RESPONSE TO THE NITRO-OLEFINS. Preprint. 1965.

The conjugated nitro-olefins have been shown to be effective agents in provoking the delayed contact reaction in guinea pigs. Studies of a variety of substituted and unsubstituted, saturated and unsaturated hydrocarbons indicate that only the conjugated, nitro-substituted compounds are sensitizers. Examination of cross-reactivity between nitro-olefins of differing chain length indicates specificity of the contact reactions dependent upon the size of the haptenic moiety. (Author's abstract)##

00259

H. E. Landsberg

WEATHER AND DISEASE. Environmental Science Services

Administration, Washington, D.C., Weather Bureau.  
(Technical Note 33-EDS-1) (REF. NO. 1) FEB. 1966. 7 PP.  
CFSTI

The atmospheric environment can cause sunburn, heatstroke, and frostbite. Air pollution may provoke or aggravate asthma. Weather changes often influence scar and arthritic pains. There are suspicions that the course of respiratory and certain heart ailments is influenced by atmospheric conditions. Indirectly, through influences on disease vectors, the climate plays a role in tropical diseases. Favorable climatic conditions, on the other hand, may alleviate the symptoms of various diseases.  
(Author's abstract)##

00281

H. Heimann, L. O. Emik, R. A. Prindle, and W. M. Fisher

PROGRESS IN MEDICAL RESEARCH ON AIR POLLUTION. Public Health Rept., 73(12):1055-1069, Dec. 1958. (Presented at the National Advisory Committee on Air Pollution, Cincinnati, Ohio, Aug. 28, 1958.)  
GPO: 3303

For 3 years the Air Pollution Medical Branch of the Division of Special Health Services has been working in the increasingly more important but relatively unexplored field of air pollution in its specific relation to human health. The work began with a search for and a systematic appraisal of the scattered sources of knowledge, followed closely by tentative explorations into those parts of the problem holding promise of significant findings. Sufficiently successful results of initial activities helped chart the present course of action, which, in turn, points toward ideas requiring emphasis in the future. (Authors' abstract)##

00308

H. Heimann

EFFECTS OF AIR POLLUTION ON HUMAN HEALTH. World Health Organization Monograph Ser., No. 46 (Air Pollution), p. 159-220, 1961.

As one chapter of a WHO Monograph on "Air Pollution," this paper covers the state of knowledge and world trends in research on the effects of such pollution on human health. The acute air pollution episodes in the Meuse Valley, Donora, London, and Poza Rica are reviewed. Data, causes, and effects for each episode are discussed. The symptoms of illness and organic and systemic effects resulting from major pollutants such as carbon monoxide, sulfur and nitrogen oxides, ozone, beryllium, fluorides, aeroallergens, carcinogens and pesticides are described. Further research to demonstrate that specific pollutants or combinations thereof can cause ill health is urged in order to obtain data to balance health effects against economic aspects for the purpose of clearing the air. The maximum allowable concentrations for community air, published by

the Russians, are considered inadequate to solve the air pollution problem. However, studies already made of the effect of low-level concentrations have been used as a base, despite controversy, to reduce pollution in many locations.##

00310

P. J. Lawther, A. E. Martin, and E. T. Wilkins

EPIDEMIOLOGY OF AIR POLLUTION (REPT. ON A SYMPOSIUM).  
Public Health Papers, No. 15, 1962, 32p.

This symposium held in Copenhagen in December 1960, was attended by participants from fourteen European countries. Although in some areas current methods of control are resulting in cleaner air, in others air pollution is increasing both in the chemical complexity of its composition and in the extent of the areas affected. Motor traffic is the cause of growing anxiety in many areas because of the emission of carbon monoxide, of lead compounds, and of polycyclic hydrocarbons with suspected carcinogenic properties. Air contaminants are also discharged in wide variety in many chemical and other industrial processes and may be responsible for local problems of a specialized character. The Symposium, however, was primarily concerned with the general pollution of urban areas resulting from the use of domestic and industrial fuels, of which the most frequently used indices are dustfall, suspended matter, and sulfur dioxide. (Author)##

00429

A. A. Thomas

LOW AMBIENT PRESSURE ENVIRONMENTS AND TOXICITY. Arch.  
Environ. Health Vol. 11:316-322, Sept. 1965.  
CFSTI, DDC: AD 628 566

A unique inhalation exposure facility has been built to study the effects of low atmospheric pressure and oxygen-rich atmospheres on the characteristics of truly uninterrupted, long-term, continuous exposure to toxic chemicals. The first experiments reported herein include exposure of a large number of mice, rats, dogs, and monkeys to graded doses of ozone, nitrogen tetroxide, and carbon tetrachloride in a 100% oxygen atmosphere at 5 psi pressure for 2 weeks duration. Further, a 90-day exposure to 5 psi 100% oxygen of a similar animal complement is also reported. Biochemical and enzymatic changes related to toxic exposure are discussed together with the future experiments planned for this facility.##

00473

F.G. Hueter, G.L. Contner, K.A. Busch, R.G. Hinners

BIOLOGICAL EFFECTS OF ATMOSPHERES CONTAMINATED BY AUTO EXHAUST.  
Arch. Environ. Health 12, 553-60, May 1966. (Presented at

the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965.)

This report represents a status summary of the biological results obtained from the chronic exposures of experimental animals to various concentrations of irradiated and nonirradiated auto exhaust for periods of 6 weeks to 23 months. The chronic exposure of experimental animals to various concentrations of irradiated and nonirradiated auto exhaust-air mixtures resulted in significant biological effects indicating the following: irradiated auto exhaust (1) increases the susceptibility to pulmonary infection and chronic disease during the latter half of the animal's lifetime, and (2) markedly decreases mouse fertility and decreases the survival rate of infant mice; both raw and irradiated auto exhaust cause a stress and adaptation response in mice as measured via spontaneous activity, increase bone lead concentrations, and increase the amount of nonfunctional or abnormal lung tissue. No experimental atmospheric effects were observed concerning: mortality; histopathology; growth-bodyweight; immunology; hematology restricted to erythrocyte count, erythrocyte cell size distribution, hematocrit or hemoglobin concentration; blood O<sub>2</sub> and CO<sub>2</sub> values; oxygen consumption; or pulmonary function in relation to permanent impairment. Further studies are indicated to elucidate more fully the affected biologic parameters.##

00499

M. Corn and G. G. Burton

THE CONCENTRATION AND DISTRIBUTION OF IRRITANTS IN POLLUTED ATMOSPHERES. Preprint. (Presented at the American Medical Association Air Pollution Medical Research Conference, Los Angeles, Calif., Mar. 2-4, 1966.)

Consideration of maximum recorded U.S. concentrations of single gaseous or particulate pollutants indicated that alterations in airway resistance and lung compliance in animals or man have not been demonstrated after inhalation of single irritants at these concentrations. At this time it is difficult to speculate on the acute or chronic changes produced, if any, in these functional measurements by inhalation of complex mixtures of low concentrations of individual irritants. Certainly, eye irritation demonstrates that effects which are not predictable on the basis of the action of a single irritant are produced by mixtures of irritants. Airborne particulate irritants should be assessed with respect to aerodynamic particle size, because (1) chemical composition of particles has been demonstrated to vary with size and (2) only certain particle sizes present in polluted atmospheres are capable of reaching receptors after inhalation by man. Among the defects of present routine sampling methodologies are: (1) size distribution of sampled particles is not known; (2) the optimum density of sampling stations for the procurement of reliable results is unknown, and (3) the irritant potential of pollutant mixtures is not taken into account when single pollutants are evaluated. (Author summary)##

E. Sawicki

AIRBORNE CARCINOGENS AND ALLIED COMPOUNDS. Preprint.  
Arch. Environ. Health 14(1):46-53, Jan. 1967. (Presented  
at the American Medical Association Air Pollution  
Medical Research Conference, Los Angeles, Calif., March  
2-4, 1966.)

The billionfold range in concentrations of some of the known components of the urban atmosphere is presented. The variation is from  $6 \times 10$  to the 8th power micrograms/1000 cu.m for CO<sub>2</sub> to 0.2 micrograms/1000 cu.m for dibenz(a,h)acridine. A wide variety of large organic compounds are found in the urban atmosphere. Some of the families of compounds which have been identified include n-alkanes, proteins, aromatic hydrocarbons, aza heterocyclic compounds, imino heterocyclic compounds, polynuclear carbonyl compounds, quinones, acids, and phenols. Four types of carcinogens have been found in the urban atmosphere. These include polynuclear aromatic hydrocarbons, polynuclear aza heterocyclic compounds, polynuclear imino heterocyclic compounds (in air polluted by coal-tar-pitch fumes), and polynuclear ring carbonyl compounds (carcinogenicity needs confirmation). The presence of alkylating agents in the aliphatic and other fractions of airborne particulates indicated the probable presence of mutagens and other as yet unisolated types of carcinogens. The number and type of carcinogens found in the atmosphere indicate that attempts to correlate carcinogenicity of the mixtures in our chemical environment with the concentrations of benzo(a)pyrene are probably naive in most cases, and spring from lack of knowledge of the composition of the mixtures. In the same way, not much can be said about the anticarcinogens and co-carcinogens in the atmosphere until the composition of environmental mixtures is better understood. (Author abstract)##

00622

A.P. Altshuller, D. Klosterman, P.W. Leach, and  
J. E. Sigsby, Jr.

THE IRRADIATION OF SINGLE AND MULTI-COMPONENT HYDROCARBON -  
AND ALDEHYDE - NITRIC OXIDE MIXTURES IN AIR UNDER DYNAMIC  
AND STATIC FLOW CONDITIONS. Preprint. 1964.

An investigation has been made of the chemical, aerosol plant damage, and eye irritation effects of irradiating various single hydrocarbon - aldehyde or multi-component hydrocarbon - NO systems under dynamic flow conditions. The systems investigated included the following individual hydrocarbons which were irradiated in the presence of NO (and traces of NO<sub>2</sub>): ethylene, 1-butene, 1,3-butadiene, toluene, xylene, and 1,3,5-trimethylbenzene, n-hexane, 3-methylpentane, 2,4,4-trimethylpentane, and cyclohexane. Mixtures of hydrocarbons including ethylene and 1-butene; ethylene, 1-butene, and trans-2-butene; and ethylene, 1-butene, trans-2-butene, and mixed xylenes also were irradiated in the presence of nitrogen oxide in air. In addition the photooxidation of the formaldehyde - oxygen,



propionaldehyde - oxygen, formaldehyde - NO and propionaldehyde - NO systems were investigated. In these dynamic irradiation experiments the 4 paraffinic hydrocarbon - NO systems produced neither oxidant nor plant damage. In all of these systems NO was only partially converted during irradiation and NO<sub>2</sub> did not peak. When 0.5 ppm of ethylene, 0.5 ppm of an ethylene - butene-1 mixture, or 0.5 ppm of xylene was irradiated with 1 ppm of NO no net oxidant and no plant damage occurred. At ethylene or toluene concentrations between 3 and 6 ppm with 1 ppm of NO, irradiation produced oxidant but no plant damage of either the ozone or PAN type. Many of these mixtures did react somewhat with the disappearance of part of the hydrocarbon and the formation of significant yields of formaldehyde or aliphatic aldehydes. Propionaldehyde when irradiated in the presence of small traces of nitrogen oxides produced severe plant damage. (Author abstract)##

00630

W. B. Deichmann, W. E. MacDonald, K. F. Lampe, I. Dressler, and W. A. D. Anderson

NITRO-OLEFINS AS POTENTIAL CARCINOGENS IN AIR POLLUTION. Ind. Med. Surg. Vol. 34:800-807, Oct. 1965. (Presented at the 23rd International Congress of Physiological Sciences, Tokyo, Japan, Sept. 1-9, 1965.)

The 21 possible linear, internally conjugated nitro-olefins having from four to nine carbon atoms were synthesized and their pharmacological and physicochemical properties studied. The eye-irritating properties of three representative nitro-olefins were investigated in a joint study with members of the staff of the Los Angeles County Air Pollution Control District. The acute toxicity of each of the compounds was investigated by inhalation, oral, intraperitoneal, and cutaneous routes, using rabbits, guinea pigs, rats, mice, chicks and dogs. The subacute inhalation toxicity of each of four nitro-olefins representative of the series was studied, using rabbits, guinea pigs, rats and mice. Nitro-olefins were identified in the exhaust of a one-cylinder, four-cycle internal combustion engine. When isobutylene was used as fuel, 1-nitro-2-methyl-1-propene were produced. When 3-hexene was used, 3-nitro-3-hexene was identified in the exhaust. (Author summary)##

00638

P. A. Kenline

OCTOBER 1963 NEW ORLEANS ASTHMA STUDY. Arch. Environ. Health Vol. 12:295-304, Mar. 1966.

This paper reports on aerometric activities carried out in New Orleans from Oct. 3 through Nov. 5, 1963. The objectives of these activities were to establish any difference in air quality between asthma outbreak days and other days, evaluate geographic and temporal variation in pollution characteristics, and evaluate various uncommon methods of measuring air pollution. (Author abstract)##

00639

M. B. Gardner

BIOLOGICAL EFFECTS OF URBAN AIR POLLUTION. III. LUNG TUMORS IN MICE. Arch. Environ. Health Vol. 12:305-313, Mar. 1966.

This paper reports the long-term effect of inhaling Los Angeles ambient air upon the incidence of lung adenomas in several inbred strains of mice. Despite the absence of histopathologic evidence for any specific acute effect related to ambient air pollution in the experimental mice colonies, the statistical evidence of this study indicates a strong likelihood that ambient Los Angeles atmosphere does possess a definite though slight activity in promoting pulmonary adenomatous tumors in aging inbred mice. These findings offer further evidence that some lung tumorigenic activity does exist in the indigenous respiratory environment.##

00658

F.L. Estes, C.H. Pan

RESPONSE OF ENZYME SYSTEMS TO PHOTOCHEMICAL REACTION PRODUCTS. Arch. Environ. Health Vol. 10(2):207-212, Feb. 1965. (Presented at the Seventh Annual Air Pollution Medical Research Conference, Los Angeles, Calif., Feb. 10-11, 1964.)

Exposure to photochemical reaction products inhibited the activity of glutamic dehydrogenase from *Escherichia coli*. With a glutamate substrate the inhibition increased at a rate comparable to the inhibition of the growth of the cells. Considerably less inhibition was observed for the reaction in the reverse direction. With increasing formaldehyde concentrations, the reaction of glutamic dehydrogenase from mammalian source was more rapidly inhibited in the reverse than in the forward direction. From the data to date, it appears that only at very low concentrations could formaldehyde produce the relationship of the reactions observed with the photochemical reaction products. There is no evidence, however, that such concentration would produce comparable magnitudes of inhibition with time. (Author summary)##

00663

S.E. Epstein

PHOTOACTIVATION OF POLYNUCLEAR HYDROCARBONS. Arch. Environ. Health Vol. 10(2):233-239, Feb. 1965. (Presented at the Seventh Annual Air Pollution Medical Research Conference, Los Angeles, Calif., Feb. 10-11, 1964.)

This review presents some incomplete studies having three principal objectives: (1) to study photodynamic mechanisms as a parameter of activity of polynuclear carcinogens; (2) to determine the nature of the correlation existing between photodynamic and carcinogenic activities in the class of polynuclear compounds;

and (3) to determine whether the degree of photodynamic activity of crude organic mixtures, such as air pollutants, could provide a useful and rapid biological measure of presumptive carcinogenic hazard to man, attributable to polynuclear compounds. Prior to separate consideration of these three objectives, the basic techniques used in these studies were briefly described.##

00664

T.T. Crocker, B.I. Nielsen, I. Lasnitzki

CARCINOGENIC HYDROCARBONS (EFFECTS ON SUCKLING RAT TRACHEA IN ORGAN CULTURE). Arch. Environ. Health Vol. 10(2):240-250, Feb. 1965. (Presented at the Seventh Annual Air Pollution Medical Research Conference, Los Angeles, Calif., Feb. 10-11, 1964.)

The present report describes organ cultivation of suckling rat trachea and the response of this tissue to exposure to three known carcinogenic hydrocarbons. In some instances, contact with the hydrocarbon was terminated to test either recuperative function of the tissue or persistence of the influence of the carcinogen.##

00750

H.L. Falk P. Kotin

AN ASSESSMENT OF FACTORS CONCERNED WITH THE CARCINOGENIC PROPERTIES OF AIR POLLUTANTS. Nat. Cancer Inst. Monograph (9) 81-9, 1962. (Presented at a Symposium on The Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

The presentation is devoted primarily to the representative carcinogenic polycyclic hydrocarbon, benzo(a)pyrene. The biological significance of particle size of naturally occurring benzo(a)pyrene is considered. Along with carcinogenic polynuclear hydrocarbons, carcinogenic agents of a different chemical nature occur in the atmosphere. These may act as cocarcinogens or may otherwise affect the action of benzo(a)pyrene. Noncarcinogenic chemical and biological agents in polluted air also may affect the biological action of carcinogenic agents, as may the simultaneous presence of related compounds. Anticarcinogenic action may be related to the ratio of the compounds, to one another and to the stability of both carcinogenic and noncarcinogenic compounds in the atmosphere. In vehicle exhaust studies further modifying factors are the conditions of engine operation and the variations in proportion of compounds due to atmospheric exposure. Further, the solvent or vehicle effect modifies the rate of entry of carcinogenic agents through epithelial surfaces and their subsequent anatomic distribution. The metabolism of polycyclic aromatic hydrocarbons in the liver and associated metabolic alterations are considered. (Authors' abstract)##

00754

U. Saffiotti, F. Cefis, L.H. Kolb, P. Shubik

EXPERIMENTAL STUDIES OF THE CONDITIONS OF EXPOSURE TO CARCINOGENS FOR LUNG CANCER INDUCTION. J. Air Pollution Control Assoc., 15(1):23-25, Jan. 1965. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Houston, Tex., June 1964.)

A method is described for the experimental induction of lung cancer. Syrian golden hamsters, receiving repeated intratracheal administrations of benzo(a)pyrene in particulate form carried by an inert dust, develop a high incidence of bronchogenic carcinoma. The conditions of exposure to the carcinogen, involving penetration and retention of carcinogen particles in lung tissues with the dust, are of prime importance in the determination of the results. Instillations of the same carcinogen in other media did not induce lung tumors. The relative importance of the identification of carcinogenic materials in air pollution and of the conditions of exposure in the origin of lung cancer is discussed. (Authors' summary)##

00779

H.E. Swann, Jr., D. Brunol, L.G. Wayne, O.J. Balchum

BIOLOGICAL EFFECTS OF URBAN AIR POLLUTION. II. CHRONIC EXPOSURE OF GUINEA PIGS. Arch. Environ. Health. Vol. 11:765-769, Dec. 1965.

Guinea pigs have been directly exposed to ambient Los Angeles air for two years. Monthly measurements of their total expiratory resistance were made plethysmographically, and compared with those of guinea pigs breathing air filtered through activated-charcoal. Variations in resistance occurred from month to month, but no difference in resistance was noted between guinea pigs residing in ambient air and those living in filtered air. Total pulmonary resistance appeared to increase with aging. During the second year of their life span, the mortality of guinea pigs living in ambient air was slightly greater than of those living in filtered air, but this difference was not significant at the 5% level by the chi square test. (Author summary)##

00803

A.P.I. RESEARCH PROJECT MC-6 "TOXICITY OF AROMATIC HYDROCARBONS IN THE LUNG" (PROGRESS REPT. FOR NOV. 1, 1962/OCT. 31, 1963 AND PROGRAM FOR 1964). Chicago Medical School, Ill., Inst. of Medical Research. 1963.

The first objective of this program, namely the experimental induction of bronchogenic carcinoma, has been achieved. The method used in these studies has given a very satisfactory result with the induction of a high incidence of

tracheobronchial tumors, with a relative short latent period and in very "clean" experimental conditions. The histological study of the treated lungs shows no unwanted side reactions such as chronic pneumonia or necrosis. The current experiments with different dosage levels of carcinogen will provide an initial understanding of the dose-response relationship in the pathogenesis of bronchogenic carcinoma. The results so far obtained suggest that repeated exposure to the carcinogen over a certain period of time is an essential factor. The role of associated factors will become amenable to experimental study: various factors have been associated epidemiologically with lung cancer induction in man, but these observations, without an experimental study of their role, do not provide final practical answers, because one can not assess the relative importance of these factors on a quantitative basis or of different exposures to individual factors. A detailed study of the histogenesis of bronchogenic carcinoma in these various conditions is also essential to the understanding of its pathogenesis. The present experimental model seems to lend itself satisfactorily to the study of all these problems.##

00809

H. Mikiskova A. Mikiska

TRICHLOROETHANOL IN TRICHLOROETHYLENE POISONING. Brit. J. Ind. Med. (London) 23, (2) 116-25, Apr. 1966.

Trichloroethylene and trichloroethanol were given intraperitoneally to guinea-pigs. Their effects were tested by measuring the threshold current intensity of electrical skin stimulation, the electrical excitability of the motor cerebral cortex, by recording and analysis of the electroencephalogram, and by electrocardiographic examination. The two compounds had similar effects on the nervous system and the heart, but trichloroethanol was the more effective by a factor of at least three. These results support the opinion of clinical investigators on the important role of trichloroethanol in the pathogenesis of trichloroethylene poisoning. (Author summary)##

00842

U. Saffiotti, S.A. Borg, M.I. Grote, D.B. Karp

RETENTION RATES OF PARTICULATE CARCINOGENS IN THE LUNGS. Chicago Med. School Quart. 24(2):10-17, 1964.

This report describes a series of preliminary chemical studies which were set up to investigate the rate of persistence of carcinogens in the lungs. These studies are necessary to gain clearer understanding of the mechanisms by which particulate carcinogens affect the respiratory tract to the extent of inducing bronchogenic carcinoma.##

00870

E. Sawicki, J.E. Meeker, M. Morgan

POLYNUCLEAR AZA COMPOUNDS IN AUTOMOTIVE EXHAUST. Arch.  
Environ. Health Vol. 11:773-775, Dec. 1965.

Evidence is presented that automotive exhaust contributes only a small percentage of the polynuclear aza carcinogens found in air. Air pollution source effluents, other than automotive exhaust, are important sources of polynuclear carcinogens found in the urban atmosphere. (Author summary)##

00883

M. Kleinfeld B. Feiner

HEALTH HAZARDS ASSOCIATED WITH WORK IN CONFINED SPACES. J.  
Occupational Med. 8(7):358-364, July 1966.

Safeguards for work in confined spaces were outlined under three broad categories: (1) testing and preparation of the confined space before entry; (2) use of precautionary measures during occupancy; and (3) assurance of the availability of prompt rescue and adequate first aid should an accident occur. In general, these safeguards can be enforced readily in large plants where they may be incorporated into existing safety programs, if they are not already part of them. However, application of these safeguards in small factories is not easy. Such establishments, in which most of the reported accidents occurred do not usually have adequate safety programs or supervisory personnel with clearly defined safety responsibilities. As a result, the necessary safeguards are not available to provide protection during confined space operations. The conspicuous absence of safe guards in small establishments is due primarily to ignorance of the potential hazards inherent in work in confined spaces. The cases discussed demonstrated the need for a vigorous educational effort, particularly in small plants, to minimize deaths and injuries due to work in confined spaces. (Authors' summary)##

00887

J.D. McEwen, J.M. McNerney, E.H. Vernot, D.T.  
Harper

CHRONIC INHALATION TOXICITY OF CHLOROBROMOMETHANE. J.  
Occupational Med. 8(5):251-256, May 1966.

Albino rats and beagle dogs were exposed to the inhalation of chlorobromomethane vapors during 124 6-hr. exposures, 5 days per week over a 6-month period. The exposure levels of 500 and 1000 ppm chlorobromomethane produced only one demonstrable effect, the

slight depression of growth in the albino rat. This finding, while statistically significant, was not associated with microscopic pathologic changes in tissues. The chlorobromomethane-exposed animals were normal in appearance, and not visibly different from the control animals. The blood bromide levels in both species were above 95 mg.% in the exposed animals. From the data presented, the most significant factor in chlorobromomethane intoxication is the serum bromide ion concentration resulting from the metabolism of the chlorobromomethane. It may be concluded from the present experiments and other experiments cited that the current ACGIH threshold limit value of 200 ppm for chlorobromomethane is a satisfactory working level for chronic daily exposure.  
(Author summary) ##

00910

O. V. Brody

A REVIEW OF PITFALLS AND PAST, CURRENT AND FUTURE RESEARCH IN THE FIELD OF AIR POLLUTION HEALTH EFFECTS. Preprint. (Presented at the Los Angeles County Medical Society, Air Pollution Section, Dec. 2, 1965.)

A general treatment of the reasons and rationale for health impairment in regards to air pollution. Salient points covered by author are: Host interactions measured on individual and among groups; Possible cumulative aero-environmental effects on the prevalence of types of morbidity and mortality; Suggestions for future research (medical research).##

00915

C. S. Weil, N. Condra, C. Haun, and J. A. Striegel

EXPERIMENTAL CARCINOGENICITY AND ACUTE TOXICITY OF REPRESENTATIVE EPOXIDES. Ind. Hyg. J., p.305-325, Aug. 1963.

Carcinogenic and acute toxicity potential were assayed while more than 60 epoxy compounds were being studied for commercial utility. Range-finding toxicity data are presented for 60; lifetime mouse skin painting results are given for 28, and mouse sebaceous gland suppression results are listed for 26 of these compounds. None of the 11 monooxides produced tumors while 5 of the 17 diepoxides were tumorigenic during lifetime skin painting of mice. The median latent period for tumor production with the diepoxides was 15 to 23 months. No generalities about the toxic, irritative or carcinogenic hazards are justified by the presently known facts. Each compound must be individually studied to determine toxicity and carcinogenicity potential. (Author abstract)##



00992

W.J. Jacumin, D.R. Johnston, L.A. Ripperton

EXPOSURE OF MICROORGANISMS TO LOW CONCENTRATIONS OF VARIOUS POLLUTANTS. Ind. Hyg. J., 25(6):595-600, Dec. 1964.

A technique for exposing microorganisms to air-borne toxicants was developed. *Serratia marcescens* were exposed to irradiated atmosphere of clean air, No<sub>2</sub> at 0.5 ppm, hexene-1 at 2 ppm, and No<sub>2</sub> plus hexene-1. Only those containing No<sub>2</sub> differed significantly from clean air, suggesting that hexene-1 played no major role. The technique has inherent difficulties, limiting its application pending further development. (Author abstract)\*\*

01015

P. Kotin and D. V. Wiseley

PRODUCTION OF LUNG CANCER IN MICE BY INHALATION  
EXPOSURE TO INFLUENZA VIRUS AND AEROSOLS OF HYDROCARBONS.  
Progr. Exp. Tumor Res. (Karger, Basel/New York) Vol  
3:186-215, 1963.

Squamous carcinomas were induced in C57 black mice after successive infections with three mouse-adapted strains of influenza virus and continuous exposure to an aerosol of ozonized gasoline. The progression of the pathological process from the initial proliferative response to influenza virus through squamous metaplasia with keratinization to the development of squamous cancer has been histologically described. The last two classes of changes were observed exclusively in mice concurrently exposed to the influenza virus and hydrocarbon aerosols.\*\*

01020

F. C. Pybus

CANCER AND ATMOSPHERIC POLLUTION. Medical Proceedings  
(Mediese Bydraes) Vol. 10(12):242-54, June 13, 1964; and Vol.  
10(13):268-77, June 27, 1964.

Author discusses the relationship of cancer and air pollution insofar as the following categories are concerned: Tar and Soot as a Cause of Cancer in Humans; Benzpyrene in Tar, Soot and Smoke; Nature and Sources of Smoke in the Atmosphere and its Benzpyrene Content; Benzpyrene as a Universal Carcinogen; Air Pollution and Cancer; Tobacco Smoking and Cancer; Positive and Contradictory Evidence; Nature of Cancer; Cancer in Animals; Diagnosis and Treatment; Cancer Education; Legislation; and The Cost of Air Pollution.\*\*

01025

S. S. Epstein, M. Small, J. Koplan, N. Mantel, and  
S. H. Hutner

PHOTODYNAMIC BIOASSAY OF BENZO(A)PYRENE WITH PARAMECIUM  
CAUDATUM. J. Nat. Cancer Inst. Vol. 31(1):163-8, July 1963.

A bioassay for benzo(a)pyrene, based on its photodynamic toxicity to *Paramecium caudatum*, is described. This procedure permits convenient and rapid analysis of a large number of replicates with satisfactory reproducibility and sensitivity.\* (Author summary)##

01029

P. Kotin, H. L. Falk, P. Mader, and M. Thomas

AROMATIC HYDROCARBONS. I. PRESENCE IN THE LOS ANGELES ATMOSPHERE AND THE CARCINOGENICITY OF ATMOSPHERIC EXTRACTS. Ind. Hyg. Occupational Med. Vol. 9(2):153-63, Feb. 1954. (Presented in part at a meeting of the Cancer Prevention Committee, N.Y., Nov. 3, 1953.)

The atmosphere of a large, urban, primarily petroleum-polluted community has been analyzed, and carcinogenic hydrocarbons have been demonstrated as part of the over-all picture of air pollutants. Extracts of atmospheric samples have been successfully used to produce skin papillomas and skin cancers on C57 black mice. The presence of aliphatic hydrocarbons and their oxidation products in the atmosphere is offered as being of significance in the pathogenesis of lung cancer, first, by providing an eluent for the separation of adsorbed carcinogenic hydrocarbon from soot particles in the air and, second, by the formation of various chemical compounds from unsaturated hydrocarbons, including theoretically the formation of diepoxides whose experimental carcinogenicity has been reported. (Author summary)##

01030

P. Kotin and H. L. Falk

THE EXPERIMENTAL INDUCTION OF PULMONARY TUMORS IN STRAIN-A MICE AFTER THEIR EXPOSURE TO AN ATMOSPHERE OF OZONIZED GASOLINE. Cancer Vol. 9(5):910-917, Oct. 1956.

Strain-A mice have been exposed to an atmosphere of ozonized gasoline and to a washed-air control atmospheric environment. A significant difference was found in the test-chamber mice both in multiple-tumor-bearing animals. After forty weeks of exposure there were 21 per cent tumor-bearing animals in the control mice

compared with 63 per cent in our test mice. Differences between the multiple-tumor-bearing-animals have been more marked and greater significance is attached to this variation in terms of ascribing carcinogenic powers to the polluted atmosphere in our test chamber. Mice housed in a polluted atmosphere showed a consistent weight deficit when contrasted with their washed-air controls. While no statistical significance has been attributed to this in relation to tumor yield, the role of calorie restriction in depressing spontaneous and induced-tumor yield has been noted. The ubiquity of gasoline and the presence of its reaction products in urban atmospheres suggest that it be further investigated as a possible etiological influence in the increasing incidence of human lung cancer. Finally, the absence of aromatic polycyclic hydrocarbons from the test chamber may be properly regarded as establishing the innate tumorigenic powers of the chemical substances in the test chamber. (Author summary modified)##

01049

R. L. Larkin and R. E. Kupel

QUANTITATIVE ANALYSIS OF POLYVINYLPIRROLIDONE IN ATMOSPHERE SAMPLES AND BIOLOGICAL TISSUES. Am. Ind. Hyg. Assoc. J. Vol. 26(6):558-61, Dec. 1965.

A quantitative method for the analysis of polyvinylpyrrolidone (PVP), collected in atmospheric samples or extracted from biological tissues, is described. PVP is a component in many aerosol hair sprays. A 0.4M citric acid solution is used to collect or extract the PVP. The color is developed by using a potassium iodide reagent, and the intensity of the color is read on a spectrophotometer at a wavelength of 432 millimicrons. The low limit of detection for this method has been established at 0.5 microgram of PVP per milliliter of final solution. (Author abstract)##

01051

W.J. Hayes, Jr. C.I. Pirkle

MORTALITY FROM PESTICIDES IN 1961. Arch. Environ. Health Vol. 12:43-55, Jan. 1966.

There were 119 deaths in 1961 possibly related to pesticides, and 111 of them were ascribed to identifiable materials. About 90% of deaths attributed to pesticides were correctly diagnosed as indicated by evidence of adequate exposure, a consistent clinical course, or appropriate laboratory and autopsy findings. Of the 111 reasonably definite cases, 51% were in children under 10 years old; at least 58% involved compounds older than chlorophenothane (DDT); not more than 15% were occupational; and several cases were associated with alcoholic intoxication, mental deficiency, improper storage of the poison, or some other special circumstance. Safer use of pesticides in this country should be attainable because, especially in children, a few countries already have a lower mortality rate associated with these useful materials. (Author summary)##

D.E. Rounds

ENVIRONMENTAL INFLUENCES ON LIVING CELLS. Arch. Environ. Health Vol. 12:78-84, Jan. 1966. (Presented at the Second American Medical Association Congress on Environmental Health Problems, Chicago, Ill., Apr. 26-27, 1965.)

This study included a consideration of only two environmental factors on an established human cell line: (1) hydrocarbon mixtures, which form a major contribution to air pollution in the Los Angeles area, and (2) a small portion of the spectral emission of sunlight. Ambient air volumes were scrubbed through either distilled water or chloroform in gas washing bottles. The resulting pollutants were suspended in water, flash sterilized, and added to double strength medium. These test solutions were compared with dilutions of a carcinogen, 3'-Me'DAB with respect to responses of an established line of human conjunctival cells in vitro. All test media produced (1) a growth stimulation, (2) an increase in chromosomal stickiness and scattering during mitosis, and (3) a decrease in a positive staining reaction for phospholipid. Treatment of conjunctival cells with either a chloroform extract of auto exhaust or a five-minute exposure to near ultraviolet light produced no marked morphological change. The combination of these treatments induced cytotoxicity within two hours. (Author summary modified)##

01077

I. I. Lubowe

THE EFFECT OF AIR POLLUTANTS ON THE SKIN. "DERMATITIS URBIS." General Practice 27(5):10-1, 27, May 1964.

In older individuals the visible signs of aging skin may become more apparent when continuously exposed to air pollutants. Thus, the existence of a condition which may be referred to as "city skin" is conceivable. It appears justified to conjecture that the pollutants which present respiratory hazards, with continuous long-term exposure, will also affect the epidermis and cutaneous system. The deposition of soot and dust on the skin affects bacterial growth and subsequent physiological activity. Contact dermatitis due to airborne contactants such as smoke and insecticide sprays is common, as well as industrial dermatoses related to acids, organic sulfides, and other substances. It seems logical to attribute the dermatoses of the hands and face to the irritating pollutants of industrial cities. Prophylactic as well as remedial topical formulas must be devised to overcome this insidious effect of air pollution.##

01080

L. F. Davignon, J. St. Pierre, G. Charest, and F. J. Tourangeau

A STUDY OF THE CHRONIC EFFECTS OF INSECTICIDES IN MAN. Can. Med. Assoc. J. (Toronto) 92, 597-602, Mar. 20, 1965.

Signs of possible chronic intoxication due to insecticides were sought among 441 apple-growers. A group of 170 persons living in the same environment and 162 other persons having no contact with insecticides were used as controls. It was the first attempt to determine signs of chronic intoxication by organic phosphate and chlorinated hydrocarbon insecticides. The greater incidence of leukopenia and of neurologic manifestations found among the subjects suggest that insecticides may have some chronic effects in man. This assumption is reinforced by the similarities in the findings between the subjects and the environments, and by the parallelism between the duration of exposure to insecticides and the number of affected subjects. The repetition of this study at five-year intervals seems desirable until a sufficient number of apple-growers have been studied who have been exposed to large doses of insecticides for 10, 15 or 20 years. (Author abstract)\*\*

01081

A. C. Allison and L. Mallucci

UPTAKE OF HYDROCARBON CARCINOGENS BY LYSOSOMES. Nature (London) 203, (4949) 1024-7, Sept. 1964.

In vitro and in vivo experiments were undertaken to determine whether hydrocarbon carcinogens become associated with particular cytoplasmic constituents. Cell cultures from monkey kidney cells and calf serum were developed and then exposed to fine particles of hydrocarbon carcinogens. All cell types, after exposure, were found to contain brilliant fluorescing granules in the cytoplasm. No fluorescence was seen in background cytoplasm, mitochondria, or nuclei. It was concluded that the carcinogens were taken up by the cells and selectively concentrated in lysosomes. The authors discuss various hypotheses previously advanced including relation of hydrocarbon carcinogens to cell growth, cell metabolism, enzyme release, cytotoxicity, and mutagenesis. The hypothesis that lysosomes are involved in carcinogenesis might provide a simple explanation for co-carcinogenesis. However, results of these experiments provide no evidence for direct interaction of hydrocarbon carcinogens with genetic material. In opposition to the theory that these carcinogens initiate cancerous transformation through specific binding to key protein, the authors suggest that the primary target is the lysosomes and that secondary effects (due to released lysosomal enzymes and perhaps involving DNA and RNA) are perpetuated when the cells continue to divide.\*\*

01286

E. L. Wynder and D. Hoffmann

SOME LABORATORY AND EPIDEMIOLOGICAL ASPECTS OF AIR POLLUTION CARCINOGENESIS. J. Air Pollution Control Assoc. 15(4) 155-9, Apr. 1965.

Chemical, analytical and biological studies were completed on the organic matter of large air pollution samples from Detroit. The high tumor response observed on mouse skin when the organic matter was applied in 12.5 per cent concentration can be partially explained by the presence of polynuclear aromatic hydrocarbons (PAH) as tumor initiators and certain acidic components as tumor promoters. Certain polaric neutral components of still unknown nature are indicated also to act as tumor promoters. The concentrations of PAH in various locations in Detroit and New York during different seasonal, meteorologic and traffic conditions are compared. The relative importance of carcinogenic air pollutants in man's environment is discussed in line with epidemiological evidence. (Author abstract)##

01346

J. M. McNerney and J. D. MacEwen

COMPARATIVE TOXICITY STUDIES AT REDUCED AND AMBIENT PRESSURES. I. ACUTE RESPONSE. Am. Ind. Hyg. Assoc. J., Vol. 26:568-573, Dec. 1965.

Comparison of the acute response to toxicants at ambient and reduced pressures (5 psia; 100% O<sub>2</sub>) were made by exposing monkeys, dogs, rats, and mice for 2 weeks of continuous inhalation exposure to NO<sub>2</sub>, O<sub>3</sub> and CC1<sub>4</sub>. The experimental results show a definite reduction in the toxic response to the pulmonary irritants NO<sub>2</sub> and O<sub>3</sub> at reduced pressure when compared with ambient pressure exposures. With CC1<sub>4</sub>, a systemic toxicant, no significant differences between the animals exposed at ambient or reduced pressure were observed. (Author abstract)##

01369

J.R. McCarroll, E.J. Cassell, W.T. Ingram, D. Wolter

HEALTH AND THE URBAN ENVIRONMENT: HEALTH PROFILES VERSUS ENVIRONMENTAL POLLUTANTS. Am. J. Public Health, 56(2):266-275, Feb. 1966. (Presented at the 92nd Annual Meeting, Epidemiology Section, American Public Health Association, New York City, Oct. 7, 1964.)

A severe and continuing air pollution problem in New York City was demonstrated. The effects of this pollution on the health of the average city dweller are subtle and often masked by symptoms stemming from other causes. Nevertheless, careful analysis of variations in health of a sizable population followed forward in time may discriminate between these different etiologic factors. Subjecting such repetitive observations to the types of discriminating analysis being developed may permit identification of many unsuspected health effects of atmospheric pollution. (Author summary)##

A. P. Altshuller, L. L. Klosterman, P. W. Leach, I. J. Hindawi, and J. E. Sigsby, Jr.

PRODUCTS AND BIOLOGICAL EFFECTS FROM IRRADIATION OF NITROGEN OXIDES WITH HYDROCARBONS OR ALDEHYDES UNDER DYNAMIC CONDITIONS. Intern. J. Air Water Pollution, Vol. 10:81-98, Feb. 1966.

Measurements have been made for chemical reactants and products, condensation nuclei and aerosol formation, eye irritation and plant damage when a wide variety of individual hydrocarbons or aldehydes or mixtures of hydrocarbons are irradiated with nitrogen oxides under dynamic conditions in a large chamber. Comparison of these results under flow conditions with static measurements also made in this study show that significant differences do occur in the chemical results obtained. Under dynamic chamber conditions, irradiated higher molecular weight paraffinic hydrocarbon-nitrogen oxide systems appear to be unreactive. The amounts of individual olefins consumed in irradiated multi-component olefin-nitrogen oxide mixtures are the same as in single component olefin-nitrogen oxide mixtures. When aromatic hydrocarbons also are included in the multi-component mixtures, interaction effects are observed. The results of the present study show that irradiated aromatic hydrocarbon nitrogen oxide mixtures not only undergo chemical reactions but also cause appreciable levels of eye irritation, plant damage and aerosol formation. It also has been shown that a representative higher molecular weight aliphatic aldehyde, propionaldehyde, when irradiated with nitrogen oxide will produce eye irritation, and moderate to heavy plant damage. The corresponding irradiated formaldehyde-nitrogen oxide mixtures did not cause damage to any of the plant varieties investigated. Using dynamic chamber conditions irradiated synthetic mixtures containing nitrogen oxides and the initial concentration levels of both olefins and aromatic hydrocarbons present in an irradiated automobile exhaust system will reasonably well reproduce the oxidant, aldehyde, eye irritation and plant damage levels measured in the irradiated automobile exhaust mixture. It is not possible to reproduce these results obtained for an irradiated automobile exhaust system, by irradiating nitrogen oxides and the initial olefin or aromatic hydrocarbon levels only. These results prove that aromatic hydrocarbons as well as olefins contribute a significant portion of the reactivity of irradiated automobile exhaust mixtures.##

J. W. Clayton, Jr. D. B. Hood, M. S. Nick, and R. S. Waritz

INHALATION STUDIES ON CHLOROPENTAFLUOROETHANE. Am. Ind. Hyg. Assoc. J., Vol. 27:234-238, June 1966.

Dogs, rats, mice, and rabbits were exposed to an atmosphere of 10% chloropentafluoroethane 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 hygiene standard of 1000 ppm as an eight-hour time-weighted average is suggested. (Author abstract)##

01440

L. Miller, W. E. Smith, and S. W. Berliner

TESTS FOR EFFECT OF ASBESTOS ON BENZO(A) PYRENE CARCINOGENESIS IN THE RESPIRATORY TRACT. Ann. N.Y. Acad. Sci., Vol. 132:489-500, Dec. 31, 1965. (Presented at the Biological Effects of Asbestos Conference, New York City, Oct. 19-21, 1964.)

Time of appearance and yields of papillomas and carcinomas in the respiratory tract of hamsters after intratracheal injections of benzo(a)pyrene are reported. Addition of the chrysotile variety of asbestos to the injections gave results consistent with an hypothesis that this material promoted benzo(a)pyrene carcinogenesis in the respiratory tract. Addition of the amosite variety of asbestos to injections of benzo(a)pyrene did not increase the yield of tumors found in the respiratory tract. The yield of tumors in the respiratory tract of hamsters treated with a limited series of intratracheal injections of benzo(a)pyrene decreased with time after discontinuation of exposure. This observation is of interest in relation to lung cancer risks in smokers who discontinue smoking. Further studies of histological material from these experiments are in progress.##

01463

G. S. Doyle, N. Endow, and J. L. Jones

THE EFFECTS OF PHOTOCHEMICAL AEROSOLS ON EYE IRRITATION (FINAL REPT.). Stanford Research Inst., South Pasadena, Southern California Labs. June 1961.

An eye-irritation panel has been exposed to many steady-state reaction mixtures generated in a 520-cubic-foot irradiated stirred-flow reaction chamber. The reactants for one set of exposures were trace concentrations (usually 0.2 to 2.0 ppm by volume) of various hydrocarbons, predominantly olefins, and nitrogen dioxide in purified air. Reaction residence times ranged from one to two hours. Sulfur dioxide was used as an additional reactant (at a concentration of about 0.1 ppm) in a comparable set of experiments. The reacting mixtures were then evaluated for relative eye-irritating ability with and without sulfur dioxide. In addition, the reactants and some of the reaction products, especially formaldehyde, were determined, and the light-scattering and particulate content of the mixtures were measured. Some of the conclusions drawn on the basis of the conditions of reaction and exposure used in this study are: (1) Aerosols derived from the cophotooxidation of sulfur dioxide and from sulfur dioxide itself probably have little, if any, effect on the eye-irritating ability of irradiated reaction mixture; (2) Trace concentrations of branched internal olefins, specifically

2-methyl-2-butene, and of a cyclic olefin, cyclohexene, can produce significant amounts of eye irritants other than formaldehyde and acrolein. (3) The use of dynamic (stirred-flow) conditions considerably enhances the sensitivity of subjects to the irritants; (4) Adding isobutane to a photooxidizing isobutylene-nitrogen dioxide mixture produced no significant effect; (5) The rate of response to an eye irritant is a function of the chemical nature of the irritant or irritants; and (6) Ethylene and propylene can produce significant eye irritation at realistic atmospheric concentrations. (Author summary modified)##

01469

P. Kotin

ENVIRONMENTAL CANCER. Am. Ind. Hyg. Assoc. J., Vol. 27:115-120, April 1966. Also published in Trans. Am. Governmental Ind. Hygienists Conf., 27th, Tex., 1965, 48-61.

The increasing sensitivity and specificity of biological test system being used to identify carcinogenic agents emphasizes the need for correlation with human experience. The growing number of reports demonstrating a relationship between congenital abnormalities and increased risk to the development of certain forms of cancer in childhood suggests the possibility of a common mechanism for their development. The role of environmental agents can be studied through the use of both experimental tetatogenic techniques. The possibility that chemical carcinogens may have their effect mediated through viral agents or in combination with viruses has been suggested by certain laboratory studies; this possibility is in need of investigation. (Author abstract)##

01584

M.O. Amdur

THE EFFECT OF HIGH FLOW-RESISTANCE ON THE RESPONSE OF GUINEA PIGS TO IRRITANTS. Am. Ind. Hyg. Assoc. J., Vol. 25:564-568, Dec. 1964.

Data on the increase in pulmonary flow-resistance produced in guinea pigs by exposure to irritants were examined to determine whether animals with higher initial control values showed a degree of response greater than the average. When the data for all irritants was pooled the increase was greater in the animals with high control resistances. When the irritant data was ssparated as to type (gas, aerosol or gas-plus-aerosol) the difference was not statistically significant for the gas alone but was significant for the other two groups. The differences were most marked when the exposures had been to low concentrations of irritant gas plus inert aerosol and in the ten animals showing the highest initial resistance. (Author abstract)##

01591

J. L. Jones, N. Endon, E. A. Schuck, R. G. Caldwell,  
C.J. Doyle

A PROGRESS REPORT ON THE CHEMISTRY OF COMMUNITY AIR POLLUTION.  
Stanford Research Inst., South Pasadena, Southern  
California Labs. Jan. 5, 1962. 59 pp.

When mixtures of propylene and nitrogen dioxide in concentrations of 0.1 to 1.0 part per million (ppm) were photochemically reacted by irradiation with near ultraviolet light, the reaction products were irritating to the eyes of human test subjects. The intensity of the ultraviolet light used in these laboratory experiments was comparable to 7:00 to 8:00 a.m. fall sunlight. Preliminary additional work on ethylene reaction mixtures, which were irradiated with near ultraviolet light corresponding to 12:00 noon summer sunlight intensity, definitely produced eye irritating reaction product mixtures. The evidence from infrared spectra of precipitated model aerosols formed by the photooxidation of lower olefin homologs nitrogen oxides - sulfur dioxide mixtures at 50% relative humidity indicated that the principal constituent of the aerosol was sulfuric acid. A study of the dark reaction of ozone with olefins has been initiated. Preliminary experimental results indicate that a kinetic reaction mechanism based on a simple bimolecular reaction between ozone and an olefin cannot account for the experimental results obtained to date. Some theoretical quantum mechanical calculations have been made that satisfactorily account for some of the experimental rate constants in the literature. (Author summary modified)##

01596

N.A. Renzetti E.A. Schuck

PRELIMINARY OBSERVATIONS ON THE RELATIONSHIP BETWEEN EYE IRRITATION IN SYNTHETIC SYSTEMS AND IN THE ATMOSPHERE.  
Stanford Research Inst., South Pasadena, Southern California  
Labs. 1960. 17 pp. Also published in J. Air Pollution  
Control Assoc. 11, (3) 121-4, Mar. 1961.

The eye irritation values found in Los Angeles smog were tentatively related to the values found in laboratory mixtures. In the synthetic systems, the major irritants appear to be formaldehyde, acrolein, and, possibly, Compound X. Because of the insufficient and inconclusive nature of the data obtained from atmospheric sampling, a definitive statement cannot be made on this matter. (Author summary modified)##

01603

E.A. Schuck, G.J. Doyle, N. Endow

A PROGRESS REPORT ON THE PHOTOCHEMISTRY OF POLLUTED ATMOSPHERES. Stanford Research Inst., South Pasadena,  
Southern California Labs. Dec. 1960. 122 pp

During the photooxidation of olefins, three reactions appear important: the reaction of olefins with oxygen atoms, with ozone, and with active intermediates. The active intermediates may be free radicals or zwitterions. The rate of disappearance of olefin, over and above that accountable by reaction with oxygen atoms and ozone, has been termed the "excess rate." The importance of active intermediates in the mechanism of olefin photooxidation is suggested by these observations: 1. Some products cannot be accounted for by simple rupture of the double bond. 2. The excess rate is proportional to the square root of the light intensity and to the square root of the initial nitrogen dioxide concentration. The major products of the photooxidation are produced by rupture of the double bond, leading to various carbonyl compounds. However, significant amounts of formaldehyde and acetaldehyde are formed from olefins in certain cases in which these compounds could not be formed by simple bond rupture. Secondary photooxidation of the initial products can also contribute to the products. Alkyl nitrites were identified among the minor products of olefin photooxidation. These nitrites are probably contributing to olefin oxidation since, as was shown previously, alkyl nitrites promote destruction of olefins as well as does nitric oxide or nitrogen dioxide. Medium to severe eye irritation was obtained with photooxidation of mixtures containing 0.5 ppm each of certain olefins and nitrogen dioxide. These concentrations are comparable to those existing in the Los Angeles atmosphere. The amount of eye irritation caused by photooxidation of auto exhaust probably may be reduced most efficiently by control of olefins rather than by control of oxides of nitrogen. This statement is based on studies of olefin mixtures of the type found in auto exhaust; these studies show that, under certain circumstances, reduction of the oxides of nitrogen can lead to an increase rather than a decrease in eye irritation. (Author summary)##

01629

F. A. Vingiello, S. G. Quo, P. Polss, and P. Henson

9-THIENYLANTHRACENES. J. Med. Chem. 7, pp. 832, 1964.

Author discusses the thienylanthracenes which were prepared as a part of an air pollution study program to make new polycyclic aromatic compounds available for carcinogenicity testing. Methods of preparation are given.##

01636

F. A. Vingiello and L. Ojakaar

NEW POLYNUCLEAR AROMATIC COMPOUNDS SHOWING CARCINOGENIC ACTIVITY. Preprint. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965, Paper No. 65-86.)

Four new polynuclear aromatic hydrocarbons containing seven fused

rings have been prepared: naphtho (1,2-a)perylene, naphtho(2,1-)benzo(a)pyrene, naphtho (1,2-) benzo(a) pyrene, and naphtho (2,3-) benzo(a)pyrene. These are closely related structurally to naphtho(2,1-a)perylene which was recently prepared and which was found to be strongly carcinogenic. The structures of the new hydrocarbons were established by elemental analyses, and by ultraviolet, visible and infrared absorption spectral studies. Further, the principles of annelation and the formation of TNF molecular compounds are consistent with the assigned structures. An analytical procedure based on high-temperature gas chromatography has been established. A new polynuclear aromatic hydrocarbon containing eight fused rings, naphtho(1,7,8-efg)anthanthrene 6, has been prepared and identified. The new hydrocarbons have been submitted for carcinogenic activity studies. (Author summary)##

01668

E. DeMaeyer J. DeMaeyer-Guignard

EFFECTS OF POLYCYCLIC AROMATIC CARCINOGENS ON VIRAL REPLICATION: SIMILARITY TO ACTINOMYCIN D. Science 146, 650-1, Oct. 30, 1964

When incorporated into a nutrient overlay, the carcinogenic hydrocarbons benzo(a)pyrene and 7,12-dimethylbenz(a)anthracene inhibit plaque formation by herpes virus and vaccinia virus, DNA viruses, but not by Sindbis virus, an RNA virus. These carcinogens also decrease herpes and vaccinia virus yields in liquid medium, without affecting Sindbis virus yields. Four structurally related, but noncarcinogenic polycyclic hydrocarbons, namely benzo(i)pyrene, pyrene, benz(a)anthracene and anthracene, have no inhibitory effect on DNA virus replication. Taken together with the known inhibition of interferon production, these effects on virus growth resemble the action of actinomycin D and hence provide evidence for a selective interaction of these carcinogens with DNA. (Author abstract)##

01692

J.H. Weisburger E.K. Weisburger

CHEMICALS AS CAUSES OF CANCER. Chem. Eng. News 44, (6) 124-42, Feb. 7, 1966.

Cancer research falls into two broad groupings--diagnosis and treatment, and etiology and prevention. Diagnosis and treatment relate to the methods leading to the discovery of a cancer already present, so that appropriate remedial measures can be used. Etiology and prevention deal with attempts to discover the causes and origins of neoplastic diseases, to understand the mechanism of their formation, and to delve into their inherent nature. The underlying idea for research on the etiology and prevention of cancer is that the disease can be prevented by modifying its course or by eliminating causative or accelerating

factors. This report covers a portion of cancer research pertaining to etiology and prevention. In particular, the article discusses cancer induction by aromatic amines, azo dyes, nitrosamines, and mycotoxins.##

01722

M. L. Edfors, L. Friberg, B. Holma, and A. Kajland

A DI-DISPERSE OCTADECANOL AEROSOL WITH NUCLEI OF AU(198) AND SC(46) RESPECTIVELY. Proc. Intern. Congr. Occupational Health, 14th. pp. 522-5. (Congress held in Madrid, Spain, Sept. 1963.)

The knowledge that particle size is of importance for lung-clearance has led to the development of monodisperse test aerosols. The experiments achieved have shown that it is possible to produce monodisperse radioactive aerosols in the range of 1-10 microns. This range has been considered to be of particular importance for studying the clearance of the ciliated respiratory tract of animals. By exposing animals to di-disperse aerosols, where the two particle sizes are tagged with different isotopes, it is possible to study at the same time clearance of two sizes, which are differently deposited and which also may have different clearance rates.##

01762

W. W. Payne

OCCUPATIONAL FACTORS IN CARCINOGENESIS. Public Health Rept. (U.S.) 81, (9) 777-81, Sept. 1966.

The author reviews the history of the occurrence of cancer in various occupational groups resulting from exposure to specific carcinogens. Examples are the occurrence of scrotal cancer in workers exposed to polycyclic aromatic hydrocarbons, bladder cancer in dye workers exposed to aromatic amines, and bronchogenic cancer in workers employed in the chromium industry. Other inorganic carcinogens are cited, among them arsenic, nickel, and asbestos dust. The importance of studying occupational exposures to possible carcinogens is emphasized.##

01794

V. Pirila, L. Noro, A. Laamanen

AIR POLLUTION AND ALLERGY. Acta Allergol. (Copenhagen) 18, 113-30, 1963

After describing some examples of acute air pollution episodes, the authors give a brief review of natural air pollution from the allergological point of view. Cultural air pollution is considered under two headings: indoor or local, and outdoor or general. The capacity of some chemical present in outdoor air-SO<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, Be and F-to provoke allergic diseases is discussed on the basis of the literature and personal investigations. Finally some figures and examples are given regarding the quality and degree of air pollution in the USA and in Finland. The authors stress the difficulty which arises in fixing the maximum allowable concentrations for general air pollution, owing to the wide variations in physiological response in general and in allergic reactivity in particular. (Author summary modified)##

01805

A. Kajland, M.L. Edfors, L. Friberg, B. Holma

RADIOACTIVE MONODISPERSE TEST AEROSOLS AND LUNG CLEARANCE STUDIES. Health Phys. 10, 241-5, 1964.

Data are given from investigations into the production of radioactive test aerosols and studies of lung clearance in the rabbit. Lung clearance was measured using a specially developed profile scanning technique. This technique made it possible to follow the clearance rate from repeated measurements of the lung activity in a single animal. Furthermore, the animal could be re-exposed. Heterodisperse radioactive aerosols were used initially; more recently, monodisperse aerosols have been used. Monodisperse radioactive aerosols in the particle range 1-10 micron have hitherto been produced mainly by a modified LaMer method for lung clearance studies. Monodisperse radioactively tagged plastic aerosols have also been produced by the spinning disk technique, and methods for iodinating (with 131 I) latex particles are in progress. (Author abstract)##

01806

P. Kotin J.L. Falk

ATMOSPHERIC FACTORS IN PATHOGENESIS OF LUNG CANCER. Advan. Cancer Res. 7, 475-514, 1963.

In this review of the atmospheric factors in the pathogenesis of lung cancer, the subject is considered under the major headings of: general epidemiological considerations, experimental considerations; bioassay studies, clinical lung cancer; and etiology of lung cancer. There is a bibliography of 194 references.##



01813

E.L. Wynder E.C. Hammond

A STUDY OF AIR POLLUTION CARCINOGENESIS. I. ANALYSIS OF  
EPIDEMIOLOGICAL EVIDENCE. Cancer 15, (1) 799-2, Feb. 1962.

The evidence indicating that general air pollution increases the risk of developing lung cancer is reviewed. In general, the rates for an urban area are less than twofold greater than those for the rural areas. This increased risk seems to apply mainly to smokers, but this is not certain, due to the scarcity of data on nonsmokers who die of lung cancer. The urban factor may not be due to general air pollution but could be a result of other variables, including the better reporting of lung cancer in cities, the moving to cities of lung cancer patients prior to death, the difference in smoking habits and patterns between residents of urban and rural areas, or occupational differences in the 2 areas. Above all, the influence of industrial exposures has not been adequately taken into consideration in any of the studies that have investigated the relationship of air pollution to cancer of the lung. Some cities, because of particular geographical or industrial situations, may have special problems. This study has reviewed data in respect to general air pollutants in ordinary city living. In this sense we have excluded the kind of air pollutants to which a worker is exposed in a specific occupational environment, which must be regarded as occupational and industrial exposures, some of which are clearly related to an increased risk of lung cancer.##

01844

P. Kotin

AIR POLLUTION WITH CANCERIGENIC SUBSTANCES. Acta, Unio  
Intern. Contra Cancrum 19, (3-4) 469-71, 1963.

Polluted urban air must seriously be regarded as one of the factors responsible for the increased incidence of lung cancer. Carcinogenic agents have been identified in polluted urban air, and extracts have resulted in the induction of malignant tumors following skin painting or subcutaneous injection in inbred strains of mice. Further, aerosols of ozonized gasoline, in conjunction with multiple influenza infections, have resulted in the induction of human type squamous cell carcinomas in C57 black mice following inhalation exposure. Evaluation of the carcinogenic potential of polluted urban air requires an assessment of the role of (a) respiratory tract irritants, (b) the physical aspects of particulates in relation to deposition in the tracheobronchial tree, and (c) chemical compounds potentially acting as anti-carcinogenic agents. (Author summary)##

01916

V. A. Rjazanov.

CRITERIA AND METHODS FOR ESTABLISHING MAXIMUM PERMISSIBLE  
CONCENTRATIONS OF AIR POLLUTION. Bull. World Health Organ.  
(Geneva) 32, 389-98, 1965.

Experience in the USSR in establishing standards for air pollution control is described. It is emphasized that health considerations must be main criterion in deciding permissible concentrations, which constitute the "hygienic" standards ultimately to be achieved. Economic and technological reasons may dictate temporary "sanitary" standards, which modify the requirements for a limited period. "Technological" standards relate to the economic and technological consequences of air pollution and do not concern health. The maximum permissible concentrations of toxic substances used in toxicology and industrial hygiene are not sufficiently stringent for general use, and control standards are therefore based on the results of tests carried out on animals and human subjects. Tests on animals show that certain concentrations of toxic substances cause functional changes (e.g., in higher nervous activity, cholinesterase activity, and excretion of coproporphyrin) as well as a number of protective adaptational reactions. The results are used to establish maximum permissible concentrations of pollutants within a 24-hour period. Tests on human volunteers provide a basis for determining the maximum average concentrations at a given time. Reactions to odorous substances give the olfactory threshold and the level of concentration causing respiratory and visual reflexes, as well as subsensory effects such as changes in light sensitivity and in the activity of the cerebral cortex. Morbidity statistics also provide evidence of harmful pollution, but cannot serve as a basis for establishing maximum permissible concentrations, which should aim not only at preventing illness but also at avoiding pathological and adaptational reactions. (Author abstract)\*\*

01968

H. L. Falk, P. Kotin, and A. Mehler

POLYCYCLIC HYDROCARBONS AS CARCINOGENS FOR MAN. Arch. Environ. Health 8, 721-30, May 1964.

The preponderance of evidence would support the conclusion that certain polycyclic aromatic hydrocarbons are carcinogenic to man just as they are to experimental species. The carcinogenicity is dependent upon numerous polycyclic aromatic hydrocarbons. While benzo(a)pyrene is perhaps the most ubiquitous and potent of all four- or five-ring polycyclic aromatic hydrocarbons found in nature, others may still possess carcinogenic potency. The cancers most easily produced with these agents in experimental species are squamous cell carcinoma of the skin and, similarly, the most frequent cancer observed in man in association with occupational exposure is skin cancer. The difficulty in induction of pulmonary cancer with polycyclic aromatic hydrocarbons in experimental species may well reflect the low incidence of occupational lung cancer. In both instances effective physiologic defenses are at work to prevent the initiation of carcinogenic processes.\*\*

01971

H. V. Warren

MEDICAL GEOLOGY AND GEOGRAPHY. Science 148, (3669) 534-9, Apr. 23, 1965.

The increasing evidence of the importance of trace elements in the earth's crust to healthy living tissue in both animals and plants was emphasized by a panel of an interdisciplinary symposium of "Medical Geology and Geography", held in Montreal, 28 Dec 1964. The themes of the four panel members, a chemical biologist, a professor of pharmacognosy, a geologist, and a general medical practitioner, are summarized. It is believed that some of the trace metals that find their way into soils and foods may play the part, directly or indirectly, of carcinogens, as in the case where certain chelates are formed. The complexities of the subject, such as variations in geographical distribution of the elements and the intricacies of certain biological processes, are discussed.##

01987

R. G. Hinners

ENGINEERING THE CHRONIC EXPOSURE OF ANIMALS TO LABORATORY PRODUCED AUTOMOBILE EXHAUST. J. Air Pollution Control Assoc. 12, 527-30, Nov. 1962. (Presented at the 55th Annual Meeting, Air Pollution Control Association, Chicago, Ill., May 20-24, 1962.)

A laboratory facility designed for studies to determine the effects of lifetime exposure of experimental animals to auto emissions is described. The emissions produced simulated atmospheric concentrations and conditions generally found in the air of a city like Los Angeles.##

01988

D. Hofreuter

THE AUTOMOTIVE EXHAUST PROBLEM (ITS RELATION TO HEALTH). Arch. Environ. Health 2, 559-63, May 1961

The problem of how automotive exhaust products may affect the public health is examined by considering the following 6 broad areas: the chemical composition of automobile exhaust; some past investigations; the possible irritating qualities of automotive exhaust gases; the possible relationship of lung cancer to products of automobile exhaust; certain specific substances of vehicular exhaust, namely, CO and lead, and their possible effects on the public health, and, finally, a few of the current medical projects that are under investigation by the Division of Air Pollution.##

01992

P. V. V. Hamill

ATMOSPHERIC POLLUTION, THE PROBLEM - AN OVER-ALL VIEW.

Arch. Environ. Health 18 241-7, Sept. 1960. (Presented at the 12th Annual Meeting, American Academy of Occupational Medicine, Williamsburg, Va., Feb. 12, 1960.)

Some epidemiological and laboratory studies are reviewed. Statistical evidence suggests a relationship between air pollution levels and mortality rates from lung cancer notwithstanding smoking habits. Health statistics regarding air pollution episodes in the United States and Europe are given.##

02173

A. S. Josephson.

IMMUNOLOGIC METHODS IN AIR POLLUTION RESEARCH. Arch. Environ. Health 8, 143-6, Jan. 1964. (Presented at the Sixth Annual Air Pollution Medical Research Conference, San Francisco, Calif., Jan. 28-29, 1963.)

Author discusses the use of immunologic techniques, both direct and indirect, to investigate the possible effects of air pollution such as alteration of proteins and sensitivity reactions to pollutants. Immunology also provides an approach to study the body defense mechanisms to pollutants.##

02223

S.D. Mprphy, C.E. Ulrich, U.K. Leng

ALTERED FUNCTION IN ANIMALS INHALING CONJUGATED NITRO-OLEFINS. Toxicol. Appl. Pharmacol. 5, (3) 319-30, May 1963, (Presented in part at the Third Inter-American Conference on Occupational Medicine and Toxicology, Miami, Fla., Aug. 1961.)

Increased total pulmonary flow resistance and tidal volumes and decreased respiratory rates of guinea pigs and decreased voluntary activity of mice occurred during inhalation of the vapors of conjugated nitro-olefins at concentrations near or below the threshold for human, sensory detection. Increasing concentrations increased the magnitude of the effects. Comparison of the effects of 2-nitro-2-butene, 3-nitro-3-hexene, and 4-nitro-4-nonene indicated that the effectiveness on pulmonary function was inversely related to the carbon chain length. However, 4-nitro-4-nonene was slightly more active than the butene and hexene in producing depression of mouse activity. At the low concentrations tested, the effects of nitro-olefins were reversible when the animals were returned to clean air. Injection of atropine sulfate overcame the increased pulmonary flow resistance induced by 4-nitro-4-nonene. The response of animals to inhaled nitro-olefins qualitatively resembles effects which have been observed when animals inhale high concentrations of irradiated automobile exhaust. These effects are, however, relatively nonspecific and are produced by several other irritating vapors and gases which have been shown to be present in measurable quantities in exhaust mixtures. (Author summary) ##

02276

M.H. Simmers

CANCERS IN MICE FROM ASPHALT FRACTIONS. Ind. Med. Surg. 34, 573-7, July 1965.

Steam-refined asphalt was separated into four fractions: asphaltenes, aromatics, saturates, and resins. The method of separation is given. The aromatics and saturates fractions showed essentially all the ultraviolet light fluorescence of the 4 fractions. These two fractions were pooled and tested for oncogenesis by painting on the skin of C57 black mice. Thirty-two percent of the mice thus treated and coming to autopsy developed cancers. This result is compared to previous experiments testing the cancer producing properties of pooled air and steam refined asphalt, and each tested separately. (Author summary)##

02277

H.E. Swann, Jr O.J. Balchum

BIOLOGICAL EFFECTS OF URBAN AIR POLLUTION. UV. EFFECTS OF ACUTE SMOG EPISODES ON RESPIRATION OF GUINEA PIGS. Arch Environ. Health 12, 698-704, June 1966 (Presented at the 25th Annual Meeting, American Industrial Hygiene Association, Philadelphia, Pa. Apr. 30, 1964.)

Measurement of total expiratory flow resistances were made on guinea pigs on days of unusual conditions of weather and smog. When these resistances were compared with routine monthly measurements on the same animals, significant increases in resistance were found at oxidant levels of approximately 0.30 ppm or more. Also, significant increases in resistance were observed when approximately 40% of alert levels of the oxides of nitrogen, carbon monoxide, and hydrocarbons were present. Only when high temperature was accompanied by approximately 0.30 ppm oxidant did a significant increase in resistance occur. During a smog episode when alert levels of oxidant and 25% of alert levels of carbon monoxide and hydrocarbon were recorded on two successive days, older guinea pigs breathing ambient air had highly significant increases in resistance. Alert smog levels apparently act as a respiratory stress which was more obvious in the older animals. Some animals had little or no response to the smog while some animals greatly responded and had quick recovery; other animals greatly responded to the smog and had a slow recovery or no recovery and died. This suggests a possible individual difference in sensitivity to smog among animals of the same species. The pathological findings on the two animals that died during the episode indicated severe pulmonary abnormality. Also, some animals that died within 45 days following the episode and had high resistances during the episode also had pathological pulmonary changes. However, others that had high resistances and died had no such alterations. Although high smog levels produced a significant increase in pulmonary resistance, this response may or may not be related to the degree of impairment.##

02288

W.C. Hueper

ENVIRONMENTAL AND OCCUPATIONAL CANCER HAZARDS. PART I OF  
SYMPOSIUM: CHEMICAL CARCINOGENESIS. Clin. Pharmacol.  
Therap. 3, (6) 776-813, Dec. 1962

The growth of an environmental carcinogenic spectrum composed of recognized, suspected, and potential human carcinogens of chemical, physical, and parasitic nature should provide an impressive warning to all concerned with the maintenance and protection of the health and well-being of mankind to exert all possible effort to develop methods and facilities by which sources of production, channels of dissemination, routes of exposure, prospective and actual target organs and tissues, and number and types of individuals exposed to natural and man-made carcinogens can be more readily and reliably identified. It is essential that, where possible, human contact with environmental carcinogens be totally eliminated or, whenever such a stringent measure appears impractical or impossible, reduced to a minimum with respect to degree, frequency, duration, and number of persons exposed. While the presently available methods of identifying carcinogenic agents are admittedly slow and not totally adequate, experimental observations and their implications in man demand that first and dominant consideration be given to the protection of the community against actual or potential cancer hazards. In such a decision, the health and life of the general public should receive the benefit of doubt without any reservation. (Author summary modified)##

02332

T. R. Lewis, F. G. Hueter, and K. A. Busch.

EFFECTS OF ATMOSPHERES CONTAMINATED WITH IRRADIATED AUTOMOBILE  
EXHAUST ON REPRODUCTION OF MICE. Preprint. 1966.

The exposure of mice to irradiated automobile exhaust prior to mating significantly impaired reproductive function in male members of sexual pairs. The impairment was expressed at various stages of reproduction: conception, fecundity, and infant survival. These effects imply that the chromatin content of the sperm was altered. This experiment suggests mutational effects on mammalian cells from components or subsequent products of irradiated automobile exhaust. Significantly, the concentrations of these pollutants were similar to those present in many urban communities today. A direct toxic effect on infant mice was noted during postnatal exposure to irradiated automobile exhaust. Death rates during the first 8 days of life were higher compared to those for controls. (Authors' summary)##

02357

B.G. Giel

AIR POLLUTION AND YOUR LUNGS. Preprint. (Presented at

the Symposium on Respiratory Diseases, Syracuse, N.Y., May 14, 1964.)

The adverse effects of man-made air pollutants on man's health, with particular reference to respiratory diseases, are discussed generally in this paper.##

02551

A.A. Minaev

DETERMINATION OF THE MAXIMUM PERMISSIBLE CONCENTRATION OF ALPHA-METHYLSTYRENE VAPOR IN THE ATMOSPHERE. (Issledovaniya po gigenicheskomu normirovaniyu parov alpha-metilstirola v atmosfernom vozduke.) Hyg. Sanit. 31, (2) 157-61, Feb. 1966.  
CFSTI: TT66-51160/1-3

Alpha-Methylstyrene vapor in a concentration of 0.04 mg/cubic meter does not give rise to any subjective sensations or reflex-sensory responses in man. In white rats which were continuously exposed to the same vapor, in a concentration of 5 mg/cubic meter over a period of 3 months, some depression of function of the central nervous system, as well as disturbances in the biochemical reactions resulted. An increased number of fluorescent leucocytes showed color changes and there were histopathological changes in the lungs, the central nervous system and the parenchylstyrene organs. Under the same conditions, poisoning with an alpha-methylstyrene concentration of 0.5 mg/cubic meter only caused a rise in the number of leucocytes showing normal fluorescent reactions, as well as some slight histopathological changes in the lungs and liver of a few of the animals. It is therefore recommended that the mean daily maximum permissible concentration of alpha-methylstyrene vapor in the air be 0.05 mg/cubic meter (the maximum one-time dose) because this concentration does not produce a toxic effect upon prolonged exposure. The synthetic rubber factory investigated polluted the air with alpha-methylstyrene vapor up to a distance of 4000 m from the factory, at which point the maximum one-time concentration of the vapor was found to be 0.04 mg/cubic meter.##

02566

G.I. Solomin

EXPERIMENTAL DATA ON THE HYGIENIC SUBSTANTIATION OF THE SINGLE PERMISSIBLE CONCENTRATIONS OF ISOPROPYLBENZENE AND ISOPROPYLBENZENE HYDROPEROXIDE IN ATMOSPHERIC AIR. (Eksperimental'nye dannye k gigenicheskomu obosnovaniyu maksimal'nykh razovykh predel'no dopustimyykh kontsentratsii izopropilbenzola i gidropeekisi izopropilbenzola v atmosfernom vozduke.) Hyg. Sanit. 29, (2) 1-8, Feb. 1964.  
CFSTI: TT65-50023/2

Concentrations of isopropylbenzene equal to 0.06 mg per cu m when present alone and 0.36 mg per cu m in a mixture with isopropylbenzene hydroperoxide are the olfactory thresholds.

Concentrations of HPIPB equal to 0.03 mg per cu m when present alone and to 0.017 mg per cu m in a mixture with IPB are the olfactory thresholds. For IPB the threshold for a reflex effect on the sensitivity of the eyes to light is 0.07 mg per cu m; when present in a mixture with HPIPB 0.05 mg per cu m. The threshold of the reflex effect on the sensitivity of the eye to the light in the case of HPIPB is 0.02 mg per cu m when alone and 0.01 mg per cu m when mixed with IPB. The threshold of the reflex effect on cerebral electrical activity for IPB is 0.028 mg per cu m; when mixed with HPIPB, 0.014 mg per cu m. For HPIPB the threshold of the reflex effect on electrical cerebral activity is 0.012 mg per cu m; when mixed with IPB, 0.007 mg per cu m. The following maximum single permissible concentrations are suggested: for IPB, 0.014 mg per cu m; for IPB in the presence of HPIPB, 0.007 mg per cu m; for HPIPB 0.007 mg per cu m, for HPIPB in the presence of IPB, 0.003 mg per cu m, that is, half as much.##

02568

K.V. Grigor'eva

STUDIES ON POLLUTION OF ATMOSPHERIC AIR WITH MALEIC ANHYDRIDE. (K voprosu o zagryzhanenii atmosfernogo vozdukha maleinovym angidridom.) Hyg. Sanit. 29, (3) 7-11, Mar. 1964.

CFSTI: TT65-50023/3

The investigations were carried out in the vicinity of phthalic anhydride production plant, where the wastes discharged in the air contained maleic anhydride. This compound was detected in the air at a distance of 500 m from the site of discharge in concentrations of 0.0 to 3.3 mg/cu m and within a radius of 1 km in concentrations of 0.0 to 2.6 mg/cu m. The work is being continued to obtain hygienic backgrounds for determining the maximum permissible concentration of maleic anhydride in the atmospheric air. Its olfactory threshold value and that for producing an irritating effect on the mucous membranes of eyes and respiratory tract have already been determined. For most sensitive persons they lie between 1.3 mg/cu m and 1.0 mg/cu m maleic anhydride respectively. (Author abstract)##

02571

M.N. Ostrovskii

TOXICOLOGY OF GUAIACOL VAPORS AND RESINS. (K toksikologii parov gvayakola i ego smoly.) Hyg. Sanit. 29, (3) 105-8, Mar. 1964.

On the basis of experimental findings on the toxicity of guaiacol vapors, a calculation of an approximate value was made for the permissible concentration of these vapors. On the basis of the LC(soh)50 (7.57 mg/l), it was found equal to 0.02 mg/l.

In the study of the effect of guaiacol resin on the skin it was determined that it possesses neither an irritating nor a blastomogenic effect.##



N. G. Andreesheheva

SUBSTANTIATION OF THE MAXIMUM PERMISSIBLE CONCENTRATION OF NITROBENZENE IN ATMOSPHERIC AIR. (Obosnovanie predel'no dopustimoikontsentratsii nitrobenzola v atmosfernom vozdukh.) Hyg. Sanit. 29, (8) 4-9, Aug. 1964.  
 CFSTI: TT65-50023/8

The effect produced by low concentrations of nitrobenzol on man and animals was studied to substantiate the maximum permissible concentration of this compound in the atmospheric air. It was found in the study of the reflex action to nitrobenzol that in most sensitive persons the threshold value of the olfactory preception amounted to 0.0182 mg/cubic meter, and that of the eye light sensitivity to 0.0157 mg/m. The cerebral electric activity was affected by a concentration of 0.0129 mg/cubic meter. Nitrobenzol at a concentration of 0.008 was not detected by smelling and produced no changes in cerebral potentials; this concentration is suggested as the singular maximum permissible concentration. A continuous round-the-clock action of nitrobenzol vapours or a period of 72 days at a concentration of 0.08 mg/cubic meter produced in the experimental animals changes in the motor chronaxy of muscle-antagonists, and in the cholinesterase activity of the whole blood; it also brought about methemoglobinemia, sulhemaglobinemia, and a fall in the total content of hemoglobin oxyhemoglobin. Under conditions of continuous action (after the same procedure) of nitrobenzol at a concentration of 0.008 mg/cubic meter the animals' organism showed to be indifferent to it. This amount is suggested as the maximum permissible concentration of nitrobenzol in the atmospheric air. (Author abstract)##

02596

A. P. Il'nitskii and S. N. Varshavskaya

WATER AS A FACTOR IN SPREADING CARCINOGENS IN THE ENVIRONMENT. (Voda kak odin iz faktorov rasprostraneniya kantserogennykh veshchestv vo vneshnei srede.) Hyg. Sanit. 29, (9) 88-96, Sept. 1964.  
 CFSTI: TT65-50023/9

Authors review the carcinogenic agent, 3,4 benzpyrene, and suggest that reduction of it in the air is essential to prevention of cancer. Although author recognizes the presence of 3,4 benzpyrene in the atmosphere he emphasises its presence in oceans and rivers (in general water). The use of detergents (and their subsequent dumping in the rivers) complicates the defection of 3,4 benzpyrene because it becomes an emulsion and the public is potentially more damaged.##

02605

A. A. Dobrinskii

ESTABLISHING HYGIENIC NORMS FOR SOME INTERMEDIATES IN CAPROLACTAM PRODUCTION IN THE AIR. (O gigienicheskoy)

normirovanni nekotorykh promezhutochnykh veshchestv proizvodstva kaprolaktama v atmosferenm vozduke.) Hyg. Sanit. 29, (12) 7-12, Dec. 1964.

CFSTI: TT 65-50023/12

In order to substantiate the maximal permissible single concentrations of cyclohexanone and cyclohexanol, the author determined their threshold values of smell, changes of the ocular light sensitivity after inhalation of small concentration of cyclohexanone, the threshold values of their action on the electric cerebral activity by the method of obtaining electrocortical conditioned reflexes and by the method of augmenting the cerebral potentials. For substantiating the average daily maximal permissible concentrations, round-the-clock chronic poisoning of albino rats with vapors of cyclohexanone and cyclohexanol was carried out for a period of 87 days. The animals' general condition and weight, the chronaxy correlation of muscle-antagonists, the kinetics of the cholinesterase activity, the content of the sulfhydryl group proteins in the blood serum and content in the brain and the liver were studied. The author suggests the maximal single and daily average permissible concentrations in the atmospheric air of cyclohexanone to comprise 0.04 mg/cu m and that of cyclohexanone - 0.06 mg/cu m (Author abstract)##

02689

W. Kutscher, R. Tomingas, B. Ptekauskas

THE ABSORPTION AND EXTRACTION OF 3,4-BENZOPYRENE WITH SPECIFIC TYPES OF SOOT. Staub (English Translation) 26, (3) 5-11, MAR. 1966.

CFSTI TT66-51159/3

Investigations into the absorption capacity have been carried out for 3,4-benzpyrene in benzole (benzene) solution of two types of soot, differing in their properties and average particle size. In the case of very low benzpyrene concentrations a complete absorption was not achieved. It has been found during extraction of soot charged with benzpyrene by means of benzole (benzene) that benzpyrene can be separated from the soot if the extraction is carried out intensively and for a sufficiently long time. (Author summary)##

02842

M. W. Korth

EFFECTS OF THE RATIO OF HYDROCARBON TO OXIDES OF NITROGEN IN IRRADIATED AUTO EXHAUST. Public Health Service, Cincinnati, Ohio, Div. of Air Pollution, 64 pp., Oct. 1966

HEW 999-AP-20

As a part of a series of investigations of the problem of vehicle exhaust as an air pollutant, photochemical reactions are being studied in detail by the use of large dynamic irradiation chambers. In these studies exhaust, generated by test vehicles on a dynamometer, is diluted with air and irradiated to simulate the

effects of sunlight under mixing conditions similar to those in the atmosphere. The irradiated mixture is used to study chemical reactions and to evaluate plant damage and human eye irritation. In this second series of irradiation tests performed by the Public Health Service, the ratio of total hydrocarbon (HC) to oxides of nitrogen (NOx) was varied between 1-1/2 and 24. Hydrocarbon concentrations were varied from 3 ppm to 12 ppm total carbon; oxides of nitrogen concentrations were varied from 1/4 ppm to 2 ppm. Greatest plant damage occurred when both the HC/NOx ratios and hydrocarbon concentrations were high. The levels of eye irritation were highest at the higher chamber hydrocarbon concentrations. For a given hydrocarbon level, chemical reaction rates were highest at the high HC/~NOx ratios. (Author abstract)##

02969

H. Petri

ASSESSING THE HEALTH HAZARDS OF GASEOUS AIR POLLUTIONS. Staub  
(English Transl.) 25, (10) 50-7, Oct. 1965.  
CFSTI: TT 66-51040/10

Many gases and vapours in molecular dispersion have pathophysiologic effects, that is, effects dangerous to health. Various substances can be detected by smell even if present in air in small quantities, and at a certain concentration they may become a nuisance; these substances are, for instance, mercaptans, butyric acid, acrolein and amines, such as trimethylamine; hydrogen sulphide, carbon disulphide, pyridine, etc. cause nuisance at slightly higher concentrations. Sulphur oxides, hydrogen fluoride and other acid aerosols, further, ozone, chlorine, bromine and nitrous gases are dangerous to health, because they irritate body tissue. As a result of the increase in road traffic the odourless carbon monoxide has become very important. The biological assessment of gas or vapour emission with regard to their effect on man, and special effects of these substances are discussed in detail. (Author summary)##

03076

S.D. Murphy, J.K. Leng, C.E. Ulrich, H.V. Davis

EFFECTS ON ANIMALS OF EXPOSURE TO AUTO EXHAUST. Arch.  
Environ. Health 7, 60-70, July 1963 (Presented at Air  
Pollution Research Conference, Los Angeles, Calif., Dec.  
5-7, 1961.)

The effects on experimental animals of brief exposure (2-6 hrs.) to exhaust polluted atmospheres were studied. The concentrations of exhaust gases in the experimental atmospheres were varied between levels which approximated polluted ambient atmospheres and concentrations several times greater than present community pollution levels. Changes in physiological function of experimental animals, which could be objectively measured, were produced during exposure to these polluted atmospheres. Analyses presented are for comparative purposes.

Comparison of concentrations in irradiated and nonirradiated atmospheres of approx. equal dilution ratios shows the photochemical formation of aldehydes, nitrogen dioxide, and total oxidant at the expense of nitric oxide and olefin. Measurements of pulmonary function, spontaneous activity, and mortality of impaired animals were the most sensitive indicators of effects. Most of these effects rapidly returned to preexposure normal when the animals were returned to clean air.##

03086

P. Stocks

ON THE RELATIONS BETWEEN ATMOSPHERIC POLLUTION IN URBAN AND RURAL LOCALITIES AND MORTALITY FROM CANCER, BRONCHITIS AND PNEUMONIA, WITH PARTICULAR REFERENCE TO 3:4 BENZOPYRENE, BERYLLIUM, MOLYBDENUM, VANADIUM AND ARSENIC. Brit. J. Cancer (London) 14, 397-418, 1960

of polycyclic hydrocarbons and a statistical process of Lung cancer mortality is strongly correlated with smoke density in the atmosphere in Northern England and Wales. In 26 localities the smoke samples were analysed in respect successive elimination was applied to discover which hydrocarbon was responsible for the smoke correlation with mortality rates. For lung cancer and bronchitis 3:4 benzopyrene emerges clearly as the substance of prime importance, with 1:12 benzoperylene contributing weakly for lung cancer, but for pneumonia 3:4 benzopyrene is apparently not important. The composite group of other cancers in males is correlated with several hydrocarbons, but cancers of the breast and other sites in females show no relations with any of them. In 23 localities spectrographic analyses for 13 trace elements were made and a similar process of successive elimination was applied to those which showed appreciable correlations with mortality rates. For lung cancer beryllium and molybdenum emerge as the elements of most consequence, with arsenic, zinc and vanadium showing weaker associations. For bronchitis molybdenum appears to be the important element in both sexes whilst males beryllium, arsenic, vanadium and zinc may also be concerned as for lung cancer. For pneumonia beryllium emerges as the important element in both sexes, with vanadium also concerned in males. With other cancer in males beryllium, molybdenum and vanadium show associations, but breast and other cancers in females show no realtions with any element. (Author summary modified)##

03214

REPORT ON THE RESULTS OF INVESTIGATION OF THE EFFECTS OF AUTOMOBILE EXHAUST ON THE HUMAN BODY. Kuki Seijo (Clean Air -J. Japan Air Cleaning Assoc., Tokyo) 4(1):39-43, 1966.

The measurement of CO, soot, nitrogen oxides, SO<sub>2</sub>, SO<sub>3</sub>, and hydrocarbons and their medical psychological effects on the human body were investigated in September, 1965 in two regions with contrasting amounts of daily traffic. A quiet region to be considered was the vicinity of Ohara-Machi Setagagya-ku, Tokyo and the other was in the vicinity of National Hygienic

Laboratory at Yoga-cho Setagaya-ka, Tokyo. The results are stated categorically for each air pollutant. To determine environmental effects meteorological data were supplied by Tokyo District Central Meteorological Observatory.

03270

W. J. Hamming and R. G. Lunche

EFFECTS OF EMISSIONS OF ORGANIC SOLVENTS ON LOS ANGELES PHOTOCHEMICAL SMOG. Proc. Tech. Meeting West Coast Section, Air Pollution Control Assoc., 3rd Monterey, Calif., 1963 153-84 pp.

Irradiation of mixtures of solvents and nitric oxide or solvents and auto exhaust will produce ozone, aerosols and eye irritation. The aromatic solvents produce the most eye irritation, and their effectiveness is about 6/10 of that of auto exhaust. The mixed ketones and chlorinated hydrocarbons are the next most active in producing eye irritation, and their effectiveness is about 1/5 that of auto exhaust; methyl ethyl ketone, the low-boiling alkanes, and the mixed alcohols are on the average, much less active in producing eye irritation. The high-boiling alkanes are unreactive. Relative to their effect on aerosol formation, or growth of aerosol, the solvents tested may tentatively be listed in the following order: 1. Aromatic Solvents, at 2 ppm - 1.2 ppm auto exhaust - greater increase in growth of aerosols 2. Chlorinated Hydrocarbons = Next in order - half the effect of aromatics or less 3. Mixed alcohols = Questionable effect on aerosol growth 4. LB Alkanes = Questionable effect 5. Mixed Ketones = May have slight effect 6. MEK = No effect 8. HB Alkanes = No effect. There is a general tendency for high concentrations of solvent to form more ozone than low concentrations. The quantities of ozone formed by irradiation of various solvents have the following orders of magnitude: (a.) Aromatics and HB alkanes produce about 1/15 ppm ozone per ppm of solvent. (b.) LB alkanes and chlorinated hydrocarbons produce about 1/20 ppm ozone per ppm of solvent. (c.) Mixed ketone (probably the active one is isobutyl ketone), 1/25 ppm ozone per ppm of solvent. (d.) Mixed alcohols and MEK form about 1/30 ppm ozone per ppm solvent. When mixed with auto exhaust at only 4 ppm the LB alkanes, HB alkanes and mixed ketone show ozone formation that has significant difference from that of auto exhaust alone. Under similar conditions both aromatic and Cl-HC show positive, but significant effect on ozone formation. A larger and more significant effect might be shown is 8 ppm of these solvents had been used. The effect of solvent on the formation of ozone when mixed with auto exhaust is much less than when they are mixed with nitric oxide and irradiated.##

03480

N. H. Cromwell

CHEMICAL CARCINOGENS, CARCINOGENESIS AND CARCINOSTASIS. Am. Scientist 53, 213-36, 1965

Many of the suspected environmental cancers of man have been reproduced in animals. Research in recent years has been intensified to gain more knowledge of the process known as carcinogenesis, which will eventually lead to the control of this scourge of mankind. This paper gives a brief account on the attempt made to interrelate facts and concepts concerned with the carcinogenic and carcinostatic action of certain organic chemicals, with special emphasis on the polycyclic hydrocarbon and heterocyclic compounds.##

03486

W. Haenszel and K. E. Taeuber

LUNG-CANCER MORTALITY AS RELATED TO RESIDENCE AND SMOKING HISTORIES. II. WHITE FEMALES. J. Nat. Cancer Inst. 32, (4) 803-38, Apr. 1964.

For a 10 percent sample of all white female lung-cancer deaths in the United States during 1958 and 1959, residence and smoking histories were collected from family informants and additional diagnostic details from certifying physicians. Residence and smoking histories were also obtained for a sample of the general population from the Current Population Survey. The findings for females agree on many points with earlier data reported for males: (a) higher lung-cancer risk, increasing with amount smoked for cigarette smokers in all population groups; (b) higher risks among residents of urban areas and metropolitan counties; (c) residence gradients in risk much smaller than smoking-class gradients; (d) accentuation of urban-rural contrasts in risks among lifetime residents; (e) higher risks for mobile populations with 3 or more exposure residences and for the foreign-born; (f) identification of the farm-born migrating to metropolitan counties as a high-risk group. The major difference between the results for each sex is that female smokers residing in urbanized areas did not display risks higher than those expected from the sum of 2 separate smoking and residence effects. Among nonsmokers, the male-female ratio for lung-cancer mortality was 1.3, a figure in line with the sex differential for most causes of death. Male smokers of 1 pack or less and more than 1 pack of cigarettes daily had lung-cancer rates 4 times higher than corresponding females. The possibility of reconciliation of the disparate risks for male and female smokers to bring them into line with the relationship holding for nonsmokers through more accurate measures of "effective exposure" is discussed. (Author summary)##

03490

K. F. Lampe, T. J. Mende, W. B. Deichmann, M. G. Eye, and L. F. Palmer

EVALUATION OF CONJUGATED NITRO-OLEFINS AS EYE IRRITANTS IN AIR POLLUTION. Ind. Med. Surg. 27, (8) 375-7, Aug. 1958.

Distinct eye irritation owing to 2-nitro-2-olefins at low concentrations in air has been observed by two laboratories. For the butene and hexene derivatives, concentrations between 0.1 and 0.5 parts per million by volume have been shown to produce irritation within three minutes. For the corresponding nonene, irritation was observed only at concentration above 1.0.##

03602

W. B. Deichmann, M. L. Keplinger, G. E. Lanier

ACUTE EFFECTS OF NITRO-OLEFINS UPON EXPERIMENTAL ANIMALS  
(PRELIMINARY REPORT). A.M.A. Arch. Ind. Health 18, 312-9,  
Oct. 1958.

The nitro-olefins are very toxic compounds; they produce, in addition, marked local changes in the skin or enteric tract, depending upon the mode of administration. Their vapors cause marked irritation of the entire respiratory tract, skin, and eyes. Absorption from the respiratory or gastro-enteric tract, peritoneal cavity, or skin is very rapid, and signs of systemic intoxication appear promptly, including hyperexcitability, tremors, clonic convulsions, tachycardia, increased rate and magnitude of respiration, followed by a generalized depression, ataxia, cyanosis, and dyspnea. Death is initiated by respiratory failure and associated with asphyxial convulsions. Pathological changes were most marked in the lungs, regardless of the mode of administration of a compound. (Author summary)##

03652

M. Ogata and K. Sugiyama

STUDIES ON THE DETERMINATION OF URINARY HIPPURIC ACID IN TOLUENE POISONING. Japan J. Ind. Health (Tokyo) 4(5):9-16, May 1962. Text in Jap.

An experiment using Gaffney's method of determining urinary hippuric acid by paper chromatography is described: in a plastics factory, workers exposed to 50 ppm of toluene excreted 3.4 times the pre-exposure value of hippuric acid and another group exposed to 20 ppm excreted 1.9 times as much, which the authors think may indicate that the urinary hippuric acid excretion is proportional to the toluene concentration in the air. In another factory using a toluene-benzene mixture (4:1), urinary hippuric acid excretion was observed after exposure to this gas mixture. (Author summary modified)##

03678

J. Bogacz and I. Koprowska

A CYTO-PATHOLOGIC STUDY OF POTENTIALLY CARCINOGENIC PROPERTIES OF AIR POLLUTANTS. Acta Cytol. 5(5):311-319, Oct. 1961.

Comparative carcinogenic properties of air pollutants, tobacco tar and benzopyrene were tested by means of correlated cytopathologic studies, utilizing the uterine cervix of mice as a target organ. It was demonstrated that ZBC and C3H mice treated intravaginally by air pollutants and tobacco tar develop cellular abnormalities and histologic lesions, which are morphologically indistinguishable from those accompanying the development of benzopyrene-induced carcinoma. The ultimate stage of development is, in general, reached later and is less advanced than in benzopyrene-induced lesions, so that after 95 weeks of

treatment, only a very small percentage of mice showed an early invasive carcinoma. The oscillating nature of cytologic findings, observed in a series of consecutive smears of air pollution and tobacco tar-treated mice contrasted with the steady progression of benzopyrene-induced cellular abnormalities, and may suggest the presence of successive, possibly multicentric mucosal lesions, some of which desquamate entirely before others progress to invasive carcinoma. (Author summary)##

03686

J. M. Campbell and J. Clemmesen

BENZOPYRENE AND OTHER POLYCYCLIC HYDROCARBONS IN THE AIR OF COPENHAGEN. Danish Med. Bull., 3(7):205-211, Nov. 1956.

Correlation between cigarette smoking, air pollution and lung cancer was the subject of investigations in Copenhagen. Four sampling stations were set up and sampling was carried out continuously between Oct 1954 to Oct 1955. Five compounds were determined regularly: anthracene, pyrene, fluoranthene, 3:4 benzperylene and 1:12 benzperylene. Results are presented graphically. Generally, the values for smoke content in microgram/cu m at all 4 stations show a maximum in winter and a minimum in summer. In comparison with English towns, Copenhagen appeared to have pollution equivalent to that of an English country town. It is believed that even if the increase in the incidence of lung cancer in Copenhagen has developed in the practical absence of air pollution, the fact remains that it has not reached the level of heavily polluted towns, and there is a possibility that the pollution may contribute in some way to the cancer development mainly because of cigarette smoking.##

03702

J. M. Barnes

MODE OF ACTION OF SOME TOXIC SUBSTANCES WITH SPECIAL REFERENCE TO THE EFFECTS OF PROLONGED EXPOSURE. Brit. Med. J. (5260) 1097-1104, Oct. 28, 1961.

Biological mechanisms that are involved when human are exposed to a polluted atmosphere are reviewed. The categories covered are: (1) study of the toxic action, (2) irritant gases, (3) the pneumoconioses, (4) delayed biological effects, (5) conjugation and excretion, (6) biological effect of trichloroethylene, (7) effects on the central nervous system and (8) chemical carcinogens.##

03813

Vernot, E. H.

ANALYTICAL CONTROL OF CONTAMINANT CONCENTRATION IN EXPOSURE CHAMBERS. In: Proceedings of the Conference on Atmospheric Contamination in Confined Spaces: 30 March - 1 April 1965,



Aerospace Medical Research Lab., (6570th), Wright-Patterson  
AFB Ohio, Contract AF 33(657)-11305, Proj. 6302.  
AMRL-TR-65-230, p. 27-33, Nov. 1965. 4 refs.  
CFSTI, DDC: AD 629622

Methods used at the Toxic Hazards Research Laboratory in the control of low concentrations of contaminants introduced into exposure chambers of various sizes are outlined. For ozone the method consists of pumping through a glass sampling tube or tonometer, and isolation of the sample after sufficient pumping for equilibration. The tonometer has a sidearm which can be capped for sub-sampling by syringes or which may be used for the addition of reagent solution. This method of sampling has proved superior to fritted bubblers. For nitrogen dioxide, the Saltzman method is used. For carbon tetrachloride, gas chromatography is used. Analytical techniques described require relatively simple operations which a technician can carry out with ease and precision. With this system, satisfactory control was maintained over contaminant concentrations in exposure chambers.##

03820

McNerney, J. M.

PRELIMINARY RESULTS OF TOXICITY STUDIES IN 5 PSIA 100% OXYGEN ENVIRONMENT. In: Proceedings of the Conference on Atmospheric Contamination in Confined Spaces: 30 March - 1 April 1965, Aerospace Medical Research Lab., (6570th), Wright-Patterson AFB, Ohio, Contract AF 33(657)-11305, Proj. 6302, AMRL-TR-65-230, p. 98-123, Nov. 1965.  
CFSTI, DDC: AD 629622

A 90-day continuous exposure of mice, rats, beagles and monkeys to a 5 pounds per square inch absolute and 100% oxygen environment produced the following pertinent results: A Wistar-derived strain of rats proved to be sensitive to altitude conditions early in the exposure (15% mortality within 14 days of exposure) whereas a Sprague-Dawley-derived strain proved resistant. A possible association of increasing serum glutamic pyruvic transaminase levels in beagles with length of exposure was found. Except for these factors, the experimental animals gave no apparent indication of being stressed throughout the exposure. A one-year study has been initiated to determine if the enzyme change was due to sampling or is indicative of an accumulating stress. No significant increase in the toxic response of animals to inhaled atmospheric contaminants (carbon tetrachloride, nitrogen dioxide, and ozone) under conditions of 5 psia and 100% oxygen was noted when compared with animals exposed under normal atmospheric conditions (except in the case of mice exposed to carbon tetrachloride). Based upon mortality data, a definite reduction in toxic response to pulmonary irritants was found in the presence of reduced pressure (5 psia) and 100% oxygen when compared with ambient pressure at the same concentration for two weeks continuous exposure. This difference in toxic response may be a beneficial effect derived from the increased partial pressure of oxygen in the experimental chambers even though total pressure has been reduced. Specifically, this is an increase in oxygen partial pressure from approximately 150 millimeters Hg pO<sub>2</sub> to 255 millimeters Hg pO<sub>2</sub>. This increase in oxygen tension at the pulmonary surface may be acting therapeutically against the pulmonary edema

produced by the lung irritants, ozone and nitrogen dioxide. In the case of carbon tetrachloride, a systemic toxicant, no such benefits were observable.##

03821

Back, K. C.

REVIEW OF AIR FORCE DATA FROM LONG TERM CONTINUOUS EXPOSURE AT AMBIENT PRESSURE. In: Proceedings of the Conference on Atmospheric Contamination in Confined Spaces: 30 March - 1 April 1965, Aerospace Medical Research Lab., (6570th), Wright-Patterson AFB, Ohio, Contract AF 33(657)-11305, Proj. 6302, AMRL-TR-65-230, p. 124-133, Nov. 1965.  
CFSTI, DDC: AD 629622

Work which was performed under Air Force sponsorship in the area of environmental toxicology of space cabin atmospheres over the past 5 years is described. This work gave the warning that materials in trace quantities could prove toxic when presented to animals over long continuous exposure periods. Four exposure chambers were constructed for this work. This permitted use of one for a control group of animals and three for contaminant exposure chambers. All animals were followed by a number of clinical laboratory examinations before, during and following the 90-day exposure, and the animals were terminally given stress tests and then necropsied with both gross and microscopic examination of tissues. Carbon tetrachloride, while not causing death at 25 ppm, did cause serious clinical and microscopic liver changes in all animals exposed. The livers of the rats were so much involved that the pathologist made a diagnosis of "cirrhosis". Phenol caused absolutely no problems whatsoever at the 5 ppm level. Hydrogen sulfide (20 ppm) did produce death in rats and mice, but none in monkeys. Methyl mercaptan (50 ppm) caused serious problems and death in 40% of the monkeys and 43% of the mice. Tests were conducted to find out whether animals could perform strenuous tasks following the 90-day exposure and to compare the long term, continuous toxicity of some propellants and propellant types in which the Air Force has an interest. Hydrazine, unsymmetrical dimethyl hydrazine, nitrogen dioxide and decaborane were tested as candidate materials. The results are discussed.##

03822

Siegel, J.

REVIEW OF AMBIENT PRESSURE ANIMAL EXPOSURE DATA FROM SELECTED NAVY COMPOUNDS. In: Proceedings of the Conference on Atmospheric Contamination in Confined Spaces: 30 March - 1 April 1965, Aerospace Medical Research Lab., (6570th), Wright-Patterson AFB, Ohio, b8contract AF 33(657)-11305, Proj. 6302, AMRL-TR-65-230, p. 134-147, Nov. 1965.  
CFSTI, DDC: AD 629622

Studies have been oriented toward operational requirements in a resolution of existing or anticipated problems, although basic research aspects are included in the Navy mission. For example, there was, and still is, a constant need to search for better methods of contaminant generations, for more reliable methods of

analysis and monitoring, for new bio-chemical predictors, and for new ways of getting more information from the exposed animal. Some chamber modifications, animals used, parameters studied, and classes of materials studied are discussed. Experimental results and plans for the future for the Navy Toxicology Unit are summarized.##

03823

Hueter, F. G.

LONG TERM INHALATION EXPOSURE EXPERIENCE WITH REFERENCE TO AIR POLLUTION. In: Proceedings of the Conference on Atmospheric Contamination in Confined Spaces: 30 March - 1 April 1965. Aerospace Medical Research Lab., (6570th), Wright-Patterson AFB, Ohio, Contract AF 33(657)-11305, Proj. 6302, AMRL-TR-65-230, p. 148-165, Nov. 1965.  
CFSTI, DDC: AD 629622

As part of the overall program by the Division of Air Pollution the Laboratory of Medical and Biological b8sciences has been charged with studying the biological effects of plants and animals, including man, of chronic exposures, long term exposures to air pollution as it exists in the ambient atmosphere of communities. The concentration has been on mixtures of normal air pollution, not single agents or simple mixtures of pure gases. The initial studies discussed primarily are concerned with chronic exposure to auto exhaust-contaminated atmospheres, both raw auto exhaust as it comes from the tail pipe, as well as irradiated auto exhaust which simulates the photochemistry that occurs due to sunlight. The results with laboratory animals are discussed.##

03839

S. Carson, R. Goldhamer, M. S. Weinberg

CHARACTERIZATION OF PHYSICAL, CHEMICAL AND BIOLOGICAL PROPERTIES OF MUCUS IN THE INTACT ANIMAL. Ann. N.Y. Acad. Sci. 130, 935-43, Sept. 30, 1966. (Presented at the Interdisciplinary Investigation of Mucus Production and Transport Conference, New York City.)

The selective sensitivity of the mucus sheath component of the mucociliary system of intact cats in respect to induced environmental changes is discussed. An assessment is made of the relative utility of in vitro and in vivo studies, with special emphasis on the latter for the determination of responses to acute and chronic exposure to cigarette smoke. Reactivity to acute exposures is considered as a function of macromolecular constituents of the mucus. The resiliency of the system is demonstrated by the reversibility of the changes effected. In addition, a method for simple in vivo measurement to determine "apparent viscosity," is presented.##

P. Stock

AIR POLLUTION AND CANCER MORTALITY IN LIVERPOOL HOSPITAL REGION AND NORTH WALES. Intern. J. Air Water Pollution 1, 1-13, 1958.

Filters designed to collect for analysis samples of the "smoke" present in the outdoor air at 17 localities in the Liverpool and North Wales region have been in operation continuously for periods of 1 to 3 years, and data are given of the average concentrations during 6 months in respect of total smoke, 3:4-benzpyrene, 1:12-benzperylene pyrene, fluoranthene and sulphur dioxide. These are correlated with the density of population per acre and with the standardized mortality ratios for cancers of the lung and of the intestine. Another 6 filters have operated in the Mersey road tunnel, a bus garage, a motor garage and an office in Liverpool, and comparisons are made between the concentrations of smoke and of its various constituents in the air inside and outside these confined spaces. The work is continuing, with inclusion also of spectrographic analysis of trace elements, and only provisional conclusions can be drawn as yet. (Author abstract)##

03898

03898

H. Matufuji and T. Sakai

HEMATOLOGICAL STUDY ON TRI - AND PERCHLORETHYLENE WORKERS. Japan J. Ind. Health (Tokyo) 4, (9) 5-10, Sept. 1962. Text in Jap.

No remarkable abnormality was found in examinations of the erythrocyte counts, hemoglobin values, hematocrit readings, specific gravity of blood, and differential counts of leucocytes in 136 male and 26 female workers exposed to tri - and perchloroethylene vapors. (Author summary modified)##

03900

K. Nomiyama, M. Minai, H. Kita, H. Shishido, K. Kaneda, and Y. Onozawa.

THREE CASES OF APLASTIC ANEMIA IN FEMALES CAUSED BY BENZENE AND TOLUENE. Japan J. Ind. Health (Tokyo) 6, (11-12) 11-18, Dec. 1964. Text in Japanese.

In a small factory using benzene and toluene, 13 of 15 workers suffered from chronic benzene-toluene poisoning. Pure benzene had been used about 5 yr as a solvent, then toluene only (May - October) and toluene with 5% benzene for over 5 years. In June, 1964, the concentration of toluene vapor in the factory was 150-550ppm and in a living room in the third floor, 30ppm. The authors consider that aplastic anemia may have been caused in 3 out of 4 females who had worked 9 hr daily and stayed on the second or third floor of the factory at night for 1-10 yr. (Author summary modified)##

03902

S. Horiguchi, S. Morioka, T. Utsunomiya, K. Shinagawa, and T. Korenari.

A SURVEY OF THE ACTUAL CONDITIONS OF ARTIFICIAL PEARL FACTORIES WITH SPECIAL REFERENCE TO THE WORK USING TETRACHLOROETHANE. Japan J. Ind. Health (Tokyo) 6, (4) 17-22, Apr. 1964. Text in Japanese.

Elimination of the use of tetrachloroethane as a solvent in artificial pearl factories reduced industrial poisoning. This conclusion was made in a study of 127 coating workers chosen from 33 factories who were given health screening tests in Nov. 1960. Lowered specific gravity of whole blood and a decrease in white cell count were found in 10% of the workers; 23% had a positive result in the urobilinogen test, and 24% had subjective symptoms of the digestive system. Medical examinations were conducted on the workers in three factories (A, B, and C) using tetrachloroethane with air analysis of the working environment in July, 1960 and in Nov. 1961. In July, 1960, the concentration of tetrachloroethane in the air was as high as 70-225 ppm. Lowered specific gravity of whole blood was seen in 12 of 18 workers examined; a decrease in red cell count was seen in 44% of the 18, relative lymphocytosis was seen in 83% of the 18, a positive result in the urobilinogen test was seen in 39%, and neurological findings were seen in 39%. Since the first survey, factories A and C had abandoned the use of tetrachloroethane on their own initiative, while factory B still used it. In Nov. 1961, air analysis of factory B showed 20 ppm. The medical examinations in Nov. 1961 showed remarkable improvement in the health of the workers in factories A and C. (Author summary modified) ##

03933

G. I. Solomin

DETERMINATION OF MEAN DAILY MAXIMUM PERMISSIBLE CONCENTRATION OF ISOPROPYLBENZENE AND ITS HYDROPEROXIDE IN THE ATMOSPHERE. Hyg. Sanit. 31, (4-6) 288-91, Apr.-June 1966. Russ. (Tr.)  
CFSTI, TT 66-51160/4-6

Isopropylbenzene concentration of 0.014 mg/cu m and isopropylbenzene hydroperoxide concentration of 0.007 mg/cu m and their mixtures in concentrations of 0.0074 and 0.0032 mg/cu m had no effect on animals after continuous exposure for 80 days. The recommended mean daily maximum permissible concentrations of isopropylbenzene and isopropylbenzene hydroperoxide should be at the level of the maximum one-time permissible concentrations. If both substances are present at the same time the total maximum concentration is calculated by simple addition of their effects. In the organism, isopropylbenzene and isopropylbenzene hydroperoxide are converted to phenol and excreted with the urine. ##

I. G. Samedov, A. M. Mamedov, Pavlova

VARIATION IN ASCORBIC ACID CONTENT IN THE ORGANISM OF ANIMALS  
CHRONICALLY EXPOSED TO SMALL CONCENTRATIONS OF HYDROCARBONS.  
Hyg. Sanit. 31, (4-6) 299-303, Apr.-June 1966. Russ. (Tr.)  
CFSTI, TT-51160/4-6

Low concentrations of gasoline vapor to which animals were exposed in a chronic experiment (mean calculated values not over 2 mg/l) caused disturbances in the vitamin C exchange in the experimental animals. Intermittent exposure to gasoline vapor had a more deleterious effect than continued exposure to corresponding concentrations. The greatest changes in vitamin C balance were exhibited by animals subjected to concentrations which increased steadily or fluctuated abruptly during the exposure. Variation in the daily diuresis and vitamin C contents in the blood and urine revealed phases which were related to the length of exposures and the exposure regimens.\*\*

03962L

03962L

V. Fiserova-Bergerova, J. L. Radomski, J. E. Davies,  
and J. H. Davis

LEVELS OF CHLORINATED HYDROCARBON PESTICIDES IN HUMAN TISSUES.  
Ind. Med. Surg. 36, (1) 65-70, Jan. 1967.

The storage and accumulation of chlorinated hydrocarbon pesticides in the tissue of humans of various age group was studied. These studies were limited to the analysis of adipose tissue, since available colorimetric procedures were not sufficiently sensitive to detect pesticides in the other tissues of the body. The application of gas chromatography to pesticide analysis and the development of the electron capture detector have made possible the analysis of pesticide levels in these other tissues. In this investigation the fat, liver, kidney, brain and gonads of 71 people were analyzed as part of a total community study on pesticides in Dade County, Florida. The pesticides analyzed were lindane, p,p'-DDT, p,p'-DDE, p,p'-DDD, and dieldrin. (Author abstract)\*\*

03978

S. W. Nicksic, J. Harkins, L. J. Painter

STATISTICAL SURVEY OF DATA RELATING TO HYDROCARBON AND OXIDES OF  
NITROGEN RELATIONSHIPS IN PHOTOCHEMICAL SMOG. Intern. J. Air  
Water Pollution 10, (1) 15-23, Jan. 1966.

Results from various photochemical irradiation chamber experiments were examined by statistical procedures to determine the effect of hydrocarbon and oxides of nitrogen concentrations on eye irritation. The regression equations are given together

with graphs drawn from these equations. Some aspects of the practical interpretation of the results are discussed. Data on existing ambient concentrations of hydrocarbon and oxides of nitrogen in the Los Angeles atmosphere are compiled. (Author abstract)##

04037

K. A. Moskovskaya

INVESTIGATION OF THE EFFECT OF AIR POLLUTION ON THE HEALTH OF CHILDREN . Tr. Leningr. Sanit. Gigien. Med. Inst. 31, 36-40, 1956. Russ. (Tr.)

Previous studies of air pollution in Leningrad are reviewed and data from these studies including concentrations of SO<sub>2</sub> and effects on human lungs are presented. Results of experimentally induced tumors in mice are reviewed. An x-ray and fluoroscopic study is made of the lungs and lymph glands of two groups of children of both sexes. One group resided in the vicinity of a power station and a coke oven gas plant and the control group did not; all children had resided in their areas at least five years. It is inferred from the results of the study that the greater degree of air pollution in the industrial areas was at least indirectly responsible for the pulmonary changes observed in that group of children.##

04051

P. Stocks

A STUDY OF TOBACCO SMOKING, AIR POLLUTION, RESIDENTIAL AND OCCUPATIONAL HISTORIES AND MORTALITY FROM CANCER OF THE LUNG IN TWO CITIES. Preprint. (Presented at the Inter-Regional Symposium on Criteria for Air Quality and Methods of Measurement, Geneva, Switzerland, Aug. 6-12, 1963.)

The methodology of this epidemiological survey of two English cities is described and a broad comparison of the results made. Tabulations and appendices provide details necessary for future simultaneous study of multiple factors in populations of many cities in different parts of the world. The purpose of this study was to test and standardize methods to be used, make modifications when desirable and publish the detailed data with a view to assembling comparable data as the project continues. Responses of health authorities responsible for population surveys and for air pollution analysis and measurement indicated that the methods devised have worked well and can be applied to other cities.##

04070

N. B. Imasheva

EXPERIMENTAL BASIS FOR THE DETERMINATION OF ALLOWABLE ACETOPHENONE LIMITS IN ATMOSPHERIC AIR. Gigiena i Sanit. 28, (2) 3-8, Feb. 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

Acetophenone is used in chemopharmaceutical, aniline dye and organic synthesis industries. For this reason such industries constitute potential sources of atmospheric air pollution with acetophenone. The basic sources of air pollution are production of acetone and of phenol by the cumene method of which acetophenone is a side product. Experiments for the determination of acetophenone in the atmospheric air were conducted by the method of V. A. Khrustaleva which was based on the reaction between acetophenone and m-dinitrobenzene which resulted in the production of a rose-colored substance, the intensity of which was proportional to the concentration of acetophenone; the test color is compared with a freshly prepared color scale. Maximal single dose of acetophenone in atmospheric air was determined by the threshold of acetophenone odor perception method, and by the effect of low acetophenone concentration on eye sensitivity to light, and by the electroencephalographic method. The threshold of acetophenone threshold odor perception for most sense persons was determined as 3.01 mg/cu m, and the maximal nonperceptible concentration (subthreshold concentration) was determined as 0.01 mg/cu m. The threshold of acetophenone reflex activity on eye sensitivity to light determined as 0.01 mg/cu m. Inhalation of 0.007 mg/cu m acetone-air mixture for a short time elicited changes in the electrical brain activity but was inactive at 0.003 mg/cu m concentration. Chronic 24-hour inhalation of 0.07 mg/cu m of acetophenone under chronic experimental conditions elicited no detected changes in the above mentioned indexes. It is recommended that 0.003 mg/cu m be adopted as the maximal single and 24-hour concentration limit for acetophenone in atmospheric air.##

04083

M. I. Gusev and K. N. Chelikanov

EXPERIMENTAL DATA AS A BASIS FOR THE DETERMINATION OF THE MAXIMAL PERMISSIBLE AMYLENES (PENTENES) CONCENTRATION IN ATMOSPHERIC AIR. *Gigiena i Sanit.* 28, (5) 3-8, May 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

It was established that 1.8 mg/cu m of amylene in the atmospheric air represented the concentration of threshold odor perception of the substance. Continuous 24 hour exposure of white rats to the inhalation of air containing 9.8+ of 0.51 mg/cu m of amylene for 75 days elicited statistically significant enhanced porphyrin metabolism, lowered cholinesterase activity, and increased number of luminescent leucocytes. In addition, the animals' pattern of established reflex responses had become disturbed. Some microscopic histologic changes had been noted in the organs and tissues of autopsied rats, most notable among which were pathologic lung changes. Exposure of rats to the inhalation of 1.9 8 or -, 0.22 mg/cu m of amylene under similar experimental conditions elicited none of the above enumerated changes, with very slight postmortem exceptions. On the basis of the above discussed results, it is recommended that the maximal permissible amylene concentration in atmospheric air be set at 1.9 mg/cu m.##



04084

N. S. Zlobina

THE TOXICITY OF LOW STYROL VAPOR CONCENTRATIONS. Gigiena i Sanit. 28, (5) 29-35, May 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

Statistical comparative evaluation of morbidity and work time loss records of workers employed in plants producing polystyrol disclosed high rates of liver and gall bladder morbidity, fall in arterial blood pressure and a variety of complaints characteristic of systemic intoxication with styrol vapor. Since the prevailing styrol vapor concentration in the air of the plant was below the permitted 0.5 mg/liter concentration it was assumed that the official limit was set too high. Chronic experiments with animals exposed to the inhalation of 0.05 mg/liter of styrol vapor impaired the glycogenic liver function, the liver parenchyma and brought about many other pathologic functional and morphologic changes in the experimental animals. Some of the pathologic changes were reversible, others were permanent. Results of tests performed with rats indicated that 0.005 mg/liter of styrol vapor concentration constituted its threshold of harmful effect for rats. It is recommended that 0.005 mg/liter of styrol vapor be adopted as the maximal permissible concentration in the air of working premises.##

04087

V. A. Chizhikov

EXPERIMENTAL DATA AS A BASIS FOR THE DETERMINATION OF MAXIMAL PERMISSIBLE TOLUYLENE DIISOCYANATE CONCENTRATION IN ATMOSPHERIC AIR. Gigiena i Sanit. 28, (6) 8-15, June 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

The concentration of toluylene diisocyanate threshold odor perception for most sensitive persons was experimentally established as 0.2 mg/cu m and the maximal odor nonperceptible concentration was established at 0.15 mg/cu m. The concentration of toluylene diisocyanate threshold effect on electric brain activity was established at 0.1 mg/cu m, while 0.05 mg/cu m concentration elicited no changes in the electric brain activity. The maximal single permissible toluylene diisocyanate concentration in atmospheric air should be set at 0.05 mg/cu m. Exposure of white rats to the inhalation of air containing 2.0 or 0.2 mg/cu m of toluylene diisocyanate 24 hours daily for 84 days caused the animals to lose weight, brought about increased cholinesterase activity, changed muscle antagonists motor chronoxy, and disturbed the protein fraction ratios, and the process of porphyrin metabolism. In 0.02 mg/cu m concentration, toluylene diisocyanate had no observable unfavorable effects on the organism of the exposed experimental rats. Based on the results of the present investigation, it is recommended that 0.02 mg/cu m be accepted as the maximal average 24 hour toluylene diisocyanate concentration in atmospheric air.##

M. V. Aldyрева

EXPERIMENTAL DATA AS A BASIS FOR THE DETERMINATION OF MAXIMAL PERMISSIBLE POROPHORE CHKH 3-5 CONCENTRATION IN THE AIR OF WORKING PREMISES. *Gigiena i Sanit.* 28(7):18-23, July 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

Toxicity parameter of porophore ChKh 3-5 was determined by administering the substance to experimental animals intragastrically. Results showed that LD<sub>100</sub> equalled 0.5 g/kg, LD<sub>50</sub> equalled 0.35 g/kg, and the maximal tolerance dose equalled 0.2 g/kg. The closeness between the tolerance and lethal dose characterizes porophore as a substance having a narrow toxic activity zone. Experimental inhalation of porophore in 20 - 30 and in 7 - 10 mg/cu m concentrations for a short time, and in 2 - 4 mg/cu m concentrations for a long time killed the experimental animals, clearly indicating that porophore ChKh 3-5 was a highly toxic preparation. Results of the investigation brought out the dominant effect of porophore ChKh 3-5 on the erythrocytes and on the central nervous system, the first being in the nature of hypoxia and the second in the nature of profound pathomorphologic changes in experimental animals which died as a result of the porophore administration. Chronic effect of porophore dust inhalation in average concentration of 0.6 mg/cu m elicited reversible functional shifts in the red blood cells and in the arterial blood pressure; slight functional changes in the nervous system and in cholinesterase activities were transient. Based on the experimental data it is recommended that 0.05 mg/cu m of porophore ChKh 3-5 in the air of working premises be adopted as its maximal permissible concentration.##

04104

O. G. Arkhipova, T. A. Kochetkova, and B. N. Shinkarenko

TOXIC PROPERTIES AND BIOTRANSFORMATION OF BENZOTRICHLORIDE. *Gigiena i Sanit.* 28, (10) 30-4, Oct. 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.) CPSTI: TT 65 61429

Benzotrichloride is a toxic substance. Air containing 1 mg/l of benzotrichloride vapor was lethal to white mice and rats. Experimental animals subjected to acute benzotrichloride poisoning developed irritated conjunctiva and mucous membranes of the upper respiratory tract, dyspnea and disturbances of the nervous system. A single exposure to the toxic effects of benzotrichloride elicited in the experimental animals vascular disturbance in the internal organs and in the brain, catarrhal desquamative bronchitis and focal purulent pneumonia, also dystrophic liver dysfunction. Repeated benzotrichloride inhalation possessed the potentiality of eliciting chronic intoxication paralleled by loss of weight, leucopenia, and fall in arterial blood pressure. Repeated benzotrichloride inhalation elicited in the experimental animals changes at the point of its entrance, of which purulent bronchitis and pneumonia were the

gravest along with changes which indicate general resorption of the substance and its capacity to disturb the blood circulation system, to produce dystrophic liver, kidney and suprarenal changes, as well as profound changes in the cortical layers of nerves, and in the thalamo, hypothalamic region. Benzotrichloride is partly eliminated with the urine as hippuric acid. Benzotrichloride penetrated through intact skin, and elicited symptoms of poisoning, such as leucopenia and alopecia. Damage done to intact skin by the direct application of benzotrichloride healed very gradually. (Author conclusions)##

04107

E. N. Burkatskaya and G. A. Voitenko

ORIENTATION DATA FOR THE DETERMINATION OF MAXIMAL PERMISSIBLE DDT CONCENTRATION IN THE AIR OF WORKING PREMISES. Gigiena i Sanit. 28, (11) 36-9, Nov. 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

CFSTI: TT 66 61429

DDT inhalation proved toxic to warm blooded animals. The minimum toxic DDT concentration in the air under conditions of acute experiments was 0.005 mg/l for cats and toxic effects were produced by 0.02 mg/l. In chronic experiments 0.008 mg/l of DDT in the air elicited sharp symptoms of intoxication and 0.15 mg/l proved to be the LD50 for cats. Inhalation of air containing an average of 0.003 mg/l of DDT was harmful to workers' health, the gravity of the poisonous effect increased with the DDT employment record. It is recommended that the maximal permissible DDT concentration in the air of working premises be set at 0.0001 mg/l or 0.1 mg/cu m. (Author conclusions)##

04109

D. D. Shapiro and I. Ya. Hetmanets

BLASTOMOGENIC PROPERTIES OF CRUDE OILS FROM DIFFERENT OIL FIELDS. Gigiena i Sanit. 27, (6) 38-41, June 1962. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

CFSTI: TT 66 61429

Results of the investigations show that crude oil coming from the Bitkov, Gozhansk, Romashkin, Radchenkov and Kokaanov oil fields possessed blastomogenic properties. Results of the investigations, show that the blastomogenic properties of the crude oils and of their derivative products differed to some extent with the concentration of paraffin contained in them. The results showed that the greater was the paraffin concentration in the crude oil, the more intensive was its blastomogenic activity. The same was true of the crude oil tar-pitch and of the crude oil cracking residue. The blastomogenic effects of crude oil derivative lubricating and cooling oils may be eliminated or greatly reduced; it is recommended that such oils be prepared from crude oil, the paraffin content of which originally was or was artificially reduced to less than 1%. (Author conclusions)##

04110

M. M. Gimadeev

THE ROLE PLAYED BY PARAFFIN THE BLASTOMOGENICITY OF CRUDE OIL.  
Gigiena i Sanit. 28, (11) 87-92, Nov. 1963. Russ. (Tr.)  
(Translated by B. S. Levine in U.S.S.R. Literature on Air  
Pollution and Related Occupational Diseases, Vol. 12.)  
CFSTI: TT 66 61429

A critique is presented of "Elastomogenic Properties of  
Crude Oils from Different Oil Fields," Gigiena i Sanit.,  
Vol. 27, No. 6, pp. 38-41, June 1962 (APTIC 4109) which was  
by Prof. D. D. Shapiro and I. Ya. Hetmanets.##

04111

E. A. Kapkaev

ORIENTATION DATA FOR THE DETERMINATION OF MAXIMAL PERMISSIBLE  
ALPHA-METHYL STYROL CONCENTRATION IN THE AIR OF WORKING PREMISES.  
Gigiena i Sanit. 28, (12) 14-22, Dec. 1963. Russ. (Tr.)  
(Translated by B. S. Levine in U.S.S.R. Literature on Air  
Pollution and Related Occupational Diseases, Vol. 12.)  
CFSTI: TT 66 61429

Results of experimental, clinical and physiological studies had  
shown that alpha-methyl styrol had a definite effect on the  
central nervous and cardiovascular systems; its action on the  
peripheral blood produced mild polychromic anemia. Chronic  
exposure to the effects of alpha-methyl styrol may produce trophic  
and metabolic changes. Examination of workers in contact with  
alpha-methyl styrol vapor should include arterial pressure,  
mucous membranes of the upper respiratory tracts, and the  
peripheral blood picture. The presence of some upper  
respiratory diseases in applicant workers should be regarded as  
contraindicative to their employment requiring contact with  
alpha-methyl styrol vapor. Results of clinical observations  
showed weakening of the liver function; wherever this is the case  
workers should be carefully examined as a prophylactic measure  
against any possibility of toxic hepatitis development. It is  
recommended that 0.005 mg/l of alpha-methyl styrol be adopted as  
the maximal permissible concentration in the air of working  
premises. (Author conclusions)##

04124

R. D. Stewart

POISONING FROM CHLORINATED HYDROCARBON SOLVENTS. Am. J.  
Nursing 67, (1) 85/87, Jan. 1967.

The fundamentals of the toxicology of the more common chlorinated  
hydrocarbon industrial solvents is reviewed for nurses in industry  
and emergency rooms. The predominant effect is central nervous  
system (CNS) depression proportional to the amount absorbed which  
is different for each solvent. Each differs, also, in its  
capacity to injure organs such as the liver and kidneys.  
Emergency treatment is supportive to combat the effects of the

CNS depression. The signs and symptoms of acute overexposure in the order of increasing severity are: lightheadedness, dizziness, lack of fine coordination, lethargy, mental dullness, drunkenness, unconsciousness, hypotension, respiratory arrest, and anesthetic death. The maintenance of an adequate airway is essential and assisted respiration may be required. When the CNS symptoms have subsided, attention is directed toward the detection of liver or kidney injury.##

04142

S. Sato

RESULTS OF A HEALTH EXAMINATION ON BENZENE WORKERS AND THE EFFECT OF THIOCTIC ACID. Japan. J. Health (Tokyo) 2, (6) 35-41, June 1960. Jap.

Decreased blood cell counts and positive urobilinogen were found in a health examination in a few of the 17 workers engaged in painting with benzene mixtures. Positive albuminuria and coproporphyrinuria were not found in any of them. The examination included counts of red and white blood cells, tests of protein, urobilinogen and coproporphyrin in the urine. Subjective symptoms such as feelings of fatigue, headache, vertigo, general weakness, and intestinal disorders were reported in many of them. The relative number of constituent leucocytes, specific gravity, and hemoglobin content of the blood sugar and urobilinogen contents in the urine were measured in five subjects who had both subjective symptoms and defective blood counts just before, one week after, and at the end of the intravenous administration of thioctic acid of 25 mg/day for 2 weeks. During these 2 weeks, a marked increase of the red and white cell counts, specific gravity of the whole blood, and hemoglobin contents as well as a marked decrease of urobilinogen excretion in the urine was noted but there was no improvement of the relative counts of the leucocytes. (Author summary modified)##

04148

I. Hara

HEALTH SUPERVISION OF ORGANIC SOLVENT HANDLERS. Japan J. Ind. Health (Tokyo) 3, (4) 231-6, Apr. 1961. Jap.

The blood composition of workers has been improved since the use of benzene was stopped after the deaths of 6 women in a vinyl shoe factory and 2 men in printing plant due to benzene poisoning over several years. Cases of poisoning by carbon tetrachloride, tetrachloroethane, trichloroethylene, methyl acetate, methylethylketone, cresol, and tetrahydrofuran have also been reported recently in many other industries. There is a tendency to use substitutes for benzene and an increase in the use of mixed solvents is prevalent. Attention must be paid to the toxic activity of these solvents and the difficulty in diagnosis of psycho-neurological symptoms due to solvent poisoning. Measures should be taken to make note of the components of the solvents, such as in the obligation of labeling and in the execution of analysis. In recognition of the degree of exposure, the determination of the atmospheric concentration and of the toxic

substances and their metabolites in the blood and urine must be made. Examination of objective psycho-neurological symptoms is very important and electrophysiological studies should be promoted for such symptom diagnosis. (Author summary modified)##

04177

R. Girard, Mallein, R. Fourel, and F. Tolot

LYMPHOMA AND CHRONIC OCCUPATIONAL BENZENE POISONING.  
Lymphose et Intoxication Benzolique Professionnelle  
Chronique. Arch. Maladies Profess. Med. Trav. Securite  
Sociale (Paris) 27, (10-11) 781-6, Nov. 1966. Fr.

A possible connection between an 11-yr industrial exposure to benzene and a diagnosis of lymphoma, 8 yr after the termination of the exposure is discussed. The worker was exposed to benzene vapors as the result of gaging operations and leaky pumps involved in the preparation of a motor fuel containing 10% benzol from 1945 to 1956, when the benzol was eliminated. The diagnosis of lymphoma was indicated by splenomegaly, with hepatomegaly and polyadenopathy, and confirmed by the examination of blood, marrow, and ganglia. The worker had records of blood examinations from 1945-65 showing a progressive elevation of the leucocytes. The rarity of reports showing a relation between lymphoma or lymphocytic leukemia may result from the delay period of 5 to 13 yr for the development of symptoms. In all cases involving lymphoma or blood pathology, any past exposure to benzene should be explored.##

04252

D. P. Partsef

CHRONIC EFFECT OF CERTAIN COMPONENTS OF EXHAUST GASES FROM MOTOR CARS. (Khronicheskoe deistvie na organizm zhivotnykh nekotorykh komponentov vykhlopnykh gazov avtomobilei.) Hyg. Sanit. 31, (9) 363-8, Aug. 1966. Russ. (Tr.)  
CFSTI: TT 66-51160/7-9

Analysis of the motor-car exhaust gases and of the air of the highways by separate chromatographic methods revealed comparably high concentrations of pentane and hexane. Their concentration in the atmosphere attained 4 mg/cubic meter and their ratio was about 1:1. A 24-hr poisoning of albino rats for a period of 86 days showed that pentane and hexane at concentrations of 94.7, 50 and 10 (at a ratio of 1:1) had no significant effect on the animal's body and it was only at a concentration of 3 mg/cubic meter that they had no effect at all on the behavior of the animals, their weight, the motor chronaxy of muscle antagonists, the blood pressure and the cholinesterase level. (Author summary)##

04253

N. V. Dmitrieva

MAXIMUM PERMISSIBLE CONCENTRATION OF TETRACHLOROETHYLENE IN FACTORY AIR. (Materialy k obosnovaniyu predel'no

dopustimoi kontsentratsii tetrakhloretilena (perlenu) v vozdukhke proizvodstvennykh pomeshchenii.) Hyg. Sanit. 31, (9) 387-92, Aug. 1966. Russ. (Tr.)

CFSTI: TT 66-51160/7-9

The toxicity of tetrachloroethylene was investigated with a view to formulating hygienic standards. Acute and chronic exposure studies were conducted on rats using varying concentrations of the compound. The effects were investigated by electrophysiological, biochemical, and histological methods. Based on the results of these studies, it was recommended that the maximum permissible concentration of tetrachloroethylene in factory air should be 0.03 mg./l.##

04258

I. N. Frolova

MAXIMUM PERMISSIBLE CONCENTRATION OF P-CHLOROPHENYL ISOCYANATE IN FACTORY AIR. (Materialy k obosnovaniyu predel'no dopustimoi kontsentratsii parakhlorofenilizotsianata v vozdukhke proizvodstvennykh pomeshchenii.) Hyg. Sanit. 31, (9) 481-3, Aug. 1966. Russ. (Tr.)

CFSTI: TT 66-51160/7-9

The effects of p-Chlorophenyl isocyanate were studied in experiments on 152 white mice, 22 albino rats and 4 rabbits. The substance was found to be toxic with respect to laboratory animals when inhaled or ingested, whereas its toxicity was only slight in the case of cutaneous application. The median lethal concentration for inhalation by white mice was 0.053 g or - 0.034 mg/l (0.061 to 0.045 mg/l). Its threshold concentration for rabbits, determined from variations in the characteristics of the unconditioned reflex, was found to be 0.003 mg/l, with an increase in the time necessary for the development of the reflex muscle strain. Experiments on the inhalation of PCIC were performed by the dynamic method. Since the liminal and the subliminal concentrations of the substance in question were found to be 0.008 mg/l and 0.0005 mg/l, respectively, as determined from its irritating effects (tested on human volunteers), it was possible to recommend a tentative maximum permissible concentration of PCIC at the level of 0.0005 mg/l.##

04321

L. S. Jaffe

THE NATURE AND EFFECTS OF PHOTOCHEMICAL AIR POLLUTANTS ON MAN AND ANIMALS. I. GENERAL CHARACTERISTICS AND COMMUNITY CONCENTRATIONS. Preprint. 1967.

Photochemical smog consists of mixtures of gaseous and particulate products resulting from atmospheric photochemical reactions of gases evolved from the combustion of organic fuels for heat and power. Ultraviolet radiation from sunlight initiates a series of atmospheric reactions between the oxides of nitrogen and photochemically reactive organic substances, such as the olefins, aromatic hydrocarbons and effluents. The photochemical oxidants are a major class of compounds found in community photochemically polluted air. They consist of a dynamic complex

mixture of oxidizing substances which vary in time and place. Nonetheless, they can be measured routinely as "total oxidant", i.e., the net oxidizing effect of all substances in the atmosphere. Ozone and the peroxyacyl nitrates (PAN compounds or PaNs), a homologous group of organic peroxidic nitrogen compounds, have been identified as important oxidants formed in photochemical smog. Ambient "total oxidant" levels serve as useful practical indices of the intensity of photochemical smog and of various biological and physical manifestations of photochemical air pollution. The sources, characteristics and methods of measurement of the photochemical oxidants are described. Specific aerometric data on the oxidant concentrations found in various urban communities in the United States are provided. These levels are sufficiently high to cause specific adverse effects on man, animals, vegetation and certain materials (rubber and textiles). (Author abstract)##

04416

R. F. Bills

ULTRASTRUCTURAL ALTERATIONS OF ALVEOLAR TISSUE OF MICE (I. DUE TO HEAVY LOS ANGELES SMOG). Arch. Environ. Health 12, (6) 689-97, June 1966.

Three animal exposure stations have been in operation for 3 years in the Los Angeles area to ascertain the effects of smog on mice. During the course of this study alterations in the fine structure of the alveolar tissue have been observed. Control animals were kept in rooms with well filtered air. Similar groups were in other rooms continually breathed the ambient air. The lungs of groups of mice ranging from 2 to 21 months old were prepared for electron microscopy. Each particular "group" of animals represented at least four or five mice, and the results are illustrated in this report.##

04500

C. C. Wang and G. V. Irons, Jr.

ACUTE GASOLINE INTOXICATION. Arch. Environ. Health 2, 714-6, June 1961.

A case of acute fatal poisoning from the inhalation of gasoline fumes is presented. Gasoline is an anesthetic agent with a very narrow margin of safety, causing death by respiratory arrest in most cases. The maximal permissible concentration of gasoline vapor for prolonged exposure is 500 ppm. There is a continuous need for thorough and repeated indoctrination of workers with toxic fuels concerning the hazards involved in their improper handling.##

04539

D. Hoffman, E. Theisz, and E. L. Wynder

STUDIES ON THE CARCINOGENICITY OF GASOLINE EXHAUST. J. Air Pollution Control Assoc. 15, (4) 162-5, Apr. 1965.



Gasoline engine exhaust tar was demonstrated to be carcinogenic to the experimental animal. The activity of exhaust tars is to a major extent due to the presence of four, five, and six ring condensed, aromatic hydrocarbons. This concept was confirmed by large-scale separations and mouse skin tests of four main fractions and five subfractions of the neutral portions of exhaust tar and by comparison with the activity of the whole tar. The emission of polynuclear aromatic hydrocarbons and phenols in gasoline engine exhaust depends on the fuel used. Other methods for the reduction of these agents in gasoline engine exhaust were discussed. Used crank-case oil and blowby tar were biologically inactive. The primary purpose of these investigations has been to study the carcinogenicity of gasoline engine exhaust in an experimental setting. (Author summary)##

04551

W. D. Won and J. P. Thomas

DEVELOPMENTAL WORK ON BIOASSAY TECHNIQUE FOR ATMOSPHERIC POLLUTANTS. Natl. Cancer Inst. Monograph 9. 1961. pp. 59-69. (Presented at the Analysis of Carcinogenic Air Pollutants Symposium, Cincinnati, Ohio, Aug. 29-31, 1961.)

A bioassay technique for carcinogenic activity has been developed, with bacteria as "test animals" and morphological and biochemical changes as indicators of the activity. Striking morphological alterations were noted in heart infusion broth cultures of *Bacillus megaterium* supplemented with benzo(a)pyrene and 3-methylcholanthrene. These anomalies were not apparent in cultures supplemented with noncarcinogenic hydrocarbons such as phenanthrene and anthracene. The addition of hydrocarbons to the heart infusion broth medium did not appreciably affect the growth rate of the organisms. Biochemical examinations of *B. megaterium* were made with cultures grown in a simple, chemically defined medium that contained glucose as the sole energy source. Morphological alterations did not develop in these cultures supplemented with carcinogenic hydrocarbons, but a growth suppression was noted. Other significant findings concerned lipid synthesis, aerobic glycolysis, and infrared spectra of lipid material.##

04553

E. L. Wynder and D. Hoffmann

A STUDY OF AIR POLLUTION CARCINOGENESIS. III. CARCINOGENIC ACTIVITY OF GASOLINE ENGINE EXHAUST CONDENSATE. Cancer 15, (1) 103-8, Feb. 1962.

The benzene extract of a gasoline engine exhaust condensate has about twice the carcinogenic activity of tobacco smoke condensate in terms of skin tumors in mice. The degree of greater activity of automobile exhaust "tar" is not readily correlated with the fact that the concentrations of known carcinogens in this material range from 50 to more than 100 times the concentrations in cigarette smoke condensate. The possibility of anticarcinogenic factors is being considered. The biological findings of this study cannot be directly applied to man. Whereas man is exposed

directly to the tobacco smoke condensate, automobile exhaust is diluted several thousand times before reaching the lung. The present study serves as a baseline for subsequent investigations with other types of automobile exhaust "tar" and air pollutants. (Author summary)##

04575

F. L. Estes J. H. Gast

THE IN VITRO EFFECTS OF ALIPHATIC NITRO COMPOUNDS ON TISSUES. Arch. Environ. Health 1, 47-52, July 1960.

The oxygen consumption of whole polymorphonuclear leukocytes and homogenates of heart and liver from guinea pigs was determined in the presence and in the absence of aliphatic nitro hydrocarbon. Saturated (C1-C3) and unsaturated (C3) aliphatic nitro compounds were inhibitors at low concentrations. As the concentration of the nitro compounds was increased, the oxygen consumption passed through a minimum and increased with further increase in the concentration of the nitro compound. (Author conclusions)##

04589

P. Kotin and H. L. Falk

AIR POLLUTION AND LUNG CANCER. Proc. Natl. Conf. Air Pollution, Washington, D.C., 1962. pp. 140-2. 1963.

Author discusses polluted air in relation to other environmental factors concerned with the pathogenesis of lung cancer, and reviews data which warrants this incrimination. A synthesis of the findings described suggests that the carcinogenic properties of polluted urban atmosphere provide at least two indispensable links in the pathogenesis of lung cancer: (1) The environmental presence and the host entry of agents proved experimentally to be carcinogenic and epidemiologically associated with increased liability to development of lung cancer; and (2) The occurrence of host-modifying factors in the atmosphere which by virtue of their effect on the ciliated mucus secreting epithelium of the tracheobronchial tree, facilitate the deposition and abnormal retention of particulate matter in the lungs. Author states that although reduction in lung cancer incidence may be possible by reducing concentrations of carcinogenic agents in the air, removal of the remaining sources of irritants and carcinogenic agents from the respiratory environment will be necessary to achieve any significant reductions.##

04590

E. L. Wynder and D. Hoffmann

PREPARED DISCUSSION: AIR POLLUTION AND LUNG CANCER. Proc. Natl. Conf. Air Pollution, Washington, D.C., 1962. pp. 143-8. 1963.

Epidemiological data have established an "urban factor" for lung cancer, the exact basis of which, however, remains to be determined. Laboratory data have presented several factors that in the experimental setting contribute to the induction of cancer. In view of these considerations, in addition to other health problems associated with air pollution, a reduction of pollutants in the atmosphere is certainly a step to be desired. Work in the field of air pollution is essential, not only because of the potential health problems, immediate and distant, that are involved, but also because of the general scientific knowledge which can be gained. These studies will contribute to knowledge of the possible interrelationship of carcinogens, cocarcinogens, anticarcinogens, cilia-static components, and infectious agents as well as possible climatic factors on the induction of lung cancer.\*\*

04645

L. G. Wayne

EYE IRRITATION AS A BIOLOGICAL INDICATOR OF PHOTOCHEMICAL REACTIONS IN THE ATMOSPHERE. Atmos. Environ. 1, (2) 97-104, Mar. 1967. (Presented at the Symposium on Photochemical Aspects of Air Pollution, Cincinnati, Ohio, Apr. 1965.)

Studies involving the quantitation of eye irritation produced by experimental exposure of humans to synthetic atmospheres are discussed. The principal methods used are panel measurements of intensity, threshold, or response delay. Advantages and difficulties of each method are reviewed, as well as characteristics of the data generated and appropriate means of manipulating the data. Evidence regarding the possible chemical identity of irritants in photochemical smog is discussed, leading to the conclusion that not all observed eye irritation is accounted for by additive effect of formaldehyde, acrolein, and peroxyacyl nitrates. Implications of the findings for air pollution control policies are considered. As one of the undesirable manifestations of photochemical smog, eye irritation has been the subject of a number of studies in recent years. This article reviews several of these studies with particular reference to those aspects relevant to air pollution research and air pollution control policy. (Author abstract)\*\*

04650

F. L. Estes

THE EFFECT OF INITIAL CONCENTRATION OF REACTANTS ON THE BIOLOGICAL EFFECTIVENESS OF PHOTOCHEMICAL REACTION PRODUCTS. Atmos. Environ. 1, (2) 159-71, Mar. 1967.

Synthetic air pollution mixtures were produced by the irradiation of air containing nitrogen dioxide and butene-1 in an all-glass flowing system. The percentage of butene-1 consumed increased with the initial nitrogen dioxide concentration in the range of 2.3 to 4.5 ppm. Further increase in the nitrogen dioxide concentration led to less butene disappearance. After the first 40-60 min of irradiation, the amount of

butene and of nitrogen dioxide which disappeared was constant. This observation, along with the small variations in oxidant analysis, suggested that photochemical products were not markedly changed with time. The amount of the reactants consumed and the inhibition of the subsequent growth of E.coli was a function of the initial ratio of the reactants. A butene-nitrogen dioxide ratio of 20 was most inhibiting. On doubling the concentration of the reactants, the inhibition factor doubled also. When the activity was determined with a glutamate substrate, the decrease in activity of glutamic dehydrogenase was linear with time of exposure of the enzyme. The activity of the enzyme was less inhibited in the reverse direction with an alpha-keto glutarate substrate. (Author abstract)##

04701

C. A. Nau, J. Neal, and V. Stembridge

A STUDY OF THE PHYSIOLOGICAL EFFECTS OF CARBON BLACK (I. INGESTION). A.M.A. Arch. Ind. Health 17, 21-8, Jan. 1958.

The continuous feeding to mice of whole and extracted carbon black in massive quantities for prolonged periods of time leads to no detectable changes from the normal in the mice fed. Carbon black may have an adsorbed component which can be removed by extraction with hot benzene. The free benzene-extractable adsorbed component when fed, mixed with dog food, to mice can and does lead to tumor formation in the stomach of the mice. The same results are obtained when methylcholanthrene, a carcinogen, is fed to mice in a similar manner. Extracted carbon black can effectively adsorb methylcholanthrene. In the adsorbed state, the methylcholanthrene loses its carcinogenic potency.##

04702

C. A. Nau, J. Neal, and V. Stembridge

A STUDY OF THE PHYSIOLOGICAL EFFECTS OF CARBON BLACK (II. SKIN CONTACT). A.M.A. Arch. Ind. Health 18, 511-20, Dec. 1958.

Report covers study on skin contact with the "whole" carbon black, extracted carbon black, the "free" benzene extract of carbon black, a known carcinogen, and, finally, a known carcinogen adsorbed to a carbon black. Carbon blacks as manufactured and used produce no observable harmful effects following skin contact. Carbon blacks have adsorbed a component which, when free, and applied to the skin of mice, produces skin cancer. The adsorbed component is ineffective as a carcinogen. Carbon blacks can adsorb effectively known carcinogens such as methylcholanthrene and 3,4-benzpyrene and by such adsorption do eliminate or reduce the carcinogenicity of these substances.##

04703

C. A. Nau, J. Neal, and V. A. Stembridge

A STUDY OF THE PHYSIOLOGICAL EFFECTS OF CARBON BLACK (III. ADSORPTION AND ELUTION POTENTIALS; SUBCUTANEOUS INJECTIONS).

This study deals with adsorption and elution possibilities and the possible effects of subcutaneous or intraperitoneal injection of various channel or furnace carbon blacks. The carbon blacks used in this study are representative of all blacks now in common use. Their properties are well defined and reviewed. Author concludes that neither blood plasma nor gastric juice elutes any significant adsorbed component when a channel or furnace black is suspended in either medium for as long as seven days. Channel black binds benzpyrene adsorbed artificially so firmly that it cannot be removed completely by benzene extraction. No significant extraction of either channel or furnace carbon black was accomplished with gastric juice to which 10% cooking oil was added when contact was maintained for 7 days. The subcutaneous or intraperitoneal injection in mice of channel or furnace carbon black leads to no significant changes from the normal. The benzene extractives of furnace blacks when injected in oil into mice lead to tumor formation. Carbon blacks, channel or furnace, can adsorb and bind known carcinogens so effectively that no tumors are produced when the adsorbed material is injected subcutaneously.##

04705

J. Neal and R. H. Rigdon

ABSORPTION AND EXCRETION OF BENZPYRENE WHEN FED TO MICE.  
Texas Rept. Biol. Med. 22, (1) 156-64, 1964.

Benzpyrene is demonstrable spectrophotometrically in the kidney and the liver of mice fed 20 mg. of the crystals per gram of laboratory chow. The skin and the viscera have a blue fluorescence. The urine likewise is blue when observed with ultraviolet light. Benzpyrene is rapidly eliminated from the body when food containing this hydrocarbon is discontinued, as indicated by the absence of blue fluorescence in the skin and the viscera, and the failure to demonstrate this hydrocarbon spectrophotometrically in the kidney.##

04706

J. Neal, M. Thorton, and C. A. Nau

POLYCYCLIC HYDROCARBON ELUTION FROM CARBON BLACK OR RUBBER PRODUCTS. Arch. Environ. Health 4, 598-606, June 1962.

Suggestions that elution from carbon black as a component of rubber tubing, conveyor belting, gasket or sealing materials might occur from contact with oils, food juice components, gastric or intestinal juices, led to the studies of carbon black and rubber test materials containing 10% to 20% by weight of carbon black. The following conclusions have been drawn: There is no significant elution of polycyclic hydrocarbons by: (a) human blood plasma, (b) artificial gastric juice, or (c) artificial intestinal juice from the various types of channel or furnace carbon blacks made and commonly used in industry. There is no

significant elution of polycyclic hydrocarbons from test rubber sheets (for fatty or nonfatty foods), prepared according to a practical formulation obtained from a commercial rubber fabricator, by: (a) cottonseed oil, (b) aqueous citric acid, pH, 3.85, (c) 3% aqueous acetic acid, (d) 3% aqueous sodium bicarbonate, (e) 3% aqueous sodium chloride, (f) whole milk (homogenized). Benzene extraction of gastric juice leads to a spectrophotometric evaluation different from benzene extraction of a gastric juice to which carbon black has been added. It appears that carbon black removes something from gastric juice rather than adds something to it. Artificial gastric juice elutes no detectable polycyclic compounds from a channel carbon black to which significant amounts of 3,4-benzpyrene have been added (adsorbed), showing the extensive adsorption potential of the carbon black.##

04708

I. M. Neiman

#### CARCINOGENIC CHEMICAL SUBSTANCES IN THE ENVIRONMENT.

(O kantserogenno deistvuyushchikh khimicheskikh veshchestvakh v okruzhayushchei srede.) Hygiene and Sanitation (Gigiena i Sanit.) 29 (12) 87-93, Dec. 1964. Russ. (Tr.)

This review of the carcinogenic substances generally present to some degree in man's everyday environment lists the following examples and situations: (1) air quality and the fact that statistics disclose that there is a greater occurrence of lung cancer in cities than in less smoke polluted areas; (2) smoking and the fact 3,4-benzopyrene, a carcinogen found in polluted city air, is also to be found in cigarette smoke; (3) contamination of foodstuffs with processing chemicals; (4) apparatus with rubber parts which may have been stabilized with soot, which upon aging may disintegrate and contaminate food stuffs, as in the case of milking machines; (5) carcinogenicity of certain drugs; and (6) hydrocarbons present in coal and petroleum. Ways of identifying carcinogens or the carcinogenicity of a substances are discussed and include spectrographic and biological methods.##

04709

R. H. Rigdon and J. Neal

ABSORPTION AND EXCRETION OF BENZPYRENE OBSERVATIONS IN THE DUCK, CHICKEN, MOUSE AND DOG. Texas Rept. Biol. Med. 21, (2) 247-61, 1963. (Presented at the Annual Meeting, American Association for Cancer Research, Southwestern Section, New Orleans, La., Nov. 16-17, 1962.)

Large amounts of benzpyrene crystals and/or benzpyrene suspended in a physiologic solution of sodium chloride with a 1 per cent solution of polysorbate 80 have been given orally to ducks, chickens, mice and dogs and intratracheally to ducks with no noticeable acute injurious effect. Benzpyrene has been demonstrated spectrophotometrically in the blood and bile of the chickens and dogs and in the blood of the duck. The presence of this hydrocarbon in the blood and biles is influenced by the interval elapsing between the injecting of the benzpyrene and the

time the sample was obtained. The skin of the chicken and mouse has a definite blue fluorescence with ultraviolet light following oral administration of benzpyrene. The mesentery, gallbladder, kidney and urine of the mice fluoresce. The kidney of the chicken and duck likewise fluoresces. Macroscopic observations of tissues with ultraviolet light and photography of the specimen may be helpful in the biological study of hydrocarbons. (Author summary) ##

04710

R. H. Rigdon and J. Neal

EFFECT OF FEEDING BENZO(A)PYRENE ON GROWTH OF YOUNG MICE.  
Texas Rept. Biol. Med. 24, (3) 483-8, 1966.

Observations are reported on the growth of mice fed benzo(a)pyrene before and after weaning. The average weight of litters of mice, nursing mothers fed benzo(a)pyrene, was less than that of litters from lactating mothers fed a normal ration. Some of the young mice were very small, almost dwarf like. This decrease in weight started at 10 to 12 days of age. After the young mice were weaned and fed a standard ration, their weight continued to be lower. This diminution in weight apparently was due to a decrease in nutrition and not to a toxic effect resulting from benzo(a)pyrene.##

04711

R. H. Rigdon and J. Neal

EFFECT OF INTRATRACHEAL INJECTION OF BENZO(A)PYRENE ON DUCKS.  
Texas Rept. Biol. Med. 23, (2) 494-506, 1965.

A variety of pulmonary tumors were previously reported to have developed in the respiratory tract of white Pekin ducks following an intratracheal injection of methylcholanthrene. However, only one microscopic tumor, a questionable carcinoma, occurred in a group of 9 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 absorbed. 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. (Author summary modified)##

04712

R. H. Rigdon and J. Neal

EFFECTS OF FEEDING BENZO(A)PYRENE ON FERTILITY, EMBRYOS, AND YOUNG MICE. J. Nat. Cancer Inst. 34, (2) 297-305, Feb. 1965.

Mice fed rations containing 0.25, 0.5, and 1.0 mg of benzo(a)pyrene per g of food absorb this hydrocarbon and develop a blue fluorescence. Benzo(a)pyrene was demonstrated spectrophotometrically in the kidney of some of these mice but not in the embryos. Apparently the maximum amount of benzo(a)pyrene that is absorbed is metabolized. A metabolite is responsible for the blue fluorescence. This blue fluorescence decreases rapidly when the benzopyrene-containing ration is discontinued. Mice do not like rations containing benzo(a)pyrene after they have been fed standard laboratory pellets. Their weight decreases and the weight curve correlates with the amount of food consumed. Mice fed the ration containing 1.0 mg of benzo(a)pyrene from weaning readily eat it and gain at the same rate as mice fed laboratory pellets. In time mice will adjust to eating food containing this hydrocarbon; however, cannibalism frequently occurs when the higher concentrations of benzo(a)pyrene are fed. This hydrocarbon in the concentrations fed these mice had no injurious effect on fertility or on the developing embryos. Mice fed 1.0 mg of benzopyrene per g of food for their entire lives reproduce. No malformations were observed and, if resorption of any embryos did occur, it was not evident.##

04713

R. H. Rigdon and J. Neal

FLUORESCENCE OF CHICKENS AND EGGS FOLLOWING THE FEEDING OF BENZOPYRENE CRYSTALS. Texas Rept. Biol. Med. 21, (4) 558-66, 1963.

The skin, feathers and viscera of young chicks, fed for 6 days a commercial ration containing 0.1 to 2.5 mg of benzpyrene per gram of food, fluoresced blue. This blue fluorescence disappeared within 6 days when the benzpyrene-containing food was discontinued. Baby chicks readily ate food containing 2.5 mg of benzpyrene per gram of food and progressively gained in weight. No deaths occurred during the 24 days they were fed the benzpyrene-containing food. Benzpyrene apparently is absorbed from the intestines and is metabolized within the body. This blue fluorescence may be due either to benzpyrene or to one of its metabolites. The skin, feathers, viscera and eggs from hens fed 0.5 and 0.1 mg of benzpyrene per gram of food fluoresced a blue color. The amount of benzpyrene fed to these chickens apparently produced no injurious effects. All birds fed this hydrocarbon are now under observation for the development of neoplasms.##

04714

R. H. Rigdon and J. Neal

GASTRIC CARCINOMAS AND PULMONARY ADENOMAS IN MICE FED BENZO(A)PYRENE. Texas Rept. Biol. Med. 24, (2) 195-207, 1966.

White Swiss mice, as used in these experiments, fed commercial laboratory pellets rarely had spontaneously occurring tumors in the stomach but did have spontaneously occurring pulmonary adenomas. Benzo(a)pyrene crystals, added to the commercial ration in



concentrations of 0.25 and 1.0 mg per g of food and fed routinely to the mice, resulted in papillomas and squamous cell carcinomas in the first portion of the stomach and an increase in the number of pulmonary adenomas. All the mice fed the 1.0 mg benzo(a)pyrene-containing ration for 86 days or longer had gastric neoplasms. Mice born of parents fed benzo(a)pyrene during pregnancy and lactation, and fed the control ration when weaned did not develop gastric tumors although litter mates fed benzo(a)pyrene did. The histologic characteristics of these gastric and pulmonary lesions were the same as described by other investigators. In this study no deaths were attributed to the toxic action of benzo(a)pyrene.##

04723

R. P. Smith, A. A. Alkaitis, and P. R. Shafer

CHEMICALLY INDUCED METHEMOGLOBINEMIAS IN THE MOUSE.  
Biochem. Pharmacol. 16, 317-28, 1967.

Nitrobenzene, aniline, p-aminotoluene (p-AT), p-aminoacetophenone (p-AAP) and p-aminopropiophenone (p-APP) have widely different activities as methemoglobin-forming agents in mice. As assessed by circulating levels after intraperitoneal administration, p-AT was the least potent compound of the series, but nitrobenzene and aniline were also only weakly active even at lethal doses. Three hydroxylamine analogues from the above series were all about equipotent as methemoglobin-forming agents in mice. Moreover, at a dose of 0.1 m-mole/kg each produced a transient methemoglobinemia that was remarkably similar to that resulting from p-APP. A methemoglobinemia with similar temporal characteristics was also produced by o-aminophenol, but this compound is about ten times less potent. p-Aminophenol was even weaker, being about as active as aniline. When aniline or nitrobenzene was given in combination with sodium nitrite, circulating methemoglobin levels were prolonged. Such a synergism was not seen when either was given in combination with p-APP. Methylene blue in vivo attenuated the methemoglobinemic response to both p-APP and nitrite. It was more effective, however, against the latter, as evaluated at doses that produced equivalent peak circulating levels. In its time pattern the effect of nitrite was similar in vivo (intact mouse) and in vitro (mouse red cell suspension). In contrast, methemoglobinemia produced by phenylhydroxylamine appears to persist longer in red cells than in the intact animal. Apparently, factors external to the red cell are important in terminating some kinds of induced methemoglobinemias. (Author abstract)##

04738

A. A. Thomas

AEROSPACE TOXICOLOGICAL RESEARCH. Proc. NATO AGARD Conf.  
(Paris) (2) 259-78, Sept. 1965.

The major areas of aerospace toxicology such as propellant toxicology, environmental pollution, and space cabin environment are reviewed. Because of the short duration, high level, and infrequent exposures, the industrial Threshold Limit Values are

meaningless. The philosophy of emergency exposure assumes that no one will be intentionally exposed to high concentrations of propellant vapors under ordinary conditions; if there is exposure, subjective and objective symptomatology may occur, but pathology should be reversible and the performance of the operator must not be impaired. Valuable information from the aerospace toxicological research projects include: exposure data that can be applied to community air pollution problems, new high-energy propellants which are potential pharmacological research tools, and a better understanding of the oxygen toxicity problem.##

04829

H. J. H. Colebatch, C. R. Olsen, and J. A. Nadel

EFFECTS OF 48/80 ON THE MECHANICAL PROPERTIES OF THE LUNGS. J. Appl. Physiol. 21, (2) 279-82, Mar. 1966.

Injection of 48/80 into the right ventricle of paralyzed, vagotomized, artificially ventilated cats increased total pulmonary resistance (RL), end-expiratory transpulmonary pressure and pulmonary arterial pressure and decreased pulmonary compliance (CL), functional residual capacity, and femoral arterial pressure. CL decreased before RL increased; the changes were prolonged and incompletely reversed by large inflations of the lungs. The changes in CL and RL were similar to those produced by right ventricular injections of histamine, and suggest that 48/80 leads to constriction of alveolar ducts. Premedication with polymethylene salicylic acid prevented these effects, but mepyramine maleate, tripelennamine hydrochloride, lysergic acid butanolamide, and heparin were not effective. These findings are consistent with the possibility that the 48/80-induced changes depend on histamine release.

04901

B. R. Wilson

FATE OF PESTICIDES IN THE ENVIRONMENT A PROGRESS REPORT. Trans. N.Y. Acad. Sci. 28, (6) 694-705, Apr. 1966. (Presented at a Division of Environmental Sciences Meeting, Mar. 2, 1966.)

Pesticides can move horizontally and vertically by such means as leaching, erosion, and run-off and can reach areas far removed from the original sites of application. It is insufficient to know only the persistence of the parent compound; one must know the fate of the compound until it is degraded to its simplest components. Soil, water, fisheries, insects and plants were selected as eventual investigative sites for pesticides. The pesticides investigated were the following: dichlorodiphenyltetrachloroethane, cyclodiene, Malathion, 1-naphthyl N-methyl carbamate, linuron, Diphenamid, Vernan, and methyl N-(3,4 dichlorophenyl) carbamate. The conclusion is that more research is needed if rational judgments on the hazards presented by pesticides in the environment is to be adequately analyzed.##

R. A. Abbanat and R. P. Smith

THE INFLUENCE OF METHEMOGLOBINEMIA ON THE LETHALITY OF SOME TOXIC ANIONS. I. Azide. Toxicol. Appl. Pharmacol. 6, (5) 576-83, Sept. 1964.

The time course and extent of the methemoglobinemia induced by intraperitoneal sodium nitrite and p-aminopropiophenone (PAPP) have been characterized in female mice. The peak methemoglobin formation (34%) from sodium nitrite (75 mg/kg) is achieved in about 40 minutes. Comparable levels from PAPP (15 mg/kg) are achieved more quickly (between 5 and 10 minutes) but decline more rapidly to normal. Both nitrite- and PAPP-induced methemoglobinemia afford a significant degree of protection against poisoning by sodium azide when administered in an appropriate time sequence. It was not possible under the same circumstances to protect mice against death from fluoride, cyanate, thiocyanate, selenate, or borate, although some prolongation of survival time was seen after fluoride. The formation of the azidemethemoglobin complex has been demonstrated within intact mouse red blood cells, and small amounts of the complex were identified in vivo in an antidotal situation. It is considered important that the protective action of methemoglobinemia has been demonstrated to date only against established inhibitors of cytochrome oxidase. (Author summary)##

04966L

AIR QUALITY CRITERIA FOR THE PHOTOCHEMICAL OXIDANTS. Public Health Service, Washington, D.C., Division of Air Pollution. Sept. 1966. 276 pp.

This document surveys published (and about to be published) scientific information on the occurrence of photochemical oxidants in polluted air and the effects of those oxidants on various receptors. On the basis of this survey, criteria are presented for the informational use of municipal, State, and interstate air pollution control agencies. The sources of the photochemical oxidants, methods of measurements, and typical atmospheric concentrations in various communities are described. Current information on the relationship between the photochemical oxidants and eye irritation and other effects on humans, various effects on animals and plants, effects on materials, and effects on visibility (haze formation) are summarized. This review includes results of both laboratory studies and ambient air exposure studies, and, for man, the results of industrial and experimental exposures and the findings of clinical and epidemiological studies. Tables summarize the reported effects of ambient photochemical smog. Supplemental data are provided to cover the effects of pure ozone or peroxyacyl nitrates--both important atmospheric photochemical oxidants--on plants, animals, and humans exposed in laboratory studies by various investigators. A bibliography at the end of the document lists the important references reviewed in its preparation. (Author introduction modified)##

L. G. Wayne

THE CHEMISTRY OF URBAN ATMOSPHERES (TECHNICAL PROGRESS REPORT-VOLUME III). Los Angeles County Air Pollution District, Calif. Dec. 1962. 223 pp.

A major part of the research conducted by the Los Angeles County Air Pollution Control District has been concerned with the effects of fuel composition on smog, potencies of various compounds as precursors of eye irritation, identification and study of reaction products in photochemical systems, and plant bioassay of polluted atmospheres. These studies have been supplemented by research projects of other institutions. The objectives, methods, and findings of such recent research in smog chemistry comprise the subject matter of the following chapters. The status of research dealing with eye irritation as a manifestation of photochemical smog, including some discussion of the biometric concepts involved in the measurement of eye irritation are discussed in Chapter 2. Various suggestions as to the chemical identity of the eye irritants are critically considered. Harmful effects of smog on plants are discussed in Chapter 3. Participation of various primary and secondary contaminants in the photochemical reactions in smog is studied in Chapter 4. Detailed consideration is given to the light-absorbing characteristics of primary pollutants and the chemical consequences of light absorption. Evidence about the development of photochemical products as secondary pollutants is critically reviewed, with special attention to the role and identity of a unique class of compounds, first discovered in the course of smog research, known originally as "Compound X". A reaction catalogue has been compiled (Chapter 5) listing the elementary reactions known or suspected to be important in the development of photochemical smog. The experimental evidence regarding the importance of airborne particulate matter in the chemistry of air pollution is reviewed in Chapter 6.##

05231

B. P. Gurinov, V. N. Tugarinova, O. I. Vasil'yeva,  
M. V. Nifontova, and L. M. Shabad

THE CARCINOGENIC PROPERTIES OF EXHAUST GAS SOOT OF MOTOR TRANSPORT. *Gigiena i Sanit.* 27, (2) 19-24, 1962. Russ. (Tr.) Translated as JPRS 13,691.)  
*Gigiena i Sanit.* 27, (2) 19-24, 1962. Russ. (Tr.) Translated as JPRS 13,691.)

At the present time it is well known that in atmospheric air, products of incomplete combustion of fuel may be present, in which there are carcinogenic hydrocarbons. Among them the most common and best studied is 3,4-benzpyrene, which possesses a strong carcinogenic effect. Among the sources of contamination of the air with this carcinogen the exhaust gases of motor transport occupy one of the leading places. The objects of this study were samples of soot scraped from the inner surfaces of exhaust pipes of automobiles with carburetor motors operating on gasoline and of trucks with diesel motors operating on solar oil. As experimental animals, use was made of mice of the black C587 and brown CC57 strains. Two procedures were used: cutaneous applications and

subcutaneous injections. Tar was applied to the skin in a 20% benzol solution in a dose of two drops in the interscapular region over an area of one- 1.5 centimeters three times a week. The tar applications were continued until the animals died. The results obtained led to the conclusion that the soot of exhaust gases of motor transport with carburetor motors possesses a blastomogenic effect, which the same soot from diesel engines does not possess.

05238

A. I. Konstantinova, and N. D. Chertova

LUNG CANCER MORBIDITY IN RELATION TO AIR POLLUTION. Klinich. Med. 40 (12), 104-6 (1962). Russ. (Tr.) (Translated as JPRS 17,523.)

In recent decades a considerable rise in the lung cancer morbidity and mortality rates has been noted throughout the world. A factor which plays a large role in the etiology of this disease, is contamination of the air with dust containing carcinogenic substances. In view of the fact that the air in the industrial section of Ufa is contaminated with the discharges of petroleum refineries and chemical and machine-building plants, it was decided to study the effect of the environment upon the occurrence of lung cancer in the clinic. Case histories of illness and statistical data on lung cancer morbidity and mortality were studied over a period of 10 years. The data show that the lung cancer mortality rate among individuals over 29 years of age is higher in the industrial section of the city.

05284

N. P. Buu-Hoi

NEW DEVELOPMENTS IN CHEMICAL CARCINOGENESIS BY POLYCYCLIC HYDROCARBONS AND RELATED HETEROCYCLES : A REVIEW. Cancer Res. 24, (9) 1511-23, Oct. 1964.

This paper is limited to the salient facts, interpretations, and theories concerning the carcinogenic polycyclic hydrocarbons and their heterocyclic analogs which have been investigated within the last decade. It comprises four parts: I. Improved Methods of Analysis of Carcinogens and Analogous Heterocyclics; II. Relationships between Chemical Structure and Activity in Principal Groups of Newly Investigated Compounds; III. Experimental Evidence; and IV. Endogenous Biosynthesis of Carcinogenic Hydrocarbons. Various bio-assay methods are discussed. Nuclear magnetic resonance spectroscopy, Rayleigh depolarized light diffusion, and the study of complex-formation processes give valuable information on the molecular properties which can be coordinated with carcinogenic activity. Non-condensed hydrocarbons, condensed hydrocarbons and heterocyclic analogs without K- and L- zones, or where the molecule's K-region is not free for biochemical interaction, naphthalenes, hypercondensed hydrocarbons with at least 6 benzene rings, polycyclic nitrogen compounds containing more than one N-heteroatom are discussed with regard to carcinogenic activity. Although there is not yet any proof that living organisms are able to synthesize polycyclic aromatic hydrocarbons, carcinogenic or

not, most of the reactions through which known metabolites of the cell could in theory be converted into such hydrocarbons are already known to occur endogenously, and others are conceivable. Cholesterol has been considered as a possible source of carcinogen endosynthesis. An interesting finding has been the sarcomagenic activity of apocholic acid, a modified bile acid.##

05294

05294

C. H. Pan, J. H. Gast, and F. L. Estes

A COMPARATIVE PROCEDURE FOR EVALUATING ANTIMICROBIAL ACTIVITY OF GASEOUS AGENTS. Appl. Microbiol. 9, (1) 45-54, Jan. 1961. (Presented at the 59th General Meeting, Society of American Bacteriologists, St. Louis, Mo., May 1959.)

A dynamic method for comparison of the antimicrobial activities of gaseous agents is proposed. Specially designed apparatuses for multiple exposure and growth of organisms are described and the validity of the method is discussed. Three gases, ethylene oxide, methyl bromide, and formaldehyde, and five bacteria, *Escherichia coli*, *Bacillus cereus*, *Bacillus megaterium*, *Bacillus licheniformis*, and *Staphylococcus aureus*, were tested and compared; typical data are presented to demonstrate the results. Application of this dynamic method for the investigation of the mechanism of action of gas sterilization is suggested.##

05298

W. W. Payne and W. C. Hueper

THE CARCINOGENIC EFFECTS OF SINGLE AND REPEATED DOSES OF 3,4-BENZPYRENE. Am. Ind. Hyg. Assoc., J. 21, (5) 350-5, Oct. 1960. (Presented at the 21st Annual Meeting, American Industrial Hygiene Association, Rochester, N.Y., Apr. 25-28, 1960.)

The aromatic hydrocarbon carcinogen 3,4-benzpyrene was administered to mice by subcutaneous injection in a graduated series of single and repeated monthly doses. For the smaller single doses, the number of tumors increased and the latent period decreased with increased amounts of benzpyrene. As the single dose was increased further a plateau was reached and an increase in the amount of benzpyrene did not increase the carcinogenic effect. For repeated monthly doses, a similar plateau was not observed in the dose range used in this experiment. Except for the very small doses, a given total amount of benzpyrene produced a larger percentage of tumors when it was injected in twelve monthly doses than when it was administered in a single injection. For 0.5 milligram, the largest dose used, the effect was almost threefold. For the repeated injections, there was a longer time interval from the first injection to the first appearance of tumors than for the single injections. At least for mice, a given amount of carcinogen is more effective when it is administered in small increments over a long period of time than when it is administered in a single dose. Conversely, it appears that a low-level, recurring exposure to a carcinogen is more hazardous than a single exposure to the same total amount. (Author summary modified)

05304

Shabad, L. M.

EXPERIMENTAL RESEARCH ON THE LINK BETWEEN ATMOSPHERIC POLLUTION AND LUNG CANCER. Intern. J. Air Water Pollution 3, (4) 221-30, 1960

The experimental study of the carcinogenic effect of air pollution and its role in the etiology of cancer of the lung is discussed with particular reference to work in the USSR. The carcinogenic hydrocarbon 3:4-benzpyrene has been shown to be present in the atmosphere and in the smoke from Russian cigarettes. Tarry products from air pollution have been tested by skin painting and subcutaneous experiments in mice and malignant tumours were obtained in about 8 per cent of cases. Adenomatous lung tumours were also produced in mice. Earlier experiments had also shown that painting the skins of mice with tar increased the number of lung adenomas. Further, when the progeny of these painted animals were themselves painted with tar, lung adenomas occurred twice as frequently as in the parents. (Author abstract)

05372

Herrold, K. McD.

THE EFFECTS OF BENZO(A)PYRENE, CIGARETTE SMOKE CONDENSATE AND ATMOSPHERIC POLLUTANTS ON THE RESPIRATORY SYSTEM OF SYRIAN HAMSTERS. Acta Union Intern. Contre Cancer 19, (3-4) 710-4, 1963.

Benign and malignant tumors of the trachea, bronchi, and bronchioles have been induced in Syrian hamsters following the intratracheal instillation of benzo(a)pyrene suspended in Tween 60. So far only atypical epithelial changes, suggestive of precancerous lesions, have been observed with benzo(a)pyrene suspended in distilled water. No significant changes were noted in the animals that received intratracheal instillation of benzo(a)pyrene dissolved in olive oil. These findings suggest that both the vehicle and the physical state of the carcinogen are important factors in carcinogenesis. The intratracheal instillation of cigarette smoke condensate and atmospheric pollutants produced regenerative epithelial changes of the tracheobronchial mucosa. These lesions included basal cell hyperplasia, and peribronchial and peribronchiolar proliferation. Atmospheric pollutants often induced extensive adenomatous proliferation that involved large areas of the lung. No tumors of the respiratory tract have been induced with cigarette smoke condensate or atmospheric pollutants. (Author summary)

05418

G. J. Stopps and M. McLaughlin

PSYCHOPHYSIOLOGICAL TESTING OF HUMAN SUBJECTS EXPOSED TO SOLVENT VAPORS. Am. Ind. Hyg. Assoc. J. 28 (1), 43-50 (Feb. 1967).

The purpose of the experiments reported here was to assemble tests sensitive enough to measure changes in psychophysiological functions in human subjects exposed to low concentrations of

solvent vapors. Four concentrations of trichloroethylene were studied, ranging from the 1965 threshold limit value of 100 ppm upward to 500 ppm. Results showed no significant effect of 100 ppm of trichloroethylene on psychomotor performance; however, there was a progressive decline in performance with increasing trichloroethylene levels at higher concentrations. Similar experiments were performed using Freon-113 (1,1,2-trichloro-1,2,2-trifluoroethane) in concentrations ranging from 1500 ppm to 4500 ppm. No significant effect of Freon-113 on psychomotor performance was seen at 1500 ppm, but slight deterioration appeared at 2500 ppm, and progressively higher concentrations resulted in an increasing decrement in performance. (Author abstract)##

05639

G.W. Griffith

ATMOSPHERIC POLLUTION AND LUNG CANCER. Cancer Progr. 86-94, 1963.

Correlation between the incidence of lung cancer and the concentration of air pollutants in Wales, England, United States, U.S.S.R., Denmark, Norway and Iceland is presented, the air pollutant being 3,4-benzpyrene. The contribution of air pollution to mortality rates in urban and non-urban areas, smokers versus nonsmokers is discussed. It is concluded that removing the 'urban' factor in the five main cities of South Africa without alteration of smoking reduces the mortality in these cities by only ten percent.##

05650

Amdur, M. O.

HAZARDS TO HEALTH (AIR POLLUTION AND HUMAN HEALTH-CHRONIC BIOLOGIC EFFECTS). New Engl. J. Med. 266, 555-6, Mar. 15, 1962.

The effects of air pollution as a respiratory ailment are reviewed. Pollutants found in urban atmospheres (sulfur dioxide, benz(a)pyrene, ozone and carcinogenic substances) are the principles discussed. It is conjectured that various irritants present in urban atmospheres may also enhance the potency of even very small amounts of carcinogenic substances. Some irritants decrease the rate of ciliary activity in the respiratory tract, thus interfering with one of the mechanisms that normally remove inhaled particulate matter from the airways, and chronic irritative damage to the epithelial lining of the airways could render it more susceptible to the action of carcinogens.

05680

E. R. Darley, J. T. Middleton, and M. J. Garber

PLANT DAMAGE AND EYE IRRITATION FROM OZONE-HYDROCARBON REACTIONS. Agr. Food Chem. 8, (6) 483-5, Dec. 1960. (Presented at the 136th Meeting, American Chemical Society, Atlantic City, N. J., Sept. 1959.)



Gas phase reaction products of several ozone-hydrocarbon mixtures, including mono-olefins, a diolefin, and aromatics, were assessed for their relative ability to damage pinto bean plants and to irritate eyes. Plant damage was obtained from all reactions whose products, after cleavage at the double bond, contained three or more carbon atoms; ozone reactions with propylene and 2-butene produced no phytotoxicant. Injury was markedly reduced by attaching a methyl group at the double bond of a straight-chain olefin; however, there was no difference in injury between cis- and trans- forms of a given olefin. None of the reactions irritated eyes above that amount reported for clean, carbon-filtered air.##

05720

K. J. Johnson

SECONDARY ANEMIA AND SUSCEPTIBILITY TO HYDROGEN COMBUSTION PRODUCTS (CASE REPORT). Ann Allergy 23, 148-50, Mar. 1965.

This case report presents data on an individual who demonstrated susceptibility to hydrocarbon fuel with its combustion products from a domestic gas furnace. This case also points out that the cause of a symptom-complex of weakness, fatigue, palpitation, faintness, etc., may not be an "either-or" situation, but can be caused by both the medical entity of anemia and the allergic entity of extreme susceptibility to the chemical environment; in this case, to hydrocarbon fuel. The intensity of patient's symptoms did not correlate with the degree of patient's anemia and tended to worsen as the winter wore on. They were dramatically alleviated by separating patient's from the airborne chemicals and recurred when she was re-exposed to hydrocarbon fuel in her home. Nevertheless, patient's anemia was not cured and patient's did not completely recover from the subjective symptoms until hysterectomy cured menorrhagia.##

05729

Kylin, B., Sumegi, I., and Yllner, S.

HEPATOTOXICITY OF INHALED TRICHLOROETHYLENE AND TETRACHLOROETHYLENE LONG-TERM EXPOSURE. Acta Pharmacol. Toxicol. (Copenhagen) 22, 379-85, 1965.

The hepatotoxicity of trichloroethylene and tetrachloroethylene, was studied in mice submitted to long-term exposure by inhalation. Duration of exposure was four hours daily for six days a week over periods of one, two, four and eight weeks. Effects on the liver were evaluated by histological examination and determination of extractable liver fat. The most conspicuous histological change consisted of fatty degeneration. With trichloroethylene this lesion was slight even at a concentration of 1,600 ppm, but with tetrachloroethylene it was massive at as little as 200 ppm. Neither liver cell necrosis nor cirrhosis was discernible. On the basis of these findings the hygienic threshold for tetrachloroethylene is discussed. (Authors' summary)

05737

Mastromatteo, E.

RECENT OCCUPATIONAL HEALTH EXPERIENCES IN ONTARIO. J. Occupational Med. (Ottawa). (Presented at the American Industrial Health Conference, Bal Harbour, Fla., Apr. 1965.). 7(10):502-511, Oct. 1965.

Industrial exposure to several toxic agents is revealed and case histories are given. Included are mercury exposure in chlor-alkali plants, electrical outdoor advertising, the hat industry, and the treating of grain seed with an organic mercurial fungicide; asbestos insulation and the manufacture of brake linings and clutch faces; exposure to toluene diisocyanate and a curing agent for isocyanate-containing polymers; furfuryl alcohol exposure; illness associated with urethane foam manufacture; and respiratory sensitization in a rubber industry.

05790

M. A. Young

HEALTH HAZARDS OF ELECTROPLATING. J. Occupational Med. (Ottawa) 7, (7) 348-52, July 1965.

In the electroplating industry, materials utilized, gases and vapors evolved, and procedures applied are such as to warrant concern with respect to personal injuries and occupational diseases. Offending agents characteristic of this industry are chromic acid and mineral acids; the metals cadmium, lead, nickel, and arsenic; and such gases and vapors as arsine, hydrogen, hydrocyanic, cyanide, and trichloroethylene. A continuing requirement in the operation of an electroplating plant is the avoidance of mixing acid and cyanide solutions. The disposal of some plating plants wastes may require special treatment prior to their discharge into public sewer systems. (Author summary modified)##

05819

Schuck, E. A. and N. A. Renzetti

EYE IRRITATIONS FORMED DURING PHOTOOXIDATION OF HYDROCARBONS IN THE PRESENCE OF OXIDES OF NITROGEN. (J. Air Pollution Control Assoc.) 10 (1), 389-92 (Oct. 1960). (Presented at the 53rd Annual Conference, Air Pollution Control Association, Cincinnati, Ohio, May 22-26, 1960.)

Individual hydrocarbons were irradiated with near-ultraviolet light in the presence of nitrogen dioxide. Two products of the photooxidations, formaldehyde and acrolein, were found to be eye irritants and to account for the majority of the observed eye irritation found in the photooxidized systems studied. At the concentrations present in the photooxidized mixtures, epoxides, most aldehydes, ketones, nitrites, ketene, ozone, alkyl nitrates, and acyl nitrates were not eye irritants. Terminal olefins in general led to the greatest amounts of irritation. Internal olefins were of lesser importance in the formation of eye irritants in spite of their rapid rates of reaction. Saturates did not

contribute to eye irritation because of their slow rates of reaction. (Author summary modified)

05882

THE HEALTH HAZARDS OF COMMUNITY AIR POLLUTION. (Senate Committee on Public Works, Washington, D.C., Subcommittee on Air and Water Pollution, June 7, 1966.) 64 pp.

In testimony before the Senate Special Subcommittee on Air and Water Pollution on June 7, 1966, the Secretary of Health, Education, and Welfare said: "There is no doubt that air pollution is a contributing factor to the rising incidence of chronic respiratory diseases - lung cancer, emphysema, bronchitis, and asthma." This summary of the results of scientific studies of air pollution and human health provides documentation of the Secretary's statement. The topics covered are: lung cancer, chronic bronchitis (and associated respiratory diseases), effects on laboratory animals, radioactive materials, sulfur oxides, carbon monoxide, oxides of nitrogen and other facets of the ill effects of air pollution. There are one hundred sixty one (161) references.##

05949

G. I. Solomin

HYGIENIC EVALUATION OF DINYL AS AN ATMOSPHERIC AIR POLLUTANT. (In: Limits of allowable concentrations of atmospheric pollutants. Book 6.) U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 9. pp. 82-92. (1962). Russ. (Tr.)

Results of odor perception study conducted with 15 persons indicated that the concentration of threshold danyl vapor odor perception was 0.06 mg/cu.m. and that the concentration of threshold danyl reflex effect on eye sensitivity to light was 0.04 mg/cu.m. The concentration of threshold danyl electrocortical conditioned reflex formation was 0.03 mg/cu.m., and the subthreshold concentration was 0.01 mg/cu.m. The maximal single allowable danyl vapor concentration for atmospheric air should not exceed 0.01 mg/cu.m. Danyl concentrations of 10 and 0.2 mg/cu.m. under conditions of chronic vapor inhalation elicited changes in the muscle antagonist's chronaxy in white rats. Rate of coproporphyrin elimination with the urine was lowered in rats which chronically inhaled 10 and 0.2 mg/cu.m. of danyl vapor. Prolonged inhalation of air containing 10 mg/cu.m. of danyl lowered cholinesterase activity, while inhalation of 0.2 mg/cu.m. under similar conditions enhanced cholinesterase activity. Inhalation of air containing 10 and 0.2 mg/cu.m. by rats increased the number of leucocytes and decreased the number of lymphocytes. Chronic 24-hour inhalation by rats of air containing 0.01 mg/cu.m. of danyl vapor for a period of 70 days had no effect on the rats' functional activities noted in rats inhaling air having higher danyl vapor concentrations. The limit of average 24-hour danyl vapor concentration in atmospheric air could be the same as the limit of maximal single concentration, i.e. 0.01 mg/cu.m. Sanitary clearance zones surrounding capronic plants which discharge up to 6 ton of danyl per month should not be less than 800 m wide.##

Shen, L.

EXPERIMENTAL DATA FOR THE HYGIENIC EVALUATION OF ATMOSPHERIC AIR POLLUTION WITH STYROL. (In: Limits of allowable concentrations of atmospheric pollutants. Book 7.) U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 9. pp. 155-68. (1963). Russ. (Tr.)

The results obtained from the hygienic evaluation of atmospheric styrol showed the following: (1) The concentration of threshold styrol vapor odor perception in most sensitive persons was 0.02 mg/cu.m., and the subthreshold non-perceptible concentration was 0.01 mg/cu.m.; (2) The threshold effect on reflex changes in eye sensitivity to light in response to styrol inhalation was the same as the threshold of odor perception, namely 0.02 mg/cu.m.; (3) The threshold styrol concentration capable of forming electrocortical reflexes was 0.005 mg/cu.m.; and (4) The recommended limit of allowable single styrol concentration in atmospheric air was 0.003 mg/cu.m. Rats exposed to continuous 70 days inhalation of air containing 50 and 0.05 mg/cu.m. of styrol vapor showed disturbed muscle antagonists chronaxy ratios, a lowered coproporphyrin elimination with the urine, enhanced blood cholinesterase activity, increased numbers of leucocytes and monocytes and reduced number of erythrocytes, also some histopathologic changes of the internal organs. Inhalation of air containing 0.003 mg/cu.m. of styrol under similar experimental conditions had no effect on any of the above mentioned indexes. Sanitary examination of the atmospheric air in the vicinity of a chemical plant producing polystyrol clearly indicated that styrol vapor air pollution extended over considerable distances from the plant and that only at 500 m from the source of pollution was the styrol concentration in the atmospheric air below the proposed limit of its allowable concentration.

06003

P. J. Lawther

BRONCHIAL CARCINOMA, AIR POLLUTION, SMOKING, AND LUNG CANCER. Trans. Med. Soc. London 81, 158-60 (1965).

In 1960 about 200 deaths in England and Wales were reported as being due to lung cancer; last year more than 26,000 people died of the disease in England. This dramatic rise in prevalence, though most regrettable, has furnished research persons with clues concerning the etiology of the disease and has made it possible to discard some unsatisfactory answers. There would seem to be good reason to blame urban air pollution for lung cancer but there are insurmountable objections to the complete acceptance of this hypothesis. However, a massive survey in the U. S. has revealed an urban/rural gradient in lung cancer mortality among non-smokers. This fact would indicate that an urban factor is operating but whether this is real or merely reflects the existence of better diagnostic facilities and greater clinical skill in towns has yet to be decided. Although the fumes of diesel engines have come under suspicion as a carcinogenic agent, there appears no sound evidence that populations exposed by virtue of occupation to more than average concentrations of petrol exhaust products suffer

especially from lung cancer. Also under suspicion are automotive exhausts from gasoline engines and various industrial emissions. It is suggested not to ignore such potent "new" carcinogens as asbestos or the possibility of synergism between air pollution and cigarette smoke and other co-carcinogens.\*\*

06004

W. Lijinsky and P. Shubik

THE DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS IN LIQUID SMOKE AND SOME FOODS. Toxicol. Appl. Pharmacol. 7, (2) 337-43, Mar. 1965.

The present study was undertaken to investigate the possible occurrence of polycyclic aromatic hydrocarbons in a variety of materials commonly occurring in the environment of man. Clearly the investigation has concerned only a small part of the total problem. Since the use of liquid smoke is now superseding the ancient chimney method, it was thought desirable to investigate the polycyclic aromatic hydrocarbon content of liquid smoke and to determine whether any carcinogens were present that might enter the food treated with it. A sample of bacon (prepared in a smoke oven) was analyzed, in addition to smoked salmon and Icelandic smoked haddock. In view of the polycyclic aromatic hydrocarbons found in commercial solvents it was of interest to examine some oils and fats used as food, since solvents are commonly used in oil and fat processing. A sample of a vegetable oil and of a solid hydrogenated fat was examined. Finally, because polycyclic aromatic hydrocarbons occur in air pollutants, it is conceivable that some of these enter drinking water by falling into reservoirs. Lake Michigan is one such open source of drinking water, and a sample of this was analyzed for polycyclic aromatic hydrocarbons. The analyses of these materials involved variants of the analytical methods for polycyclic aromatic hydrocarbons in use for many years in these laboratories. The aromatic materials were concentrated by extraction and solvent partition, the polycyclic aromatic hydrocarbons were separated by chromatography and identified and estimated by absorption spectrometry. Polycyclic aromatic hydrocarbons were absent from the water and vegetable oils, but were present in bacon, smoked salmon, smoked haddock, and liquid smoke at concentrations of the order of parts per billion. Traces of the carcinogen benzo(a)pyrene were present in smoked salmon and smoked haddock, but no carcinogens were detected in bacon or in the two samples of liquid smoke examined.\*\*

06017

R. A. Schneider, C. E. Schmidt, and J. P. Costiloe

RELATION OF ODOR FLOW RATE AND DURATION OF STIMULUS INTENSITY NEEDED FOR PERCEPTION. J. Appl. Physiol. 21 (1), 10-4 (Jan. 1966). (Presented at the Annual Meeting, Federation of American Societies for Experimental Biology, Atlantic City, N. J., Apr. 10, 1965.)

To ascertain the influence stimulus flow rate and duration of olfactory perception of n-butane in nitrogen, thresholds were

measured in eight adults for 16 combinations of 4 flow rates (10, 20, 40, 80 ml N<sub>2</sub>/sec) and 4 durations (0.25, 0.50, 1.00, and 2.00 sec). Expressed as total amount of odorant, thresholds were highest at the fastest flow rates and longest durations. Expressed as concentration of odor, thresholds were highest at the slowest flow rate and shortest durations. Analysis of variance showed that flow rate and duration separately and flow duration interaction significantly contributed to the observed variance. It was concluded that the critical condition for perception is that sufficient odor molecules strike the end organ within a given period of time and that this condition could be defined as a critical intranasal odor rate or as a critical intranasal concentration. (Author abstract)##

06099

R. J. Bryan

INSTRUMENTATION FOR AN AMBIENT AIR ANIMAL EXPOSURE PROJECT.  
J. Air Pollution Control Assoc. 13 (6), 254-65, June 1963.  
(Presented at the 55th Annual Meeting, Air Pollution Control Association, Chicago, Ill., May 20-24, 1962.)

A comprehensive physiological study on the problem of air pollution from automobile exhaust was started by the University of Southern California under a contract with the U.S. Public Health Service. Several different types of experimental animals, including mice, rats, guinea pigs, and rabbits, were to be exposed at four separate locations in the Los Angeles Basin. In determining the possible biological effects of automobile-related air pollution on test animals, the planned studies included those for cancer, lung function, blood analysis, enzyme determinations, and tissue tests. The animals were divided into 2 groups, one being supplied untreated ambient air, and the other purified air for a control. All other environmental conditions were designed to be as nearly identical as possible. The design of facilities, including ambient air room ventilation and control room air purification systems, is discussed. In the design of facilities, the most important problem encountered was that of existing limitations on air purification systems. The experimental design concept used in this project called for no alteration of the breathing air provided to control animals except for the removal of air contaminants. It was not possible to provide such a system in which removal of CO, lower molecular weight hydrocarbons, and NO, could be accomplished effectively. Experience to date, however, indicates that the air purification system selected does remove O<sub>3</sub>, higher molecular weight hydrocarbons, NO<sub>2</sub>, and filterable black aerosols quite effectively. The conclusions to date are limited. However, it is concluded that additional design and evaluation projects are necessary in order to improve ventilation and air purification equipment design for environmental exposure projects.##

06163

G. T. Smith

SMOG - ITS ORIGIN. Rocky Mt. Med. J. 64, (3) 55-8, Mar. 1967

Volatile materials produced by vegetation may be responsible for smog as well as man-made products. It has been calculated that one billion tons of volatile organic substances (terpenes) are released per year by vegetation over the surface of the earth. Throughout the world the terpenes are present in the air at concentrations of 2 to 20 parts per billion. It has been postulated that the dissipation of terpenes passes through the same cycle as that of gasoline vapors in producing a pollution haze. These blue hazes are seen especially in the mountain and desert regions in the U.S. There is some evidence to suggest that these terpenes may be toxic. In Reno, Nevada there was a close correlation between the occurrence of asthma attacks and the concentration of terpenes in the air as determined by monitoring with a gas chromatograph. White rats exposed to 40-60 parts per million of alpha terpene became lethargic in 10 min. Symptoms progressed through agitation, staggering, and finally convulsions in 25 min with death in 30 min. At autopsy, the rats had focal loss of tracheal mucosa, pulmonary edema, and cerebral edema. The adult guinea pigs weighing more than the rats died on the first exposure in 35 to 45 min. The pilot study showed that alpha pinene is toxic in high concentrations to both humans and laboratory animals. The investigation is being continued to study the long term effects of lower concentrations found in nature to determine if pulmonary lesions are produced by prolonged exposure.\*

06196

Rector, D. D., B. L. Steadman, R. A. Jones, and J. Siegel

EFFECTS ON EXPERIMENTAL ANIMALS OF LONG-TERM INHALATION EXPOSURE TO MINERAL SPIRITS. Toxicol. Appl. Pharmacol. 9(2):257-268, Sept. 1966. 18 refs.

A series of short-term repeated and long-term continuous inhalation studies were conducted with a widely used Navy paint thinner (mineral spirits) at concentrations ranging from 114 to 1353 mg/cu.m. Guinea pigs exposed continuously for 90 days to 363-1271 mg/cu.m. showed mortality rates ranging from 27 to 79%. Hematologic, biochemical, and pathological studies failed to reveal changes that might account for these deaths. On the basis of these studies a 90-day tentative guideline for submarines has been established at 40 mg/cu.m. for mineral spirits containing 15-20% aromatic hydrocarbons. (Authors' summary)

06219

J. N. Spencer

PESTICIDE POISONING: THE INSECTICIDES. S. Dakota J. Med. 20, (2) 25-9, Mar. 1967.

The purpose of this paper was not to present a comprehensive review of insecticide intoxication, but to emphasize that with prompt and adequate therapy, an uneventful recovery may be anticipated. The insecticides and especially the organic phosphates and the chlorinated hydrocarbons are highly toxic and frequently are the cause of poisoning in man and animals. With the large number of pesticides sold under a variety of trade names, the diversity of their toxicology, and the multiplicity of their symptoms, the physician may be confused when called upon to

diagnose a case of insecticide poisoning. The two classes of pesticides commonly involved in poisoning are organophosphates and the chlorinated hydrocarbons. The typical reaction of the organo-phosphates is an anticholinesterase action which with an early diagnosis can be treated by prompt administration of atropine and pralidoxime. The chlorinated hydrocarbons offer less hazard to man than the organophosphates. There are no specific antidotes for poisoning from the chlorinated hydrocarbon insecticides. The treatment is symptomatic and supportive. In addition to the actual treatment of the poisoning, the patient's exposure should be terminated and the attending personnel should be protected. In a well-ventilated area, ordinary surgical gloves should control the hazard. All contaminated clothing should be removed and the patient washed with generous amounts of soap and water to which washing or baking soda may be added. When recovery has been attained and no sequelae have been noted, the patients usually show no further complications.##

06266

R. H. Rigdon

PULMONARY NEOPLASMS PRODUCED BY METHYLCHOLANTHRENE IN THE WHITE PEKIN DUCK. Cancer Res. 21(4), 571-4 (May 1961). (Presented at the Pan-American Medical Association Meeting, Mexico City, May 2-11, 1960.)

Many neoplasms occurred in the respiratory tract of white Pekin ducks following one intratracheal injection of methylcholanthrene suspended in a 1.0% aqueous solution of polysorbate 80. No tumors occurred when only polysorbate was injected. The histologic type of the tumors varied. Some were neurofibromas, and others were ganglioneuromas, hemangiomas, squamous cell-like carcinomas, adenocarcinomas, whereas still others were unclassified types of neoplasms. Frequently a single tumor showed a variety of histologic patterns. No metastases occurred. The first tumor was found 56 days after the injection of the carcinogen. Fluorescence studies showed the distribution of methylcholanthrene in the respiratory tract. Methylcholanthrene crystals persisted in the tract for long periods. This technic appears to be very satisfactory for the production of neoplasms in the respiratory tract of the duck. (Author summary)##

06268

Shabad, L. M., L. N. Pylev, and T. S. Kolesnichenko

IMPORTANCE OF LOCAL RETENTION OF CARCINOGENIC AGENT IN PATHOGENESIS OF LUNG CANCER (EXPERIMENTAL INVESTIGATION). Federation Proc., Transl. Suppl. 24(4):T717-T720, Aug. 1965. (Translation of: Vopr. Onkol. (Moscow) (Problems of Oncology) 10, (6) 65-72, 1964.)

Experiments were designed to study the elimination from the lung of 3,4-benzpyrene with repeated administration of suspensions of varied composition. Use was made of 280 random-bred rats of both sexes (138 males and 142 females), aged about 3 months and weighing 80-100 g. The amount of benzpyrene detectable in the lungs 24 hr after a single administration of the substance in physiological saline was somewhat less than after administration of benzpyrene



with India ink and colloidal infusin. Three days after administration with India ink and colloidal infusin, the amount of benzpyrene retained in the lungs was nearly 12 times the amount remaining after administration in physiologic saline. After 5 days a difference was noted between the results of administration of benzpyrene with India ink and colloidal infusin and the administration of this substance with each of these ingredients separately. A distinct relationship is noted between repetition of administrations and the accumulation of benzpyrene in the lung. With repeated administrations, there is evidently further extension of inflammatory processes in the lung tissue, and the latter acquire a chronic character with corresponding exacerbations, which may be conducive to retention of the carcinogen in the lung tissue. Therefore the decisive factor in the retention of benzpyrene in the lung tissue is the nature, combination and, probably, the quantity of the absorbent factors. The greatest deposition of benzpyrene was seen following its administration with India ink and colloidal infusin jointly, whereas its administration with either of these ingredients separately or with physiologic saline did not achieve this end.##

06329

M. Honma and E. H. Kawasaki

THERMAL DEGRADATION OF POLYMERIC MATERIALS. II. TOXICITY EVALUATIONS OF SOME GASES EVOLVING FROM EPON 828 + LP 33 COMPOSITE POLYMER (TECHNICAL REPT.). Lockheed Aircraft Corp., Sunnyvale, Calif., Missile and Space Div. (1961). 36 pp. (Rept. LMSC-800894.)  
CFSTI, DDC: AD 263270

A toxicological evaluation of SO<sub>2</sub>, CO<sub>2</sub>, and H<sub>2</sub>S originating from the epoxy-polysulfide polymer is discussed in detail. The evaluation is further extended to a realistic case in which the laboratory data are extrapolated to 100 lb of polymer pyrolyzing at different temperatures (150, 250, 350, 450 C) into a constant air volume of 90,000 cubic feet. The concentration levels for these gases are shown at selected significant time intervals. Currently available threshold limit values for an 8-hour day are used for comparison in the assessment of the toxicity hazard. Based on the evaluation information, epoxy-polysulfide polymer does not present a hazard below 150 C. Sulfur dioxide and hydrogen sulfide become problematic at 250 C where a definite toxicological trend is established. Beyond this temperature the threshold limit values are rapidly exceeded by the sulfur gases, but carbon dioxide because of its high human tolerance presents only a marginal problem. Similar evaluations of the hydrocarbon gases (considered only hazardous and not toxic) are possible by calculations from the gas composition tables.##

06383

Epstein, S. S.

CARCINOGENICITY OF ORGANIC EXTRACTS OF ATMOSPHERIC POLLUTANTS. J. Air Pollution Control Assoc. (Presented at the 60th Annual Meeting, Air Pollution Control Association, Cleveland, Ohio, June 11-16, 1967, Paper 67-81). 17(11):728-729, Nov. 1967.

The carcinogenicity of atmospheric pollutants can be demonstrated by chemical or biological methods. Chemical methods depend on the identification and measurement of known carcinogens, such as benzo(a)pyrene (BaP), in extracts of atmospheric pollutants. The value of chemical approaches is limited as various pollutant fractions, e.g., the oxyneutal or basic, contain undefined carcinogens; additionally, chemical techniques cannot predict the probability of in vivo interactions between various pollutant components or of enhanced carcinogenicity due to promoting agents such as phenols. Biological methods for demonstrating carcinogenicity are generally based on repeated skin painting or subcutaneous injection of pollutant extracts in mice. Marked variation in the carcinogenicity of organic extracts from various urban sites, incidentally with low activity in Los Angeles, has been noted. In addition to BaP, the role of other carcinogens in crude organic extracts is now generally accepted. Evidence for this includes, tumor production by BaP-free pollutants such as aliphatic aerosols of a synthetic smog and by aliphatic and oxygenated fractions of organic extracts, lack of parallelism between carcinogenicity of organic extracts and their BaP concentrations, and finally by the pattern and multiplicity of tumors developing following injection of pollutant extracts in infant mice. Recent indirect evidence, based on the photodynamic assay has incriminated di-alkylated benz(c)acridines and 7H-benz(de)-anthracene-7-one as the probable major polycyclic carcinogens in basic and oxygenated fractions, respectively. Definitive identification of organic carcinogens in atmospheric pollutants, inter alia, depends on the availability of adequate amounts of organic extracts, their fractions and sub-fractions, approximately 10 kg of atmospheric particulates are required to produce a 10 g sample of the basic fraction, and in correlated chemical and biological investigations.##

06496

H. R. Wolfe, W. F. Durham, and J. P. Armstrong

HEALTH HAZARDS OF THE PESTICIDES ENDRIN AND DIELDRIN (HAZARDS IN SOME AGRICULTURAL USES IN THE PACIFIC NORTHWEST). Arch. Environ. Health 6 (4), 458-64 (Apr. 1963).

Studies were carried out to determine the health hazards associated with endrin and dieldrin, under conditions of some of their agricultural uses in the Pacific Northwest. Dermal exposure of spray-equipment operators was determined by exposing absorbent alpha-cellulose pads on various parts of their bodies for one or more complete cycles of spraying or dusting. Contamination of hands was measured either by rinsing in alcohol in a polyethylene bag or by swabbing with alcohol-impregnated gauze swabs. Respiratory exposure was estimated from the contamination of filter pads of respirators worn during pesticide application operations. The calculated exposure to endrin while dusting potato fields was 1.8% of a toxic dose per hour of exposure. While spraying endrin on orchard cover crops for mouse control, and while spraying dieldrin on pear orchards, the calculated exposure was only 0.2% and 0.3% of a toxic dose per hour, respectively, for each of the operations. Although these studies of acute exposure do not indicate that the workers studied were contaminated with amounts of endrin approaching the toxic level, the fact that the compound is stored in body fat must be taken into account in evaluating the hazard of repeated exposures. (Author summary modified)##

Bils, R. F. and J. C. Romanovsky

ULTRASTRUCTURAL ALTERATIONS OF ALVEOLAR TISSUE OF MICE. II. SYNTHETIC PHOTOCHEMICAL SMOG. Arch. Environ. Health, 14(6): 844-858, June 1967. 15 refs.

The possibility of using artificial photochemical smog was investigated. Male A-strain mice were exposed for three hours to previously irradiated synthetic atmospheres which initially contained propylene, nitric oxide, carbon monoxide, and water vapor to simulate the oxidant concentration produced during a heavy smog peak. The lungs of these treated mice showed a pattern of ultrastructural alterations of alveolar tissue similar to that of tissues in heavy natural smog. Wall cell lamellar bodies generally increased in size and number in exposed 8-month-old mice, but only temporarily. Delaying death only 12 hours allowed the lungs to return to normal. Some permanent changes seemed to occur in exposed respiratory tissue of 15-month-old mice. Reasonably good recovery of smog-disrupted alveolar and capillary lining cells took place, but few wall cells remained. More extensive disorganization of wall cell cytoplasm and disruption of lining membranes occurred when the 20-month-old mice breathed the synthetic smog and delayed death allowed further damage and revealed cell debris in the alveoli. Since the synthetic smog produces cytological effects similar to the heavy Los Angeles smog, it may prove to be a useful tool in further studies concerning the effects of photochemical smog on biological systems.

06640

M. C. Battigelli, R. J. Mannella, and T. F. Hatch

ENVIRONMENTAL AND CLINICAL INVESTIGATION OF WORKMEN EXPOSED TO DIESEL EXHAUST IN RAILROAD ENGINE HOUSES. Ind. Med. Surg., 33, 121-4 (Mar. 1964).

Within the limits of exposure to diesel exhaust products, of locomotive repairmen in three representative railroad engine houses over a period up to 15 years (average duration of 10 years), 210 workers (average age -- 50 years) did not show any significant difference in pulmonary function performance from a group of 154 railroad yard workers (average age -- 50 years) of comparable job status but without history of exposure to diesel exhaust products. Environmental studies in two engine houses revealed levels of exposure to several known constituents of diesel exhaust which were well within the tolerable limits of these substances considered as separate agents. These low values support the negative medical and physiological findings. In contrast, this investigation suggests higher frequency of respiratory complaints, physical examination of abnormalities of the chest, and decreased pulmonary function and performance of cigarette smokers compared to non-smokers regardless of occupation. (Authors' summary)\*\*

A. P. Rusinova

BENZENE AND ITS HOMOLOGUES AS POISONS IN ELECTRICAL WINDING AND INSULATION PLANTS . U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 7, 176-81, 1962. (Gigiena Truda i Prof. Zabolevaniya) 1, (1) 20-4, 1957  
Translated from Russian.  
CFSTI: 62-11103

The air of winding and insulation department of the plant investigated contained benzene and its homologues in concentrations exceeding the allowable limits. Most unfavorable operations were: application of adhesives to micanite on tables manually and their loading into the drying ovens; insulation and lacquering of windings; brush coating of pole coils; and finally, washing and cleaning various finished products. Unsatisfactory labor conditions produced occupational poisoning with aromatic hydrocarbons among the women workers, with symptoms of typical blood picture changes and nervous system disturbances. A state of susceptibility occurred to some common non-occupational diseases, as was shown by increase in the morbidity of such diseases in woman with toxic symptoms as compared with the control women.##

06680

Hervy B. Elkins

EXCRETORY AND BIOLOGIC THRESHOLD LIMITS. Am. Ind. Hyg. Assoc. J., 28(4):305-314, July-Aug. 1967. 27 refs.

"The Industrial Hygienist today recognizes that the peril incurred by the inhalation of harmful dust is a function of two variable factors - the degree of harmful exposure and the specific susceptibility of the exposed individual to ... injury." The preceding statement was made by Don Cummings in a paper published in 1938. The following year he repeated a suggestion he had discussed previously. "...It is also suggested that for each hazardous industrial dust two limiting concentrations should be established. The first, to be designated as the primary threshold, should express that concentration of dust in which a healthy man may be employed for a working lifetime without incurring a disabling injury. The second, to be designated as the secondary threshold, should express that concentration of dust in which a healthy man will inevitably contract silicosis if regularly employed for many years." Practically all industrial hygienists presently pay lip service to the principle stated in the first of these statements. The suggestion in the second statement has been only half adopted. Threshold limits, so-called, or under a different name, have been prepared for over 400 industrial hazards by various organizations in this country and abroad. There seems to be some confusion outside, if not within, the profession, however, over whether these values correspond to the primary or secondary limits. Certainly, when the observation that one or two workers can endure concentrations well above the Threshold Limit Value for a few months, without obvious ill effects, leads to the conclusion that the threshold limit is too low, it would seem that the observer has the secondary threshold in mind, rather than the primary one. The only biologic fluid finding much application for exposure tests is

blood; limited use has been made of biopsy specimens of lung, skin and fat, but these are not very practical for periodic sampling. The excretory products most frequently analyzed are urine and breath; sweat, the other major excretion product, is not well adapted for exposure tests.##

06710

J. Jagatic, M. E. Rubnitz, M. C. Godwin, and R. W. Weiskopf

TISSUE RESPONSE TO INTRAPERITONEAL ASBESTOS WITH PRELIMINARY REPORT OF ACUTE TOXICITY OF ASBESTOS IN MICE. Preprint (1967).

The use of asbestos fibers exposed to a high temperature and injected into the experimental animals produced a high degree of toxicity, resulting in sixty per cent mortality. This experiment gives further support to the general consensus that asbestos produces fibrosis. Tissue in contact with asbestos needles not only produced fibrosis, but a special and peculiar type which is proliferative, granulomatous and invasive. It cannot be doubted that tissue behaves differently around asbestos fibers than it does around foreign body granulomas. It is not the intention of this article to theorize as to how or why asbestos powders produce fibroblastic proliferation or malignancies; these questions are under investigation, utilizing tissue culture techniques. The acute toxicity of heated asbestos observed was very unusual. There are still twenty mice under observation seven months after injection with the heated asbestos. After surviving the acute toxicity, these mice have recovered and are in good health.##

06820

G. F. Smith

TRICHLORETHYLENE: A REVIEW. Brit. J. Ind. Med. (London) 23 (4), 249-62 (Oct. 1966).

The physical and chemical characteristics of trichlorethylene are reviewed in relation to its uses in industry and medical practice with special attention being paid to its metabolism, toxicity, and determination in air. Although the acute toxicity of trichlorethylene was recognized soon after it came into widespread industrial use chiefly by its effects on the central nervous system, the recognition of a possible chronic toxic effect characterized by a mild psycho-organic syndrome came much later and is still not universally accepted. The opinion that trichlorethylene is non-toxic has long since been abandoned in view of the increasing evidence to the contrary. The preponderance of opinion is against any serious toxic effect on the liver, although individual cases of liver damage in industrial workers have been reported. The sudden fatal collapse of young workers during mild exercise has been reported on rare occasions which generally involved heavy exposure. The most common method of determination involves the use of gas detector tubes. The other chemical and physical methods of determination are discussed. The maximum permissible levels for trichlorethylene in air were reduced from 400 ppm in 1947 to 200 ppm, and to 100 ppm in 1961. Effects on the hemopoietic system are rare as are reports on renal

damage. Air concentration as well as urinary metabolite levels are considered the best means of monitoring working conditions.##

06840

D. F. Rounds

THE EFFECT OF AIR POLLUTANTS ON CELLS IN VITRO. Preprint. (1964).

In this study the areas of investigation fell into three categories: (1) The effect of hydrocarbon mixtures on cells in tissue culture, (2) The effect of air pollutants on respiratory activity, and (3) Considerations of a vital constituent (surfactant) of the lung under normal and pathological or treated conditions. Since mitotic events are interrelated with the rate of increase of the total cell population, it was concluded that an evaluation of the effect of auto exhaust on cell number can provide a simple, reproducible, and sensitive test system for estimating the relative concentrations of physiologically active components of automobile emissions. It was observed that serial dilution of hydrocarbons stimulated the growth rate of human fetal lung cells and an established line of conjunctival elements in a linear fashion. Anaphase and telophase figures which resulted from a 24-hour treatment with 3'Me-DAB and air pollutants revealed a twofold increase in the incidence of bridged or lagging chromosomes. Time-lapse cinematographic records of the mitochondria of cells treated with ozone in culture revealed that these organelles undergo morphological alterations which suggested a loss of respiratory function of these cells. Oxygen depletion with time was proportional to the cell number with 250,000 to 500,000 control cells showing a decrease of 35 to 50 mm Hg of O<sub>2</sub> pressure over a two-hour period. A careful comparison of mitochondrial images of alveolar wall cells, taken before and after treatment with 20 ppm NaNO<sub>2</sub>, suggested some degree of transformation of the filamentous morphology of the globular form. Studies on surface tension of mixtures of normal and oxygen poisoned lung extracts and studies using ultraviolet fluorescent microscopy, suggest that oxygen poisoning results in both absence of surfactant and presence of an inhibitor.##

06847

J. Gabliks

INSECTICIDICAL COMPOUNDS (EFFECTS ON REPLICATION OF VACCINIA AND POLIO VIRUSES IN HUMAN CHANG-STRAIN LIVER CELLS). Arch. Environ. Health 14 (5), 698-702 (May 1967). (Presented at the 50th Annual Meeting, Federation of American Societies for Experimental Biology, Atlantic City, N.J., Apr. 14, 1966.)

Since virus replication is dependent upon the metabolism of host cells, the author postulated that some alterations in cell metabolism may influence the mechanism of viral biosynthesis. This possibility is supported by the previous observations that chronic exposure of cultivated cells to insecticides alters their susceptibility to diphtheria toxin and to poliovirus infection. To investigate the effects of insecticidal compounds on animal virus replication, six insecticidal compounds in human liver cells infected with vaccinia and poliovirus were tested. Insecticidal

compounds DDT, chlordane, dicofol, trichlorophon, malathion, and dinocap at subtoxic concentrations inhibited vaccinia virus replication in human Changstrain liver cells. Under the same experimental conditions, the replication of poliovirus was inhibited only by chlordane and malathion, whereas dicofol and dinocap increased the virus yields 4 and 18 times, respectively, and DDT exhibited a light stimulatory effect. Since the reduction in virus yields was not due to extracellular inactivation of virus, the results suggest that some insecticides exert an antiviral activity by altering some physiological activities of cells. Consequently, the magnitude of virus replication may be useful as a parameter for the detection of toxicity in insecticides and other chemicals below their acute toxicity levels.##

06869

M. L. Krasovitskaya, L. K. Malyarova T. S. Zaporozhets

ATMOSPHERIC POLLUTION BY PETROLEUM REFINERIES AND PETROCHEMICAL PLANTS. (Zagryaznenie atmosfernogo vozdukh v raione neftepererabatyvayushchego i neftekhimicheskogo predpriyatiya.) Hyg. Sanit. (Gigiena i Sanit.) 30(4):118-121, Apr. 1965. Russ. (Tr.)

The nature of the atmospheric pollution in the area around a large petrochemical industrial complex was investigated and its effect on the health of children was studied. The pollutants are hydrocarbons, carbon monoxide, hydrogen sulfide, sulfur dioxide and chlorinated hydrocarbons. Three stationary observation points were established to examine the purity of air in the city. One point within the industrial complex, another 2.5 km away and a third 20 km from the plant. The concentration of atmospheric pollutants highest in the first district, a little lower in the second and even lower in the third. At the most distant observation point the atmospheric concentrations of CO and SO<sub>2</sub> exceeded the maximum permissible levels. The content of harmful substances exceeded the maximum permissible concentrations in 51.2% of all the analyses. Studies of the records of first visits at children's clinics showed that, other conditions being equal, the incidence of influenza, upper respiratory tract infections, the common infections of childhood, and pneumonia, were higher in children residing in the area affected by the discharge, than in the control group, the difference being statistically significant. The children showed diminished immunobiological and redox reactions, as well as certain changes that are specific for petroleum gases, such as leucopenia, thrombocytopenia and hypotonia. A need for engineering improvements to reduce the industrial discharges from the oil refineries and petrochemical plants was demonstrated. One of the most important ways of combatting air pollution, which is still awaiting its engineering solution, is the extraction of sulfur from the raw materials and fuel used in the process of oil refining. Another necessary measure is the prevention of loss of petroleum products by evaporation from storage tanks, by hermetically sealing the reservoirs against gas leaks, their thermal insulation, and the installation of the floating protective covers.##

Tarkhova, L. P.

MATERIALS FOR DETERMINING THE MAXIMUM PERMISSIBLE CONCENTRATION OF CHLOROBENZOL IN ATMOSPHERIC AIR. ((Materialy k obosnovaniyu predel'no dopustimoi kontsentratsii khlorobenzola v atmosfernom vozdukh.) Hyg. Sanit. (Gigiena i Sanit.), 30(3):327-333, Mar. 1965. Translated from Russian.

CFSTI: TT 66-51033

According to the data in the literature, the toxicity of chlorobenzol is noted only in high concentrations. But there are no data on the content of this substance in atmospheric air, or on the action of small concentrations on man. The maximum permissible concentration of chlorobenzol in the atmospheric air of populated places has not been ascertained. The author undertook the present investigation in order to fill this gap. The threshold of olfactory preception of chlorobenzol is 0.4 mg/cu m for the most sensitive persons. The threshold of the action of this substance on the electric activity of the brain is 0.2 mg/cu m; the ineffective concentration is 0.1 mg/cu m. The maximum single-time permissible concentration of chlorobenzol lies at the level of 0.1 mg/cu m. Chlorobenzol in 1 mg/cu m concentration in the chronic treatment of white rats causes a lowering and distortion of the correct ratio of the chronaxia of the antagonist muscles, raises the cholinesterase activity and lowers the alpha-globulin content in the blood serum. Chlorobenzol in 0.1 mg/cu m concentration in chronic action on white rats does not cause the changes observed at a high concentration of that substance (1 mg/cu m). The average 24-hour maximum permissible chlorobenzol concentration may be at the level of the maximum single-time concentration (0.1 mg/cu m). (Author Summary modified)##

06895

T. Yuldashev

MAXIMUM PERMISSIBLE CONCENTRATION OF ETHYLENE OXIDE IN THE ATMOSPHERE. (Eksperimental'nue dannye k gigienicheskomu obosnovaniyu predel'no dopustimoi kontsentratsii okisi etilena v atmosfernom vozdukh.) Hyg. Sanit. (Gigiena i Sanit.) 30 (10), 1-6 (Oct. 1965). Russ. (Tr.)

The maximum permissible one-time and mean-diurnal concentrations of ethylene oxide were determined. Twenty human subjects are used to determine the olfactory threshold. The olfactory threshold for ethylene oxide is 1.5 mg/cu m in the most highly sensitive individuals, the threshold for a change in the sensitivity of the eye to light is 1 mg/cu m, and the electrical activity of the cerebral cortex is affected at the level of 0.65 mg/cu m. The maximum one-time permissible concentration of the substance in the atmosphere is 0.3 mg/cu m. Prolonged round-the-clock poisoning of albino rats with ethylene oxide concentration of 0.3 mg/cu m for 83 days causes changes in the ratio of flexors and extensors as well as in the concentrations of chlorides and residual nitrogen in blood. The mean-diurnal maximum permissible concentration of ethylene oxide in the atmosphere is established at the level of 0.03 mg/cu m.##



I. S. Gusev

REFLECTIVE EFFECTS OF MICROCONCENTRATIONS OF BENZENE, TOLUENE, XYLENE AND THEIR COMPARATIVE ASSESSMENT. (Reflektornoe deistvie mikrokontsentratsii benzola, toluola, i ksilola i ego sravnitel'naya otsenka.) Hyg. Sanit. (Gigiena i Sanit.) 30 (12), 331-6 (Dec. 1965). Russ. (Tr.)

The reflective effect on the electrical activity of the cerebral cortex of imperceptible concentrations of benzene, toluene, and xylene was investigated on highly sensitive individuals. The threshold concentrations of aromatic hydrocarbons decrease from benzene to xylene with respect to their effect on cerebral electric activity. The electric potentials are increased by benzene and toluene, while xylene has the opposite effect, causing a marked inhibition of the electric activity of the cerebral cortex. Concentrations of 1.5 mg/cu.m. benzene, 0.6 mg/cu.m. toluene, and 0.2 mg/cu.m. xylene are subliminal with respect to their effect on the electric activity of the cerebral cortex and imperceptible with respect to odor. These concentrations are recommended as the maximum permissible one-time atmospheric concentrations.##

06907

A. I. Kopanev

VITAL STAINING OF TISSUES IN ESTABLISHING STANDARDS OF ATMOSPHERIC POLLUTANTS. (Ob ispol'zovanii metoda vital'nogo okrashivaniya tkanei pri normirovanii atmosferykh zagriaznenii.) Hyg. Sanit. (Gigiena i Sanit.) 30 (12) 390-3 (Dec. 1965). Russ. (Tr.)

The method of vital staining was used in order to study the functional state of the tissues of animals which had been exposed for a prolonged period to relatively low concentrations of ethyleneglycol vapor, and also to determine the effective threshold for this substance. Three groups of albino rats were continuously exposed to ethyleneglycol vapor concentrations of 75, 15, and 3 mg/cu.m. for 60 days, while the fourth group serves as the control. The accumulation index, the elimination index and the trophic potential are determined. The organs investigated are the liver, kidney, brain, lungs and spleen. In the first group (75 mg/cu.m.) a high accumulation index was found in the tissues of liver, kidneys, and brain; in the second group (15 mg/cu.m.) the increase in the absorption of the vital dye was less pronounced and was observed only in the liver tissues. Changes directed at compensating the disturbed functions are investigated by studies of the elimination index of vital dye. In the first group (75 mg/cu.m.) the elimination index is high in the lung and kidney and low in the liver; in the second group the elimination index is low in the liver and kidney. The group of animals exposed to the smallest investigated concentration of 3 mg/cu.m. did not exhibit any difference from the control group with respect to the indices of the accumulation and the elimination of the vital dye. Animals exposed to ethyleneglycol concentration of 75 mg/cu.m. exhibited a decrease in the trophic potential in lungs. The liver, brain and

spleen exhibited a significant increase in the trophic potentials pointing to increased activity of the appropriate cells. Animals treated with ethyleneglycol vapor concentration of 15 mg/cu.m. exhibit an increase of trophic potential in the liver, kidneys and spleen. Ethyleneglycol concentration of 3 mg/cu.m. causes no changes of the trophic potential in any organs of the animals, neither does it cause changes in any other indices of vital staining in comparison with the control group. This concentration of the substance also proved to be subliminal in its effect on the chronaxie of antagonistic muscles, acetylcholinesterase activity of blood and certain other tests. Vital staining of tissues is a sensitive method and deserves to be used when assessing hygienic standards for atmospheric pollutants.##

06910

M. O. Amdur D. A. Cresasia

THE IRRITANT POTENCY OF M-TERPHENYL OF DIFFERENT PARTICLE SIZES. Am. Ind. Hyg. Assoc. J. 27, 349-52 (Aug. 1966.)

The effect of homogeneous aerosols of m-terphenyl of 0.30, 0.65, 1.0, and 2.0 microns diameter on pulmonary-flow resistance of unanesthetized guinea pigs was studied. At equal mass concentration the irritant potency increased as the particle size decreased and the number of particles increased. A small increase in mass concentration for the smaller particles produced a greater increment in response than occurred when the large particles were used. The results were in agreement with earlier work on aerosols of zinc ammonium sulfate. (Author abstract)##

06947

D. A. Hockensmith

AN EVALUATION OF THE THEORY OF CARCINOGENIC AROMATIC HYDROCARBONS. California Univ., Livermore, Lawrence Radiation Lab. (May 17, 1967). 27pp. (Rept. No. UCRL-50269.)

Several polynuclear aromatic hydrocarbons have been found to be carcinogenic. One of the most interesting is 9, 10-dimethylbenzanthracene, which causes mammary cancer in rats with essentially 100% effectiveness. The purpose of this investigation is to evaluate the theoretical explanation of this activity insofar as it has been developed. The three major points under consideration are the electronic properties of the carcinogens, the influence of steric factors, and the formation of charge transfer complexes. It is found that a qualitative theory can be put together but is by no means complete. The most reliable aspects of the aromatic hydrocarbon carcinogenesis theory are based on experimental rather than theoretical evidence. It was already known that the L region of anthracene was the most reactive part of that molecule. When the L region is blocked as in 3,4-benzpyrene and 9, 10-dimethylbenzanthracene, the K region is found experimentally to be the most reactive site. It is reasonable to assume even with no calculation that the reactivity of this region is due to the localization of  $\pi$  electrons. The theory being evaluated here is primarily concerned

with the carcinogens and their mode of interaction with the unknown cellular receivers. It can be combined with other theories that specify the cellular receiver. For instance, the carcinogen could form a complex with a protein moiety of the cellular membrane. Or a virus in an inactive state could be activated by the interaction of a carcinogen with the virus nucleic acid. Even though the theory is not well confirmed at present, the approaches tried have been valuable in sharpening the concepts involved and in providing an interpretation of the experimental results as well as suggesting additional experiments. Appended: the Hickel approximation theory and electronic indices of the K and L regions of the aromatic hydrocarbons.##

07026

A. Morgan, D. J. Morgan, G. M. Arkell

A STUDY OF THE RETENTION AND SUBSEQUENT METABOLISM OF INHALED METHYL IODIDE. Proc. Intern. Symp. Inhaled Particles Vapours II, Cambridge\$ England, 1965. p. 309-320, 1967.

Radioiodine released from irradiated uranium is predominately in the elemental form, but a small amount is usually released as methyl iodide. To enable estimates of the radiological hazard resulting from the inhalation of radioactive methyl iodide to be made, measurements of its retention in a number of volunteer subjects were carried out using iodine-132 labelled methyl iodide. At normal breathing rates, the retention varied from 53 to 92% depending principally upon the respiratory rate (breaths per minute); low rates corresponding to high retention and vice versa. The mean value for retention is 72%. Studies of the clearance of radioactive methyl iodide from the lung, showed that its uptake into pulmonary blood and removal to other parts of the of the body in the general circulation is extremely rapid. The metabolism of iodine-132 introduced as methyl iodide was found to be very similar to that observed after oral intake of iodine-132 as inorganic iodide. It may be concluded that the retained methyl iodide is broken down quite rapidly and that the liberated iodide participates in normal iodine metabolism. AS##

07027

B. Altshuler, E. D. Palmes, N. Nelson

REGIONAL AEROSOL DEPOSITION IN THE HUMAN RESPIRATORY TRACT. In: )inhaled Particles and Vapours II. (Proc. Intern. Symp. Brit. Occupational Hyg. Soc., Cambridge, England, Sept. 28-Oct. 1, 1965.) C. N. Davies (ed.), London, Pergamon Press, 1967, p. 323-337. 20 refs.

Regional deposition of aerosol in the human respiratory tract is estimated from experiments in which aerosol concentration and respiratory flow were measured continuously during individual breaths and from a theoretical analogy with a tabular continuous filter bed model of the respiratory tract. Since the volume of anatomic dead space is uncertain, regional distinction is made by selected boundary volumes which separate the upper tract of the selected volume from the more distal lower tract. The central feature of the estimation procedure is the determination of a combined upper tract penetration, for inspiration, pause, and

expiration, derived from expired aerosol concentration corrected for aerosol mixing. The estimations indicate the particle size for maximum alveolar deposition is greater than 2 microns, equivalent diameter of a unit density sphere. This result is consistent with the calculations of Findeisen, Landahl, and Beeckmans and higher than the 1 micron of Brown et al. (Authors' abstract)##

07068

R. Niewenhuis, L. Scheel, K. Stemmer, and R. Killens

TOXICITY OF CHRONIC LOW LEVEL EXPOSURES TO TOLUENE DIISOCYANATE IN ANIMALS. Am. Ind. Hyg. Assoc. J., 26 (2), 143-9 (Apr. 1965).

Toluene diisocyanate (TDI) is one of the important ingredients in the manufacture of lacquers, fibers and polyurethane foam plastics. The production and consumption of these products has increased greatly in recent years. TDI is known to have an irritating effect upon the skin, eyes, gastrointestinal tract and respiratory tract. Its Threshold Limit Value formerly established at 0.1 ppm has been lowered to 0.02 ppm; however, the Maximal Allowable Concentration level remains 0.1 ppm. The toxicity of repeated inhalation exposures to 0.1 ppm of toluene diisocyanate was studied in rats, rabbits and guinea pigs. The experiment consisted of two parts: (1) 38 six-hour weekly exposures on rabbits and rats, and (2) 58 six-hour daily exposures on rabbits, rats and guinea pigs. The development of bronchiolitis fibrosa obliterations in rats is the complication of primary interest. A description and illustrations of the lesion are given. Other biological effects of toluene diisocyanate are discussed. (Authors' introduction, modified)##

07159

Clarke, J. M.

THE PROBLEM OF CANCER IN NEW ZEALAND. New Zealand Med. J. Vol. 63:788-799, Dec. 1964

In considering the problem of cancer in New Zealand clinical features are not discussed in detail, but a general view of the situation is presented. The subject is discussed as follows: 1. The problem in New Zealand as shown by mortality returns, with some comparisons with other countries. 2. Action taken in the past to meet the position. 3. Recommendations. In 1961, the last year for which statistics are available, there were 3,572 deaths from cancer, about one-sixth of the total number of deaths registered in New Zealand in that year. These figures include Maoris, but in the more detailed figures and comparisons include, the reference is to Europeans only. This number of cancer deaths is the highest total ever registered here in one year, an increase of 282 over the previous year. The death rate per 10,000 of the population is also a record, being 14.72, as compared to 13.84 in 1960. Deaths due to cancer, according to sex, at 15 major sites, in New Zealand in 1961 are tabulated.##

N. C. Delarue

RECONSIDERATION OF SOME SIGNIFICANT ASPECTS OF THE CIGARETTE SMOKING - LUNG CANCER CONTROVERSY. Can. Med. Assoc. J. (Toronto) 89, 1277-83. (Dec. 21, 1963). (Presented at a sectional meeting, American Coll. of Surgeons, Toronto, Canada, Apr. 25, 1963.)

The five-stage procedure used in the assessment of epidemiological evidence for the verification of assumptions drawn from observations about the characteristics of human disease incidence is as follows: First, retrospective and prospective studies are undertaken to define the nature of the specific problem. Later, in subsequent steps, the responsible agent is isolated and if possible eliminated. The hypothesis underlying these studies is then tested by a further prospective study if the injurious agent has been removed from the vehicle to be tested. In line with this procedure it was hoped that a single carcinogen could be identified and recovered from cigarette smoke and, on the elimination of this agent, a safe cigarette could be produced, tested and provided for public consumption. Unfortunately, the complex interrelationships of carcinogens and co-carcinogens seem to make the attainment of this ideal, the safe cigarette, remote indeed. The cigarette manufacturer faces a Herculean task in eliminating all of the various agents of this nature while maintaining a cigarette with aroma and flavour. If such an ideal solution cannot be reached and if no dramatic improvements in therapy are discovered, no alternative remains but to pursue as vigorously as possible every available means to curtail the cigarette smoking habit. (Author conclusion)##

07162

B. G. Ferris, Jr. and N. R. Frank

AIR POLLUTION AND DISEASE. Anesthesiology 25(4):470-478 Aug. 1964.

Atmospheric pollution can be classified under three headings: general, occupational and personal. The components are complex and variable so that it is difficult to extrapolate the prevalence of disease in one area to that of another unless the two have similar chemical compositions. Significant exposures can occur at work and may produce impairment of respiratory function. It is emphasized that tobacco smoking, and particularly cigarette smoking, is a most important factor in the causation of chronic nonspecific respiratory disease. Much research has been done to elucidate the mechanism whereby such changes are induced but specific answers concerning the mechanisms have not been forthcoming. Tables are included showing types of atmospheric pollution; comparison of Los Angeles and London types of pollution; categories of airborne materials with selected examples that may occur in industry and that may cause disease; age standardized rates of respiratory diseases by tobacco usage and sex; age standardized rates (%) of respiratory disease by current cigarette smoking habits and sex.##

W. I. Glass and N. G. Thom

RESPIRATORY HAZARDS ASSOCIATED WITH TOLUENE DI-ISOCYANATE IN POLY-URETHANE FOAM PRODUCTION. New Zealand Med. J. (Toronto), Vol. 63. 642-647 (Oct. 1964).

Three plants engaged in the production of poly-urethane foam were visited. Air samples were taken at different stages of production and considered in relation to symptoms recorded from workers who had been or were affected. It is suggested that a maximum allowable concentration of toluene di-isocyanate in air of less than 0.01 ppm for the unprotected worker would lead to the appearance of few if any cases of illness in previously unexposed workers. The clinical pattern of the symptoms of the nine cases is discussed. Symptoms developed among different workers at different times after first beginning work with the compounds. The severity of the symptoms varied from slight dryness of the throat to a severe asthmatic type illness. The sequelae varied from the development of tolerance or of hypersensitivity, to the worker who remained unaffected or who was affected to a mild extent but whose condition did not deteriorate. (Authors' summary) \*\*

07251

TOLERABLE LIMITS FOR TOXIC MATERIALS IN INDUSTRY. DIVERGENCES AND POINTS OF AGREEMENT AT THE INTERNATIONAL LEVEL. (1) ((Les limites tolerables pour les substances toxiques dans l'industrie divergences et points d'accord a l'echelle internationale. (1))) ((Arch. Maladies Profess. Med. Trav. Securite Sociale (Paris))), 26(1-2):41-56, Feb. 1965. Text in French.

The report of the International Committee on the Study of Tolerable Limits presented to the XIV International Symposium on Maximum Tolerable Concentrations of Toxic Materials in Industry held in Paris in 1963, which are given, represent a summary of the present knowledge on maximum allowable concentrations. The chief difficulty in establishing international standards involves the widely different views of the concept of tolerable limits and the methodologies of the U.S. and Russia. The study of the effects of many toxic materials on the central nervous system by Russian workers has led to the establishment of standards that are much more rigid than the U.S. standards for many materials. The Russian and U.S. limits for some toxic materials is mg/cu m, respectively are: ethylene oxide 1 and 90; chlordane 0.01 and 2.0; carbon tetrachloride 20 and 160. For 34 gases and 8 dusts, fumes, and mists, the Soviet standards are at least one fifth of the U.S. limits and in most cases even less. Some workers object to the methods used by the Russian experts on the grounds that they are too sensitive and show physiological rather than pathological effects. Because of the differences in concepts, the objective approach should be a discussion of the interpretation of the results obtained by both groups to understand and reconcile the different approaches. Fortunately, there are 21 gases and vapors and 19 dusts, fumes, and mists in which there is practical agreement and which can serve as a core for international standards which can be amplified with

an exchange of information and results. There is a necessity for further research to obtain data to permit the establishment of zones of tolerable concentrations rather than rigorous limits.##

07270

Advisory Committee on Tetraethyl Lead, Washington, D. C.

PUBLIC HEALTH ASPECTS OF INCREASING TETRAETHYL LEAD CONTENT IN MOTOR FUEL. ((Public Health Service, Washington, D. C., Occupational Health Program,)) PHS Publ. no. 712, 49p., 1959. 7 refs.

GPO: 526258-59-2

The advice of the Public Health Service was sought on increasing the maximum concentration of tetraethyl lead (TEL) in auto gasoline from 3.0 to 4.0 cc per gallon. An ad hoc committee was appointed to determine whether the proposed increase represented a public health hazard. Data on technical reasons for the increase, the results of research, the consumption of TEL by year, and a review of the medical problems are presented by the Ethyl Corp. Representatives of the duPont Co. supplied production figures, and information on actual and estimated TEL demand on U. S. producers. The Committee concluded that (1) a change in the maximum concentration of tetraethyl lead in motor fuel from 3.0 to 4.0 cc. would not increase the hazards involved in the manufacture and distribution of leaded gasoline and (2) available data do not indicate that such change would significantly increase the hazard to public health from air pollution.##

07291

Gurinov, B. P., F. D. Mashbits, and L. M. Shabad

A STUDY OF THE BLASTOGENIC PROPERTIES OF SOME TARS DERIVED FROM ATMOSPHERIC DUST AND FROM COMBUSTION PRODUCTS OF DIFFERENT FUEL TYPES. Text in Russian. Gigiena i Sanit., No. 10:12-16, 1954. 3 refs. Engl. transl. by B. S. Levine, U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol. 2, p. 74-80, March 1960.

CFSTI TT60-21188

A study was conducted of the blastogenic properties of some tarry substances, particularly of the products of combustion of various types of fuel, such as coal, wood, peat, oil and its by-products, as well as of substances isolated from atmospheric dust. Samples were collected either by sedimentation or by aspiration and CC57 mice 2 - 3 months old were used as the experimental animals. The fur was removed from the skin between the shoulder blades and 10% benzene solution of the tar under study was applied to the exposed skin section about three times a week. The reactions observed were recorded up to the time of the death of the test animals. After that, and following autopsies, all tumors discovered were examined histologically. The data obtained strengthens the belief that the number of malignant tumors which developed in mice subjected to the applications of different tars, is to some extent related to the amount of 3.4-benzpyrene contained in the tars. Furthermore, on the basis of the results of experiments with test animals and of the spectral-fluorescence

analysis of atmospheric pollutants, it can be stated that 3,4-benzpyrene, a carcinogenic substance, is present in the air of certain towns. ASM##

07301

Shabad, L. M.

THE PRESENCE OF CARCINOGENIC SUBSTANCES, AND OF 3,4-BENZPYRENE IN PARTICULAR, IN THE ENVIRONMENT OF MAN. Vopr. Onkol., 5(3):271-275, 1959. 35 refs. Translated from Russian by B. S. Levine, U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol 2, p. 141-146, March 1960.  
CFSTI: TT60-21188

The ability to produce experimental tumors in different organs and tissues by blastomogenic substances, presented the opportunity to make a detailed study of the origin and development of blastomata. Results of numerous experiments on the development of a variety of cancers carried out in the laboratory of the Institute of Oncology in Leningrad by a number of investigators indicated that four distinct phases were distinguishable in the development of all cancers. I. Irregular diffuse pretumor hyperplasia. II. Focal proliferations, the precancer stage proper. III. The so-called benign tumors. IV. Malignant so-called benign tumors. IV. Malignant tumors. Although the morphological changes may be different in different organs and may depend on a number of contributing factors, the basic characteristics of the process were identical in all cases. The enumerated states of development progressed from one into another without sharp demarcation; the development may become temporarily arrested at any one of the phases, or the arrest may become permanent and not attain the cancer phase. Tumors acquire specific cancer characteristics gradually in the process of development. This applies not only to the morphological characteristics, but also to the pathophysiological, biochemical and immunological characteristics. The mechanisms of the action of blastomogenic substances are unique and differ from the mechanisms of action of most stimulating agents. For instance, carcinogenic hydrocarbons suppress the inflammation and distort the course of the inflammatory reaction. The aforesaid illustrates that the study of carcinogenic substances considerably broadened the concept of the etiology and pathogenesis of malignant tumors and points to the means for their prevention in the following two ways: 1) early diagnosis and elimination of a precancerous condition, and 2) prevention of tumor formation by clearing the environment of carcinogenic agents.##

07302

Mironova, A. T.

A STUDY OF THE POSSIBLE BLASTOMOGENIC PROPERTIES OF SOME SUBSTANCES RESULTING FROM THE PRODUCTION OF SYNTHETIC LIQUID FUEL. Vopr. Onkol., 5(5):534-539, 1959. 5 refs. Translated from Russian by B. S. Levine, U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol. 2, p. 147-155, March 1960.  
CFSTI: TT 60-21188



Mice were tested with the primary and finished products of the manufacture of synthetic liquid fuel. A total of 588 two-month old mice were used in the experiment, using from 40 to 50 animals for each sample. One small drop of the test material was applied twice a week to the interscapular area of the mice. After the third or fourth application alopecia of varying degree developed in the majority of the animals. In the mice treated with the primary products the alopecia was extensive, the skin was hard, crusty and cracked. Simultaneous falling out of the old and the appearance of new fur was observed throughout the period of application of the test substances. Treatment of the skin with the final synthetic product produced limited alopecia. The tests consisted of 50 applications, after which the mice were kept under careful observation up to the time of their natural death. The dead animals were preserved in 10% formaldehyde and histologic examinations made of sections of the skin parts to which the test substances were applied and of pathologically affected organs. Four of the five primary products tested caused skin cancer development at the site of application in 12 to 16% of the mice; this justifies the conclusion that the substances possessed mild, but definite carcinogenic properties. Among the seven final synthetic products of hydrogenation, two manifested slight blastomogenic properties; no carcinogenic properties were detected in five products of this group. The conclusion regarding positive carcinogenic properties possessed by two primary materials, namely, the heavy tar and the mazout from direct distillation, originally arrived at on the basis of 3,4-benzpyrene presence in these products, as indicated by fluorescentspectral analysis, was confirmed by the results of tests with animals. The biological tests also established the blastomogenic properties of four additional substances which gave negative fluorescent-spectral tests, indicating that carcinogenic substances other than those which yield a positive 3,4-benzpyrene test may be present in the substances investigated.##

07306

Novikov, Yu. V.

EFFECT OF SMALL BENZENE CONCENTRATIONS ON HIGHER NERVOUS ACTIVITY OF ANIMALS IN CHRONIC EXPERIMENTS. Gig. Sanit., No. 2:20-25, 1956. 4 refs. Translated from Russian by B. S. Levine, U. S. S. R. Lit. on Air Pollut. & Relat. Occup. DIS., VOL. 2, P. 185-191, MARCH 1960.

CFSTI TT60-21188

Groups of three types of conditioned reflexes were developed in mice: two positive, (one strong and one weak), and one negative. The group pattern was as follows: 2 positive conditioned reflexes in response to a ball (strong); 2 positive conditioned reflexes in response to a red light (weak); 1 positive conditioned reflex in response to a bell (strong); 1 negative conditioned reflex in response to a buzzer; two positive conditioned reflexes in response to a bell and 2 positive in response to a red light. After this pattern of motor conditioned reflexes had been established tests were made to determine the animal's type of higher nervous activity by extending differentiation to 3 min. and by testing the effects of 24 hour starvation. The average length of latent period of the second and third conditioned reflexes to bell ringing was thus calculated; first and second reflexes to red light stimulation and average length of conditioned motor

nutritional reflex reaction were calculated covering a period of ten days. The data thus obtained served as reference points for the evaluation of further changes in the conditioned reflex activity of the experimental animals. After having determined the typological characteristics of the rats' higher nervous activity animals were separated into groups according to higher nervous activity types. Final test groups contained rats of every neurotype. Chronic exposure to 64 mg/cu m of benzene vapor concentration produced functional changes in conditioned reflex activity of white rats. The changes were most marked in animals of weak and strong unbalanced type of higher nervous activity. In chronic intoxication with 13 mg/cu m of benzene vapor no changes occurred in the activity of the cerebral cortex. Results presented can serve as physiological basis for the adoption of the limit of allowable benzene concentration in atmospheric air.\*\*

07308

Koslova, T. A.

THE EFFECT OF BENZENE ON THE ORGANISM AT HIGH AIR TEMPERATURE. *Gigiena i Sanit.*, 22(4):18-24, 1957. Translated from Russian by B. S. Levine, U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol. 2, p. 196-203, March 1960.  
CFSTI TT60-21188

The study was conducted over the years of 1953 - 1955 along two channels: direct observations in a leatherette factory (the Nogin plant), and experimental studies with laboratory animals. Observations under direct factory conditions were conducted during the months of June, July and August, when the temperature inside the work shops ranged between 28 - 42, and again during the months of December, January and February when the air temperature of the work shops ranged between 20 - 28. The control group consisted of individuals who lived under local climatic conditions free from benzene air pollution. The study covered blood pictures of 273 workers. The results showed that during the summer months, when the effect of benzene vapor on the workers was paralleled by high atmospheric temperature, the number of workers having anemias of moderate intensity increased (Hb. by Sahli hemoglobinometer was 55% and erythrocyte count below 4,000,000/cu mm). The number of workers showing signs of early leucopenia, with leucocytes below 5,000/cu mm also increased. In some workers the number of leucocytes fell during the summer months to 3,800 and of thrombocytes to 8,000/cu mm, pointing to the onset of a chronic state of benzene intoxication of I degree. The increase in benzene toxicity with increase in air temperature may have been due to the effect which increased temperature exerted on the rate of benzene permeation into tissues, its distribution rate and rate of toxicity neutralization by the organism and effect of temperature on the functional state of the nervous system (hyperthermic effect). The simultaneous exposure of animals to benzene vapor and elevated air temperature brought about a lowering in the resistance of the animal to temperature effects as indicated by increased disturbance in the processes of thermoregulation. There arises the possible need to determine differential limits of allowable benzene vapor concentrations in the air of industrial work rooms. This may apply equally to other gaseous air pollutants.\*\*

Alexeyev, A. Ye.

THE CENTRAL NERVOUS SYSTEM AND THE PHARMACO-DYNAMICS OF SOME VAPOR FORMING SUBSTANCES INHALED WITH THE AIR. *Farmakol. Toxilogiya*, 18(6):22-24, 1955. Translated from Russian by B. S. Levine, U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol. 2, p. 251-254, March 1960.  
CFSTI TT60-21188

A study was conducted to determine whether the CNS plays an important role in the penetration of pharmacological agents through the alveolar membrane. Frogs were used as cold-blooded and white rats as warm-blooded animals. The study was made by the method of heart-lung preparation retaining its connection with the central nervous system; therefore, the method can be described as the heart-lung-brain-preparation method. The frogs were anesthetized and the thoracic cavity opened; blood vessels were ligatured in the following order: both cutaneous arteries, then both basal arteries, inferior vena cava and subclavian veins. In this way the pulmonary and carotid arteries and the internal and external jugular veins and the pulmonary veins remained open; through them blood was supplied to the brain via a small circuit. The posterior part of the frog's body was severed between the thoracic and lumbar vertebrae. A tube was then inserted into the trachea connecting the latter with a device for artificial respiration; heart contractions were registered kymographically. When a frog woke from narcosis, as was indicated by the appearance of protective reflexes in the eye or skin in response to needle prick, the administration of the test substances was begun. An intact frog served as control and its heart action was registered. Tests were made with chloroform, formalin, and paraldehyde. It was demonstrated that the central nervous system played an important part in regulating and directing lung membrane function. Severing the connection between the lung membrane and the central nervous system substantially affected the pharmacodynamics of some vapor forming pharmacological substances inhaled with the air. Volatile narcotics such as chloroform, and vapor forming substances such as paraldehyde freely permeated through the lung membrane which changed their pharmacodynamic effects when the connection between the lungs and the central nervous system remained intact.\*\*

07332

F. Sperling, W. L. Marcus, C. Collins

ACUTE EFFECTS OF TURPENTINE VAPOR ON RATS AND MICE. *Toxicol. Appl. Pharmacol.*, 10(1):8-20, Jan. 1967. 16 refs. (Portions of this paper were presented at the Second Int. Pharmacol Congr., Prague, Czech., Aug. 20-23, 1963, and at the Third, Fourth, and Fifth Annual Meetings, Soc. of Toxicol., Williamsburg, Va.)

The use of a small, inexpensive, dynamic inhalation system to determine the 2-hr LC50 for mice and the 1, 2, 3, and 6-hr LC50 for rats exposed to turpentine is described. The mice and rats were placed in individual glass cylinders which were so sized that the animals could move back and forth and rotate on their long axis, but could not turn around. The turpentine

vapor was obtained by pumping air through a wash bottle containing turpentine. A parallel system supplied air alone and by rotameters, the concentration in the exposure chamber could be varied from zero to saturation. The LC50 of turpentine vapor for rats for 1 to 6 hr of exposure ranged from 20 mg/liter to 12 mg/liter. The 2-hr LC50 for mice was 29 mg/liter. Exposure to the vapor caused an increase in respiratory rate, a decrease in tidal volume, and no change in the minute volume in rats. No evidence was found of pulmonary lesions induced by turpentine. Tissue distribution of turpentine in rats following exposure showed that the brain and spleen had the highest concentrations immediately after exposure as well as 60 min after exposure.##

07340

U. Saffiotti, R. Montesano, A. R. Sellakumar, S. A. Borg

EXPERIMENTAL CANCER OF THE LUNG. INHIBITION BY VITAMIN A OF THE INDUCTION OF TRACHEOBRONCHIAL SQUAMOUS METAPLASIA AND SQUAMOUS CELL TUMORS. Cancer, 20(5):857-864, May 1967. 16 refs. (Presented at the 9th Int. Cancer Congr., Tokyo, Oct. 1966.)

The purpose of this investigation was to explore the mechanisms controlling the initial metaplastic change in the response of the tracheobronchial mucosa to carcinogens using vitamin A as a tool to investigate the role of cellular differentiation in the pathogenesis of tumors derived from the bronchial mucosa. Two groups of Syrian golden hamsters, each containing 36 males and 36 females received 10 intratracheal installations of 3 mg. of benzo(a)pyrene (BP) and 3 mg of hematite suspended in saline given once weekly. One group received stomach tube feedings of vitamin A palmitate (5 mg or 5,000 IU in 0.1 ml of corn oil) twice weekly for life beginning one week after the end of the BP treatment. In the group receiving no vitamin A, there were 13 cases of squamous tumors and 13 cases of squamous metaplasia in 53 animals at risk. In the group receiving vitamin A, one developed a microscopic squamous tumor in a bronchus and one developed a patch of squamous metaplasia in the trachea among 46 animals at risk. There was a marked reduction of forestomach papillomas among the vitamin A group. It is indicated that vitamin A administered following a carcinogenic exposure to the respiratory tract to benzo(a)pyrene can interfere with the induction of squamous metaplasia and squamous tumors in the tracheobronchial mucosa.##

07342

C. W. Elston

PNEUMONIA DUE TO LIQUID PARAFFIN: WITH CHEMICAL ANALYSIS. Arch. Disease Childhood (London), 41(218):428-434, Aug 1966. 13 refs.

A case of liquid paraffin pneumonia is reported in an infant with congenital abnormalities and a method of extraction and identification of the oil is included. In most of the cases recorded since the first description of oil aspiration pneumonia in man by Laughlen in 1925, the diagnosis was made

on purely histologic grounds. In this fatal case of lipid pneumonia due to inhalation of liquid paraffin in an infant who had a congenital oesophageal atresia repaired 24 hours after birth, identification of the oil was not possible by histological or histochemical means. After the material was extracted with petroleum ether and purified by chromatography, it was identified as liquid paraffin by its refractive index and infrared spectrum. The administration of liquid paraffin to infants, especially those with feeding difficulty is potentially dangerous. In adults, the physical condition plays a part in determining the degree of lung involvement. In debilitated patients there is a tendency to develop a generalized lipid pneumonia, whereas, a person in good general health is more likely to develop a localized granuloma.##

07352

Iizuka, Y.

TOXICOLOGICAL AND HYGIENIC STUDIES ON DIELDRIN. (REPT. 1. BIOASSAY OF DIELDRIN BY USE OF LARVAE OF ORTHOCLADIUS AKAMUSHI, TOKUNAGA. REPT. 2. EXTRACTION OF DIELDRIN FROM MOTH-PROOFED KNITTING YARN BY HUMAN SALIVA AND ITS HYGIENIC SIGNIFICANCE. REPT. 3. DIELDRIN CONCENTRATION IN AIR IN MOTH-PROOF PROCESSING.) Text in Japanese. Japan J. Ind. Health (Tokyo), 5(8):531-541, Aug. 1963. 24 refs.

Dieldrin (chemical abbreviation, HEOD) is widely applied as an insecticide in agriculture, and for vector control and recently as a moth-proofing agent for knitting yarn. The author devised a simple bioassay method of dieldrin using larvae of *Orthocladus akamushi* Tokunaga which is sold on the market as fish feed throughout the year. By aid of this micro-determination method, the author investigated the possible hazard to babies by chewing a moth-proofed woolen dress. It was concluded that some amount of dieldrin, which adheres to the surface of yarn, will be readily dissolved by saliva while the remaining portion (70% or more) is firmly fixed to the wool protein. The magnitude of extracted dieldrin by saliva (0.4 mg from three grams of knitting yarn) is far beyond the estimated toxic doses for babies and infants (1 mg/kg), but the washing by detergent after the moth-proofing process will increase the safety by more than twice. Dieldrin concentration in air in the moth-proofing process was determined by the bioassay method. Near the boiling dye bath containing dieldrin, it was 0.09 mg/cu. m. on an average (range: 0.04 to 0.14 mg/cu. m.), revealing the concentration for less than 0.25 mg/cu. m. in the threshold limits by ACGIH. When the lid was kept half opened simulating the most careless conditions, the concentration rose to 9.62 mg/cu. m. This was, however, an unreasonable figure in routine conditions. (Author's summary, modified).##

07368

Harashima, S. H. Sakurai, and K. Nakamura

DIFFERENCE IN RESPONSES OF TWO STRAINS OF MICE TO BENZENE INHALATION. Text in Japanese. Japan J. Ind. Health (Tokyo), 7(11):8-12, Dec. 1965. 13 refs.

Strain difference of responses to acute and long-term benzene inhalations was investigated in male mice of CFW and ddN lines. Observed responses included mortality and lethal time by acute exposure to higher concentrations of benzene, and changes in leucocyte counts and hemoglobin levels after repeated inhalations of lower concentrations. Groups of mice aged 5, 7 and 10 weeks for both strains were exposed to 1.5% benzene and mortalities were observed. Mice of both strains were exposed, at 10 weeks of age, to 3% and 2% benzene and lethal time was determined for each animal. After 20-days exposure to 200 ppm benzene, leucopenia was found only in ddN, and a decrease of hemoglobin concentration, on the contrary, was observed in CFW and not in ddN. From the results, it was concluded that the susceptibility of adult mice to the inhaled benzene of higher concentrations was greater in ddN than in CFW, and its variance was smaller in ddN than in CFW. Consequently, it was noted that ddN was more suited for studying acute response, such as mortality or lethal time, to benzene inhalation in mice.##

07475

Gusev, I. S.

A COMPARISON OF THE EFFECTS OF LOW CONCENTRATIONS OF BENZENE, TOLUENE AND XYLENE. ((Sravnitel 'naya otsenka deistviya malykh kontsentratsii benzola, toluola i ksilola.)) Hyg. Sanit. (English translation of: Gigiena i Sanit.), 32(2): 159-163, Feb. 1967. 7 refs.

CFSTI: TT67-51409/1

Investigation of the effects of exposing animals to low concentrations of benzene, toluene and xylene over a prolonged period of time (85 days) is described. The 105 male albino rats used were divided into seven groups: 15 animals in each group. Purified air was supplied to the chamber containing the first group of animals (controls) at a rate of 30 - 35 l/min. The other chambers were supplied, at the same rate, with air containing admixtures of the vapors with the substances in question. The concentrations of benzene, toluene and xylene in the chambers were checked daily. Concentrations of 15 mg/cu. m. caused marked changes in cholinesterase activity and in the white blood count of animals continuously exposed to these substances over a prolonged period of time. The magnitude of the changes increased from benzene to xylene, while the rate of recovery diminished in the same direction. Toluene in a concentration of 0.6 mg/cu. m. and xylene in a concentration of 0.2 mg/cu.m. produced no effect on the experimental animals throughout the period of exposure, so that these may be recommended as the mean daily maximum permissible atmospheric concentrations. As little is yet known regarding the absence of cumulative properties when low concentrations of benzene are involved, the mean daily maximum permissible concentration should remain at the present level of 0.8 mg/cu. m., which is only half the noneffective concentration of this substance established by the above experiments.

07573

Tkach, N. Z.

COMBINED EFFECT OF ACETONE AND ACETOPHENONE IN THE ATMOSPHERE. (Kombinirovannoe deistvie atsetoma i atsetofenona v atmosfere)

vozukhe.) Text in Russian. Gigiena i Sanit., 30(8), Aug. 1965. 7 refs. Engl. transl. by Israel Program for Scientific Translations, Hyg. Sanit., 30(8):179-185, Aug. 1965.

CFSTI: TT66-51033/3

When acetone and acetophenone act together, their odors are completely summated. The combined effect of acetone and acetophenone on ocular sensitivity to light and electrical activity of the brain displays complete summation. When acetone and acetophenone are simultaneously present in the atmosphere, their maximum one-time concentration, expressed in fractions of the accepted separate maximum permissible concentrations, should not exceed 1.5. Prolonged poisoning of albino rats with acetone and acetophenone concentrations of 1.855 and 0.0165 mg/cu m. (the sum total of the fractions of their separate maximum permissible concentrations being 10.9) for 84 days caused disturbances of the normal chronaxial ratio of antagonistic muscles, inhibited the activity of cholinesterase, increased the excretion of coproporphyrine and 17-ketosteroids in the urine, and produced eosinopenia. No effect was produced by an acetone plus acetophenone mixture having a total concentration of 1.2. in the case of the combined presence of acetone and acetophenone in the atmosphere, their mean daily concentration expressed in fractions of their separate maximum permissible concentrations should not exceed 1.2.##

07574

Statsek, N. K.

MAXIMUM PERMISSIBLE CONCENTRATION OF DICYCLOHEXYLAMINE NITRITE IN THE AIR OF FACTORIES. (Materialy k gigenicheskomu normirovaniyu nitrita-ditsiklogeksilamina v vozdukh prozvodstvennykh pomeshchenii.) Text in Russian. Gigiena i Sanit., 30(8), Aug. 1965. 3 refs. Engl. transl. by Israel Program for Scientific Translations, Hyg. Sanit., 30(8):208-212, Aug. 1965.

CFSTI: TT66-51033/3

Dicyclohexylamine nitrite (DAN) is an inhibitor of the atmospheric corrosion of ferrous metals and belongs to a class of aminocyclic compounds. On intragastric introduction, LD50 of this compound for mice amounts to 80 mg/kg and for rats 325 mg/kg, no local irritating effect was noted. Repeated inhalation of DAN in the form of vapors at a concentration of 0.009, 0.004 and 0.002 mg/l produces no signs of intoxication. The maximum permissible concentration of DAN in the air of the working zone is recommended to be at a level of 0.001 mg/l. (Author's Summary

07782

Hsu, Wen-Tah, John W. Moohr, Albert Y. M. Tsai, and Samuel B. Weiss

THE INFLUENCE OF POLYCYCLIC AROMATIC HYDROCARBONS ON BACTERIOPHAGE DEVELOPMENT, II. Proc. Natl. Acad. Sci. U. S., Vol. 55, p.1475-1482, June 1966. 11 refs.

Further information is provided on the nature of the hydrocarbon response in infected and noninfected *Escherichia coli* spheroplasts. A method is described for preparing infected spheroplasts from cells preinfected with phage which permits one to assay the hydrocarbon effect on the replication of both single- and double-stranded viruses whereby significant differences are observed. The present study demonstrates the inhibition of viral nucleic acid and protein synthesis by 7,12-DMBA, and, in contrast to one of the authors' earlier observations, it is now reported that 7,12-DMBA inhibits nucleic acid and protein synthesis in the bacterial host itself. The protective effect of various aromatics on 7,12-dimethyl-benzanthracene induced viral inhibition is also reported.

07783

Harrington, J. S. and Marianne Smith

STUDIES OF HYDROCARBONS ON MINERAL DUSTS: THE ELUTION OF 3:4 BENZOPYRENE AND OILS FROM ASBESTOS AND COAL DUSTS BY SERUM. Arch. Environ. Health, 8(3):453-458, March 1964. 12 refs.

The effectiveness of serum to remove 3-4 benzopyrene and oil from asbestos and coal was investigated. The material examined consisted of virgin crocidolite, amosite, and chrysotile from South African asbestos fields. The following experiments were performed: 1. The Adsorption of 3:4 Benzpyrene on Washed Asbestos and Coal Dust. 2. The Elution of Freshly Adsorbed 3:4-Benzpyrene from Washed Crocidolite, Chrysotile, and Coal Dust by Serum. 3. The Elution of 3:4-Benzpyrene From Natural Crocidolite and Coal Dust by Serum. Chrysotile asbestos adsorbed 100% 3:4-benzpyrene from solution after 48 hours at 37 C compared with 40% and 47% for crocidolite and coal, respectively, and 10% for amosite. No correlation was found between the degree of adsorption of 3:4-benzpyrene and the extent to which it was eluted by serum. Serum eluted the naturally occurring oils more effectively from coal dust than it did from crocidolite fiber and was slightly more effective than cyclohexane in eluting 3:4-benzpyrene from coal and crocidolite. 3:4 Benzpyrene was eluted more easily from [natural] coal and crocidolite than it was after it had been freshly adsorbed on dusts previously freed of their naturally associated hydrocarbons. These findings are discussed in relation to the pathogenesis of coal workers' pneumoconiosis and asbestos malignancy.

07785

Toth, B. and P. Shubik

CARCINOGENESIS IN AKR MICE INJECTED AT BIRTH WITH BENZO(A)PYRENE AND DIMETHYLNITROSAMINE. Cancer Res., 28(1):43-51, Jan. 1967. 26 refs.

Newborn AKR mice were injected s.c. with either 200 micrograms of benzo(BP) or with 30 micrograms of dimethylnitrosamine (DMN). The BP was found to result in a more rapid occurrence of malignant lymphomas than observed in the controls and to result in many lung adenomas. The DMN had no apparent effect on the development of virally mediated lymphomas but resulted in the appearance of benign and malignant liver tumors and lung adenomas.##



Lewis, T. R., F. G. Hueter, and K. A. Busch

IRRADIATED AUTOMOBILE EXHAUST. (ITS EFFECTS ON THE REPRODUCTION OF MICE.) Arch. Environ. Health, 15(1):26-35, July 1967. 20 refs.

This study attempts to define the relative importance of pre-exposure of each member of the sexual pair to irradiated auto exhaust, and exposure of the female partner and her litter, following removal of the male with regard to conception, fetal development, fecundity, and infant survival. There were 150 virgin female mice preconditioned to either filtered air or irradiated automobile exhaust for 46 days, who were randomly paired with 150 similarly preconditioned males. All mice were 12 to 13 weeks of age at the time of mating and were caged individually during the preconditioning period. Males and females were paired randomly to form approximately equal numbers of sexual pairs (18 or 19) in each of eight treatment groups. The experiment was repeated with a new population of mice of the same strain 15 days after completion of the first investigation. The adverse effects of pre-conditioning male mice with irradiated auto exhaust on conception, implantation of fertilized ova, fecundity, and infant survival appear to be induced by a common mechanism. This is the first experiment the results of which imply mutational effects on mammalian cells by components or subsequent products of irradiated auto exhaust. An effect of the alteration of one environmental factor in this investigation, i.e. atmospheres to which the females were exposed, was evidenced by mild stress on litter sizes. Litters born in an atmosphere of irradiated auto exhaust showed a marked increase in mortality in both experiments, but the magnitude differed.\*\*

07886

Mastrangelo, J. J., W. P. Giordan, and R. P. Johnson

SURFACE BEHAVIOR OF INDIVIDUAL LIPIDS SIMILAR TO CONSTITUENTS OF PULMONARY SURFACTANT. Edgewood Arsenal, Md., Medical Research Lab., Project 1C622401A097, Task 1C622401A09708, EATR 4087, 22p., April 1967. 22 refs.  
CFSTI, DDC: AD 651001

Surface films of amphipathic neutral lipids and phospholipids, similar to those found in pulmonary surfactant, were characterized by their surface behavior, including that under high surface pressure. Each lipid was studied with respect to equilibrium point, hysteresis, hypercompressibility, and isotension point, the last two being newly defined parameters. It was found that saturated (straight) hydrocarbon chain molecules exhibited much lower isotension-point surface tensions than did their respective unsaturated (branched) analogs, whereas the reverse was true for the equilibrium-point surface tensions. Saturated compounds exhibited considerably more hypercompressibility than did their unsaturated analogs. The ordering of limiting surface tension at highest compression (the isotension point) was not exclusively dependent on obvious steric factors; rather, subtle and undefined electronic factors were also participating. The significantly lowest surface tensions obtained on compression were exhibited by

dipalmitoyl lecithin, sphingomyelin, and palmitic acid. The last compound demonstrates that lipids other than phospholipids can exhibit surface activity similar to pulmonary surfactant. Development of post-isotension-point hysteresis was limited to the saturated class of molecules tests. AA

07952

O. Tope

HEALTH IMPAIRMENT FROM EXHAUST GASES WITH SPECIAL REFERENCE TO SPECIAL VEHICLES AND POWER EQUIPMENT. (Gesundheitsschädigungen durch Auspuffgase unter besonderer Berücksichtigung von Spezialfahrzeugen und motorisiertem Gerät.) Text in German. Städtehygiene (Jelzen/Hamburg), 16(2):29-37, Feb. 1965. (37) refs.

Data on concentrations and effects of lead, carbon monoxide and carcinogenic compounds like benzpyrene were assembled. The maximum allowable concentration of 4 mg lead/cu m is exceeded on many urban arterial streets e.g. in center city Philadelphia, Pa., 9.5 mg/cu m were found. Milk from cattle grazing on pastures near highways may be endangered since up to 3000 mg lead/kg grass have been found. But the most dangerous component of exhaust gases is CO which causes impaired vision, fatigue and may lead to heart and brain damage. It thus may become directly responsible for traffic accidents. The maximum allowable concentration value is 0.01% by volume which may be exceeded in heavy traffic in particular if the driver of an automobile smokes. Organic compounds may lead to lung cancer. Here especially benzpyrene which can be found both in exhaust gases and on road surfaces originating from tar and rubber tires may be incriminated. Control measures such as scrubbers and afterburners on exhausts are described. Their maintenance is tricky and expensive which so far has prevented compulsory use. Particularly hazardous are street cleaning equipment and trash removal trucks since workers must almost constantly be near the exhaust. Similar problems are posed by lawn mowers, chain saws, cranes, tractors, pesticide sprayers and similar equipment. Small engines are very difficult to modify to limit air pollution. The problem of air pollution from engine exhaust gases can only be tackled by legislation and technical improvements and innovations.##

07956

Schuttmann, W.

POLYNEURITIS AFTER OCCUPATIONAL CONTACT WITH DDT. ((Polyneuritis nach beruflichem Kontakt mit DDT.)) Text in German. Z. ges Hyg. (Berlin), 12(5):307-315, May 1966. 16 refs.

For more than 11 yrs a woman was exposed to DDT. She frequently worked 8 hrs/day disinfecting indoor areas, wearing neither masks nor gloves, and had inhaled or swallowed air containing DDT. The symptoms - a severe polyneuritis, with previous and/or concomitant tiredness, anorexia, circulatory disorders, interrupted pregnancy - all support the view that the etiological factor was contact with DDT. The literature on the

untoward effects of DDT-inhalation is reviewed and the data from 15 cases are compared with the present instance.##

07964

Upholt, W. M. and P. C. Kearney

PESTICIDES. New Engl. J. Med., 275(25):1419-1426, Dec. 22, 1966. 28 refs.

The modern trend in the introduction of new pesticides has been toward those with more specific biologic activities. This results in less disturbance of the environment, but multiplies the number of chemicals that must be considered. Pesticides may contribute to pollution of the air to some extent, but their major effect is in the contamination of vegetation and water. Due to the activity of soil microorganisms, most pesticide residues are not showing a progressive accumulation in the soil. For humans, pesticides do appear to present a hazard at distances greater than the spray can be seen to drift. However, herbicides may damage crops several miles from the point of application. Understanding the health hazards of specific pesticides is simpler if they are grouped according to chemical structure. Among the organic phosphorus compounds, tetraethylpyrophosphate (TEPP) has a direct inhibitory effect on acetyl and non-specific cholinesterases and it is rapidly absorbed making handling quite hazardous. The mode of action of chlorinated hydrocarbons has never been clearly established, although for DDT it has recently been proposed that it might be the formation of a charge transfer complex in the axon. The carbamate group includes the methyl carbamates, which are weak cholinesterase inhibitors, and the phenyl carbamates which have a very low order of toxicity. Approximately half the annual deaths due to pesticides occur through ingestion. It seems, therefore, that the greatest human hazard stems from careless handling.##

07972

Hays, Richard B.

APPLICATION OF CELL CULTURE AS A PRIMARY TOXICITY SCREEN OF POSSIBLE SPACECRAFT CONTAMINANTS. National Aeronautics and Space Administration, Langley Station, Hampton, Va., Langley Research Center, NASA-TN-D-4251, 12p., Nov. 1967. 11 refs.

Cell culture has been investigated with regard to its applicability as a primary toxicity screen. Forty-nine compounds have been screened by this method. These compounds are all contaminants which may occur in manned spacecraft. The data presented indicate that cell culture can be a useful tool for selecting, from a long list, those compounds most likely to be toxic to a living system. The compounds tested might be ranked, in terms of decreasing toxicity to cells in culture, as follows: unsaturated aldehydes, amines, aldehydes, acids, ketones, and alcohols. (Author's summary)##

M. H. Simmers

PETROLEUM ASPHALT INHALATION BY MICE. EFFECTS OF AEROSOLS AND SMOKE ON THE TRACHEOBRONCHIAL TREE AND LUNGS. Arch. Environ. Health, Vol. 9, p. 728-734, Dec. 1964. 14 refs.

The effects on the tracheobronchial tree and lungs of 20 C57 black mice inhaling an aerosol of petroleum asphalt and another group of 30 mice inhaling smoke from heated petroleum asphalt were studied. The most frequent changes were peribronchial infiltration of round cells, bronchial dilation, and destruction and atrophy of the epithelium. Thickening of the alveolar septa and emphysema were seen occasionally. Squamous metaplasia was frequent but hyperplasia occurred. The changes were characterized by variability with respect to length of exposure and location of the lesion in each animal. If any generalization can be made regarding the changes in the lungs of the mice, it is the reduction in the amount of functional respiratory tissue. This is accomplished by a variety of pathological changes. The findings sufficiently parallel those reported by others for the inhalation of cigarette smoke, artificial smog, and other air pollutants, so as to suggest the possibility that the changes in the tracheobronchial tree and lungs are only loosely related to the composition of the inhaled material. The concordance of findings by all investigators on the effects of air pollutants containing aromatic polycyclic hydrocarbons supports the suspicion that the changes are a general phenomenon caused by the non-specific irritating effect of the entire class of chemicals when inhaled over a long time.##

08026

MacEwen, James D. and Robert P. Geckler

COMPARATIVE TOXICITY STUDIES ON ANIMALS EXPOSED CONTINUOUSLY FOR PERIODS UP TO 90 DAYS TO NO<sub>2</sub>, O<sub>3</sub> AND CCl<sub>4</sub> IN AMBIENT AIR VS. 5 PSIA 100% OXYGEN ATMOSPHERE. In: Proc. 2nd Ann. Conference Atmospheric Contamination in Confined Spaces, 4 and 5 May 1966, Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio, Aerospace Medical Div., AMRL-TR-66-120. p. 238-257, Dec. 1966. 6 refs. CFSTI, DDC: AD 646512

The data obtained from a 90-day continuous exposure of animals to the industrial threshold limit value (TLV) of NO<sub>2</sub>, O<sub>3</sub> and CCl<sub>4</sub> are presented. Animal exposure facilities of the Aerospace Medical Research Laboratories were used for the 90-day continuous experiments. The atmosphere compositions were 100% oxygen at 260 mm Hg pressure and air at either 820 (rho O<sub>2</sub> = 154 mm Hg) or 740 mm Hg (rho O<sub>2</sub> = 148 mm Hg) pressure. The data are unremarkable except for the deaths at 720 mm Hg pressure in the ozone exposures. Mice appear somewhat more sensitive to ozone than the other species. Guinea pigs also showed mortality upon exposure to ozone, which was the only material to which this species was exposed. Note that most of the deaths occurred during the first half of the 90-day exposure suggesting some degree of adaptation in the survivors. The data

are consistent with the hypothesis that the animals first respond to the atmospheric contaminant and then adapt to the changed environment. The data do not, however, reveal significant differences between those animals exposed to contaminants at reduced pressure in 100% oxygen and those exposed at normal atmospheric pressure (740 mm Hg). With respect to the clinical data, although the values of serum enzymes of exposed animals were different from the control values, no adverse effects on the experimental animals were noted. It appears clear that the TLV for space applications may not be radically different from industrial TLV if only the factors of continuous dosage, reduced pressure, and pure oxygen atmosphere are considered.##

08028

D.T. Harper, Jr. F.R. Robinson

COMPARATIVE PATHOLOGY OF ANIMALS EXPOSED TO CARBON TETRACHLORIDE AT AMBIENT AIR VS. 5 PSIA 100% OXYGEN ATMOSPHERE. In: Proc. 2nd Ann. Conference Atmospheric Contamination in Confined Spaces, 4 and 5 May 1966, Aerospace Medical Research Labs., Wright-Patterson AFB Ohio, Aerospace Medical Div., AMRL-TR-66-120, p. 265-285, Dec. 1966. 18 refs.  
CFSTI, DDC: AD 646512

The provocative aspect of these findings is not so much their correlation with the observed histological events as their similarity to the mechanisms thought to be important in oxygen toxicity. Lipid peroxidation, mitochondrial swelling and reduplication, uncoupling of oxidative phosphorylation and depressed levels of reduced pyridine nucleotides have all been observed with oxygen. It is very likely that the basic biochemical mechanisms of both oxygen and CC14 toxicity are highly similar. The superimposition of the one stress on the other therefore would be expected to have an additive or synergistic effect, and this is what was found.##

08042

D. V. Booker, A. C. Chamberlain, J. Rundo, D. C. F. Muir, M. L. Thomson

ELIMINATION OF 5 MICRON PARTICLES FROM THE HUMAN LUNG. Nature(London), 215 (5096):30-33, July 1, 1967. 5 refs.

Experiments in which a monodisperse aerosol of particles 5 micron in diameter was tagged with chromium-51 so that measurements could be made by external gamma ray counters over the lungs are described. On each occasion the subjects inhaled only a single breath of the aerosol and the particles could penetrate the airways only as far as they were carried by the volume of the inhaled air, which varied between 140 and 500 ml in the different experiments. The elimination of particles from the respiratory tract has two main phases. The rapid phase corresponds to the removal of particles initially deposited on the ciliary mucosa and takes 10-20 hours; the slow phase, which has a half period of from 150-300 days, corresponds to those particles which have reached the nonciliated regions.##

R. M. Norris, J. M. Bishop

THE EFFECT OF CALCIUM CARBONATE DUST ON VENTILATION AND RESPIRATORY GAS EXCHANGE IN NORMAL SUBJECTS AND IN PATIENTS WITH ASTHMA AND CHRONIC BRONCHITIS. Clin. Sci. (Cambridge), Vol. 30, p. 103-115, 1966. 24 refs.

Some effects of inhaling calcium carbonate dust have been studied in twenty-four healthy subjects, eight patients with bronchial asthma, and eleven patients with chronic bronchitis. The distribution of ventilation was measured by the single-breath oxygen test and respiratory gas exchange was studied by sampling expired gas and arterial blood. Alveolar ventilation was distributed more unevenly, after breathing dust, in ten of the normal subjects, all of the patients with asthma, and eight of the patients with chronic bronchitis. The increase persisted for 43-55 minutes. In normal subjects the alveolar-arterial difference in oxygen tension (A-a $\Delta$  O<sub>2</sub>) increased after breathing dust, and remained elevated for 23-25 minutes. There was no significant change in physiological dead space and only a small transient decrease in anatomical dead space. The patients with asthma showed a change in the single breath test which was similar to the normal subjects but the increase in A-a $\Delta$  O<sub>2</sub> was more protracted. It was difficult to compare the ventilatory changes in the patients with chronic bronchitis, since the initial slope of the single-breath test was greater than normal. The time course of the increase in A-a $\Delta$  O<sub>2</sub> was similar to that in the patients with asthma. Acetyl choline infused into the atrium caused a small increase in A-a $\Delta$  O<sub>2</sub> in the control state. On three occasions the infusion was repeated at a time after dust when the A-a $\Delta$  O<sub>2</sub> had returned to normal but the single-breath test remained abnormal; there was then a greater increase in A-a $\Delta$  O<sub>2</sub>. These results support the hypothesis that vasoconstriction was released, causing a flow of blood through poorly ventilated lung units.##

Borisova, M. K.

EXPERIMENTAL DETERMINATION OF THE LIMIT OF ALLOWABLE CONCENTRATION OF DICHLORETHANE IN ATMOSPHERIC AIR. In: Survey of U. S. S. R. Literature on Air Pollution and Related Occupational Diseases Translated from Russian by B. S. Levine. National Bureau of Standards, Washington, D. C., Inst. for Applied Tech., Vol. 3, p. 110-118, May 1960.

CFSTI: TT 60-21475

Data were obtained regarding the intensity and other characteristics of dichlorethane air pollution by industrial production and manufacturing plants; parallel with this some experimental data were secured regarding the effect of low dichlorethane concentrations on man. Chlorethan determinations were made by the microcombustion method in a gas analyzer. The results obtained for each plant investigated show that the average concentration ranged from 3.5 to 19.4 mg/cu m. The effect of low concentrations of dichlorethane on man was studied by the method of threshold of odor perception of dichlorethane by the adaptometer

method and by the methods of plethysmography and spirometry. Twelve test subjects sensed the odor of dichlorethane in 23.2 mg/cu m concentrations, 6 in 17.5 mg/cu m concentration and one each in 12.2 and 24.9 mg/cu m concentrations. The results of experiments indicate that a 6 mg/cu m concentration was the threshold concentration of dichlorethane affecting the functional state of the vision analyzer and of the vascular and respiratory reactions which was below the threshold concentration sensed by the olfactory organs in Russia that the limit of maximal single concentration of dichlorethane in atmospheric air should not exceed 4 mg/cu m.

08153

Izmerov, N. F.

HYGIENIC STANDARDIZATION OF THE LIMITS OF ALLOWABLE CONCENTRATIONS OF VAPORS OF GASOLINE IN ATMOSPHERIC AIR. In: Survey of U. S. S. R. Literature on Air Pollution and Related Occupational Diseases. Translated from Russian by B. S. Levine. National Bureau of Standards, Washington, D.C., Inst. for Applied Tech., Vol. 3, p. 126-134, May 1960.

CFSTI: TT 60-21475

The physiological effects of low air concentrations of gasoline were studied. On the basis of the experimental results it can be concluded that the inhalation of gasoline vapors in 100 mg/cu m concentration under conditions of chronic exposure elicited in white rats clear cut changes in the higher nervous activity, the intensity of which increased with the duration of the exposures, and which disappeared only two weeks after exposure was discontinued. In the case of man the inhalation of gasoline vapors in concentration of 217 mg/cu m for a brief period of time elicited reflex changes in the optical analyzer so far as sensitivity to light was concerned. The threshold of gasoline odor perception was considerably below the concentrations which elicited the previously noted changes in the functional state of the cerebral cortex; the odor perception threshold concentration was between 6.5 - 10.0 mg/cu m. It appears safe to conclude that the threshold of olfactory gasoline odor perception is the most sensitive index for the determination of limits of allowable concentrations of gasoline vapors in atmospheric air. It is proposed in Russia that a concentration of 5 mg/cu m calculated as C be adopted as the allowable limit of a single maximal concentration of the three grades of Groznenski gasoline investigated.

08210

Vysamyae, A. Yu

THE CARCINOGENIC EFFECT OF SHALE FUEL SOOT ON WHITE MICE. Vopr. Onkol., 4(4):408-411, 1958. 8 refs. Translated from Russian by B. S. Levine, U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 5, p. 191-195, Jan. 1961

CFSTI: TT 61-11149

The cancerogenic properties of shale fuel soot was investigated. Experiments were performed with 218 white mice. The benzene extract of the shale fuel soot was applied to 100 mice twice every week for approximately 25 weeks, or 50 applications. Eighteen

control mice were treated in a manner described above with 2 drops of a mixture of benzene and vaseline. The basic control group consisted of 100 white mice which received no treatment of any kind. Special-fluorescent analysis showed that 3.4 -benzpyrene was present in soot of shale fuel; benzene extract of such soot, applied to the skin of mice, or injected subcutaneously, produced malignant growths, indicating that it possessed cancerogenic properties. Papillomas appeared 5 months after the application of the benzene soot extract to the skin of the experimental mice. Most of the malignant formations resulting from the application of the soot extract to the skin of the experimental mice were malignant epitheliomas, more often squamous cell carcinomas, occasionally cytoblastomas, which frequently metastasized into the local and lung lymphatic nodes. Benzene extract of the shale fuel soot extract vehicle had no blastomogenic properties. Results of the investigations point to the urgent need of adopting energetic measures for the prevention of air contamination with shale fuel soot.

08221

Grigor'ev, Z. E.

EFFECT OF VOLATILE SUBSTANCES AND OF GASES ON THE HIGHER NERVOUS ACTIVITY OF WHITE RATS IN THE COURSE OF INHALATION EXPOSURE. Farmakol. i Toksikol., 18(4):49-52, 1955. Translated from Russian by B. S. Levine, U. S. S. R. Literature on Air Pollution and Related Occupational Diseases, Vol. 5, p. 125-130, Jan. 1961.

CFSTI: TT 61-11149

A tightly closing chamber was built which could be used simultaneously for the development of light, sound and motor nutrition conditioned reflexes in rats, and for their exposure to the inhalation of gas, vapor or dust under investigation. Some data of the effects of gasoline vapor and of carbon monoxide on the central nervous system of rats are presented to illustrate the suitability of the chamber described for the recording of rats' conditioned reflex activity changes on a dynamic basis while they are being exposed to the inhalation of gases, vapors or suspended dust.##

08241

Hueper, W. C.

METHODOLOGIC EXPLORATIONS IN EXPERIMENTAL RESPIRATORY CARCINOGENESIS. Arzneimittel-Forsch, Vol. 14, p. 814-822, July 1964. ((84)) refs.

The study, by bioassay methods, of chemicals introduced during the past 30 years into the human environment or to be introduced in the future into the human economy, for carcinogenic effects on the respiratory organs, is assuming increasing importance for the following reasons. The rapid rise in the frequency of lung cancers among the populations of all industrialized countries since the turn of the century indicates that new and potent man-made respiratory carcinogens have entered the human environment. This epidemiologic phenomenon has been associated with the recognition



of a growing number of occupational carcinogens to which large worker groups become exposed and which in part also pollute the general atmosphere and thus act increasingly on the general population. Additional and epidemiologic and experimental evidence incriminates an appreciable number of other chemicals as respiratory carcinogens, some of which are evidently operating following their introduction into the organism by various non-respiratory routes. The thereby demonstrated polyetiology of lung cancers in man and animals militates strongly against a blind acceptance of the widely propagandized scientifically unsound and sociologically irresponsible allegation that cigarette smoking is the proven predominant cause of lung cancer and that, therefore, the control of pulmonary cancer hazards can largely be achieved by simply reducing the consumption of cigarettes and by technologic decarcinogenization of cigarette smoke. Despite the various shortcomings in the presently available bioassay methods for testing chemicals for possible carcinogenic effects on the respiratory organs, their wide application nevertheless provides effective safeguards against a further dissemination of these agents. AS##

08243

Kotin, Paul, and Hans L. Falk

POLLUTED URBAN AIR AND RELATED ENVIRONMENTAL FACTORS IN THE PATHOGENESIS OF PULMONARY CANCER. Diseases Chest., 45(3):236-246, March 1964. 21 refs. (Presented at the 29th Annual Meeting, American College of Chest Physicians, Atlantic City, June 13-17, 1963.)

Data from several spheres of laboratory investigation lend support to the belief that the epidemiologic association between urban residence and lung cancer is of pathogenetic significance. Admittedly, the identification of carcinogenic agents in pollutant sources and in the atmosphere does not inevitably connote an adverse biologic effect. Nevertheless, the findings of the present investigation unite to form a constellation that strongly implicates the atmosphere as one dominant factor in the pathogenesis of lung cancer. The data are accorded additional significance by virtue of their congruity with the epidemiologic pattern of lung cancer. Epidemiologically, a reduction in lung cancer incidence may be properly anticipated as a result of reducing or eliminating the concentration of any of the environmental factors discussed. However, predictions as to the extent of reduction when but one of the factors is eliminated are meaningless in light of the multiplicity of factors described. It is wholly unwarranted to anticipate a quantitative reduction in lung cancer rates equal in number to the percentage showing a statistical association with any environmental source or specific carcinogenic agent. While atmospheric pollution is advanced as but one potential source of agents carcinogenic to the lung, proper evaluation of its contribution to the pathogenesis of lung cancer will be possible only in terms of its relation to the action of other significant environmental sources. ASM##

Litvinov, N. N., Goldberg, M. S., and Kimina, S. N.

MORBIDITY AND MORTALITY IN MAN CAUSED BY PULMONARY CANCER AND ITS RELATION TO THE POLLUTION OF THE ATMOSPHERE IN THE AREAS OF ALUMINUM PLANTS. Acta, Unio Intern. Contra Cancer, Vol. 19, p. 742-745. 1963.

The discharge of carcinogens by aluminum plants was studied by sedimentation and aspiration methods. It was found that over 10 kg of 3,4-benzpyrene was discharged per day into the atmosphere. The distribution in snow and dust in the environment was analyzed. Chronic morbidity of the respiratory tract was studied as a disease predisposing to cancer in three test groups and a positive correlation with air pollution was established, as was done for actual cancer incidence. (Authors' summary)

Schlipkoter, H. W., A. Brockhaus, and E. Weisser

EXPOSURE OF LARGE CITY INHABITANTS TO SOLID AND LIQUID AEROSOLS. ((Die Belastung des Grossstadtmenschen durch feste und flussige Fremdaerosole.)) Text in German. Zentr. Bakteriол., Parasitenk., Abt. I, Orig. (Jena), Vol. 198, p. 113-131, Dec. 1965. 5 refs.

Hamsters were forced to inhale a dust of a constant Degussa soot concentration of 25-50 mg./cu m daily for 8 hours, simulating the dust in large cities which contains about 30% carbon and soot caused by incomplete combustion. The animals were killed at intervals varying from 1 1/2 to 67 hours. The lung tissue was fixed and examined with an electron microscope. Nine illustrations are provided showing the cytological condition of the tissue at various time intervals. After one to two hours exposure, the soot particles were found exclusively in the extracellular tissues of the aveoli. After 8 hours a phagocytosis of the soot dust was observed. The soot particles which lay in the vacuoles were extremely hard; with increasing exposure the vacuoles increased in size and eventually overlapped, causing the cytoplasm to dissolve. After 32 hours the tissue consisted mainly of cell fragments containing soot particles and after 67 hours fused particles were found whose primary parts could not be differentiated. These experiments show that even relatively insoluble compounds can cause harmful alterations in lung tissue. Since benzopyrene is readily absorbed by soot and can be found in the atmospheric dust of large cities, 12 gamma benzopyrene absorbed on 20 mg. soot was injected into white rats and the animals killed at different time intervals. Eighty per cent of the benzopyrene was dissolved from the soot and 20% stayed absorbed over a period of 20 days. The damage caused to the lung tissue, and the relatively quick dissolution of benzopyrene in vivo, makes the elimination of soot as a pollutant a matter of primary importance.##

08295

Barnes, R. and R. C. Jones

CARBON TETRACHLORIDE POISONING. Am. Ind. Hyg. Assoc. J., p. 557-560, Nov.-Dec. 1967, 6 refs.

Three cases of poisoning by carbon tetrachloride in one industry are reported. Liver damage as evidenced by altered liver function tests was a feature of other workmen of this plant also exposed to carbon tetrachloride. Kidney damage, which is a feature of other reported cases of carbon tetrachloride poisoning, was only shown by one of the cases reported here. The dangers of carbon tetrachloride are noted, and care in its industrial and household use is emphasized. (Authors' summary)

08305

Kagawa, Jun

THE USEFULNESS OF THE METHOD OF SINE WAVE OSCILLATING PRESSURE FOR MEASURING TOTAL RESPIRATORY FLOW RESISTANCE IN HUMAN SUBJECTS AND GUINEA PIGS. Text in Japanese. Japan. J. Hyg. (Tokyo), 21(6):424-436, Feb. 1967. 18 refs.

The validity and applicability of a sine wave oscillation method for measuring total respiratory flow resistance in man and guinea pigs were investigated. Diagrams giving exact measurements of the body plethysmographs and the pressure imposing device used in the experiments are provided. The frequency of the sine wave oscillation with which the activity of the chest-lung system becomes zero, was found to be 7 approximately 9 c.p.s. in both man and guinea pig. Over 12 c.p.s. the impedance of the system showed a steep rise. By analyzing the flow and its imposed pressure curves, it was found that the total respiratory flow resistance showed continuous change according to the different stages of the flow curve. By the use of an artificial mouthpiece resistor having three kinds of known resistance in man, the frequencies 7 approximately 9 c.p.s. also showed the most pertinent reproducibility, and the impedance was overestimated by frequencies below or above this range. When this technique was applied to the short term inhalation study of low concentration of SO<sub>2</sub> (1.5-2.0 ppm) in man, it revealed rapid response and individual difference of the sensitivity of the total respiratory flow resistance after a few seconds of the exposure. In long term exposure of guinea pigs to 0.1 ppm of toluene diisocyanate vapor without any surgical treatment, the animals showed a repeated day to day response with different individual sensitivity, and when sodium chloride aerosols were added the response of the total respiratory flow resistance was affected in a meaningful pattern. The results, which are illustrated in graphs and tables, show this procedure to be a relevant and sensitive method to evaluate the behavior of the respiratory air way in both man and guinea pig in short or long term studies of environmental toxic materials.

08329

Laws, Edward R., Jr., August Curley, and Frank J. Biros

MEN WITH INTENSIVE OCCUPATIONAL EXPOSURE TO DDT. A CLINICAL AND CHEMICAL STUDY. Arch. Environ. Health, Vol. 15, p. 766-775, Dec. 1967. 25 refs.

A study was made of 35 men with 11 to 19 years of occupational exposure to DDT. Findings from medical history, physical examination, routine clinical laboratory tests, and chest x-ray film did not reveal any ill effects attributable to exposure to DDT. The overall range of storage of the sum of isomer and metabolites of DDT in the men's fat was 38 to 647 ppm as compared to an average of 8 ppm for the general population. Based on their storage of DDT in fat and excretion of DDA in urine it was estimated that the average daily intake of DDT by the 20 men with high occupational exposure was 17.5 to 18 mg per man per day as compared to an average of 0.04 mg per man per day for the general population. There was significant correlation ( $r = +0.64$ ) between the concentration of total DDT-related material in the fat and serum of the workers. The concentration in fat averaged 338 times greater than that in serum. Workers store a smaller proportion of DDT-related material in the form of DDE, and the difference is related chiefly to intensity rather than duration of exposure. DDE is relatively much less important and DDA much more important as excretory products in occupationally exposed men than in men of the general population. (Authors' summary, modified)##

08339

Tomingas, Rene

SOOT HAZARDS INVESTIGATED FROM THEIR CARCINOGENIC ASPECTS. Staub (English translation), 27(8):8-10, Aug. 1967. 3 refs.  
CFSTI: TT 67-51408/8 (-HC \$2.00)

Experiments carried out on rats shown that subcutaneous implantation of benzopyrene combined with soot can cause sarcomata. The result is affected by the high number of soot eruptions. Sarcoma yield depends on complete remainder of the implantate. The investigation of the residual implantate in the case of rats has shown that, if the action in an animal body is sufficiently long, benzopyrene is completely eliminated from the implantate.

08415

Lawther, P. J.

AIR POLLUTION, BRONCHITIS AND LUNG CANCER. Postgrad. Med. J. (London), Vol. 42, p. 703-708, Nov. 1966. 13 refs.

The emission of pollutants at levels close to the ground and during adverse meteorological conditions, such as temperature inversion, contribute to low altitude air pollution. Particulate matter in the air can be measured by optical and electron microscopy. An electron micrograph of common solid pollutants and a table showing the average and maximum winter concentrations of common gaseous pollutants in central London during 1954-1964 are provided. The results of various field and laboratory tests indicate that irritants in smoke, rather than SO<sub>2</sub>, were the

causative agents for the exacerbation of existing chest diseases. While simple bronchitis may be caused by cigarette smoking, chronic bronchitis is related to urban factors. Tests further support the theory that the rise in the incidence of lung cancer is correlated with the incidence of cigarette smoking rather than with the level of polycyclic hydrocarbons in coal tar, coal smoke, and soot. Urban factors are also involved in the genesis of lung cancer. As a remedial measure it appears reasonable to recommend that fuel be burned centrally, and that the effluents be dispersed from tall stacks.##

08431

V. R. Tsulaya

THE SANITARY AND TOXICOLOGICAL CHARACTERISTICS OF THE EFFECT OF A MIXTURE OF BENZENE AND ACETOPHENONE VAPORS IN THE ATMOSPHERE. ((Sanitarno-toksikologicheskaya kharakteristika kombinirovannogo deistviya smesi parov benzola i atsetofenona v atmosfernom vozdukh.) Hyg. Sanit. (English translation of: Gigiena i Sanit.), 32(4-6):6-10, April-June 1967. 1 refs.

CFSTI: TT 67-51409/2

As a result of studying the reflex action of a mixture of benzene and acetophenon vapors on the human body, it is concluded that the effect produced by this mixture is the summation of effects of the two substances. An investigation of the resorptive action of a mixtures of benzene and acetophenon vapors in a concentration of 9.2 and 0.030 mg/cu m consecutively revealed a series of shifts in the central nervous and hemopoietic systems and the nucleic acids content in the blood of experimental animals. A mixture of benzene and acetophenon vapors in a concentration of 0.91 and 0.0030 mg/cu m, consecutively, had no noxious effect on experimental animals. (Author's summary)##

08442

I. L. Kulinskaya

EFFECT OF CHRONIC EXPOSURE TO LOW CONCENTRATIONS OF TOLUENE ON THE ACETYLCHOLINE SYSTEM IN THE BLOOD OF RABBITS. ((Vliyanie khronicheskogo deistviya malykh kontsentratsii toluola na sistemy atsetilkholina v krovi krolikov.)) Hyg. Sanit. (English translation of: Gigiena i Sanit.), 32(4-6):291-295, April-June 1967. 9 refs.

CFSTI: TT 67-51409/2

Alterations in the acetylcholine system were studied with a view to identifying early signs of poisoning with small doses of toluene. This system is a sensitive indicator of the functional state of the nervous system. Shifts occurring in this system on long-term exposure to benzene had been determined earlier. Chronic effects of low concentrations of industrial substances are accompanied by changes in the overall reactivity of the organism. Therefore this experiment combined the poisoning of experimental animals together with immunization with typhoid vaccine. Changes in acetylcholine

concentration in blood appeared already at early stages of the unfavorable effect on the organism, before the appearance of changes in the activity of the AC-decomposing enzyme. Therefore, it is not expedient to limit studies of chronic poisonings to investigations of acetylcholinesterase activity, but parallel determinations of AC concentration should also be performed. Accumulation of AC in blood and increase in the ACE activity in the first and in the second periods of chronic poisoning point to an increased functional activity of the nervous system while the decrease in the mediator exchange indices in the third period points to possible inadequacy (humoral decompensation phase). The results confirmed that the process of prolonged poisoning initially intensified the functions of different systems but later these functions become weakened according to the depletion of the compensatory resources of the body.##

08443

Sh. S. Khikmatullaeva

MAXIMUM PERMISSIBLE CONCENTRATION OF THIOPHENE IN THE ATMOSPHERE. (Materialy k obosnovaniyu predel'no dopustimoi kontsentratsii tiofena v atmosfernom vozdukh.) Hyg. Sanit. (English translation of: Gigiena i Sanit.), 32(4-6):319-322, April-June 1967. 8 refs.  
CFSTI: TT 67-51409/2

The single maximum permissible concentration of thiophene in the atmosphere was set at a level of 0.6 mg/cu m by means of determining its threshold values of smell (2.1 mg/cu m), of ocular-light sensitivity and that of the bioelectric activity of the human cerebral cortex (0.8 mg/cu m). A study of the resorptive action of thiopene at concentrations of 20 and 3 mg/cu m on albino rats revealed definite shifts in the chronaxy muscle-antagonists, in the content of protein fractions, of sulfahydride groups, and that of syalic acids in the blood serum, in the leucocyte count and formula of the blood, in the level of coproporphyrins in the urine and that of ascorbic and pyro tartaric acids in the organ tissues. As thiophene at a concentration of 0.6 mg/cu m proved to be ineffective, it is suggested that this concentration be set as the daily average maximum permissible concentration of the substance in the atmosphere. (Author's summary)##

08483

Momotani, Hiroshi

THE RESPIRATORY DEPOSITION OF POLYSTYRENE AEROSOLS IN MAN. Text in Japanese. Japan. J. Hyg. (Tokyo), 21(6):417-423, Feb. 1967. 15 refs.

Aerosols were generated from three sizes of polystyrene particles (0.188, 0.557, and 1.305 micron diameters) suspended in water. The aerosols were stocked in a 9-liter, Benedict-Roth type spirometer to dry and then were inhaled. Subjects (7 healthy males and 1 female, 22-29 years old) were asked to breathe the aerosols through the nose, while sitting, at rates of 10, 15, or

20 inspirations per minute. Each experiment lasted 1-2 minutes; 60 were performed in all. Results are tabulated. Aerosol concentration was measured by the Kimoto light-scatter photometer (Sinclair-Phoenix type): 10 consecutive respirations were recorded to get an average deposition rate for one experiment. Average concentrations of the aerosols were estimated for inspired and expired air, and deposition rates computed for one respiratory cycle. The effects of respiratory rate, tidal volume, and respiratory flow rate on deposition are discussed. Aerosol deposition in the respiratory tract varies from subject to subject, and according to particle size, so that the larger the particles, the higher the percentage deposition. Aerosols with diameters of 0.188 or 0.557 microns exhibit similarly low deposition rates, suggesting that the minimum deposition size approaches these two sizes. The lower the respiratory rate, the greater the deposition (particularly for 1.305 micron particles). Tidal volume and flow rate have no relation to deposition rate.##

08511

Anderson, Donald O.

THE EFFECTS OF AIR CONTAMINATION ON HEALTH: A REVIEW. PART II. Can. Med. Assoc. J. (Toronto), Vol. 97, p. 585-593, Sept. 9, 1967. 103 refs.

The literature on the health effects of specific pollutants is reviewed. Included are studies on dustfall, sulfur dioxide, oxidizing pollution (as a mixture, or when broken into these components: carbon monoxide, oxides of nitrogen, ozone, and peroxyacetyl nitrate), polycyclic hydrocarbons, industrial sources of community air pollution (especially arsenic, beryllium, and asbestos), and several other pollutants. The effects of low levels of common air pollutants, classified as particulate matter, irritants, oxidants, and systemic poisons, are not known precisely. According to one study, high and significant correlations were obtained between lung cancer mortality in men, and levels of beryllium, arsenic, zinc, molybdenum, vanadium, cobalt, manganese, lead, and titanium. No correlation was observed for nickel and antimony. In terms of magnitude of the effect, the hazard of long-term exposure to levels of urban pollution is much less than that of personal air pollution by cigarette smoking. The biological effect, however, is similar to that of smoking, and is documented in excess mortality, respiratory conditions, and possibly also in respiratory cancer. The most important constituent currently measured in the air is dust.

08526

Zorina, L. A., T. M. Sukharevskaya, and E. A. Soloveva

THE MECHANISM OF THE DEVELOPMENT OF THE HEMORRHAGIC SYNDROME IN CHRONIC BENZENE INTOXICATIONS. K mekhanizmu razvitiya gemorragicheskogo sindroma pri khronicheskoi intoksikatsii benzolom.) Text in Russian. Gigiena Gruda i Prof. Zabolevaniya (Moscow), 10(8):26-31, Aug. 1966. 19 refs.

A study of the blood coagulation system in chronic benzene intoxications showed that hemorrhage is caused mainly by the quantitative and qualitative deficiencies of the platelets (thrombocytopenia and thrombocytopathy) which lower the activity of the blood coagulation system, increase fibrinolysis and change the properties of the vascular walls (disturbed endothelial barrier and increased permeability). Hemorrhagic symptoms are experienced not only in patients with thrombocytopenia but also in patients with normal platelet counts suffering from thrombocytopathy.

08598

Davis, Kieffer

ENVIRONMENTAL HEALTH RESEARCH: INTERACTION OF SULFUR AND OTHER ATMOSPHERIC CONTAMINANTS. PROGRESS REPORT Med. Bull. Standard Oil New Jersey, 27(3):258-2698 Nov. 1967. (Presented at the 32 Midyear Meeting, American Petroleum Institute's Division of Refining, Los Angeles, Calif., 1967.)

The objectives and general experimental designs are presented of research projects which are currently sponsored by the American Petroleum Institute: 1) research into biological tolerance to air pollutants and mechanisms of SO<sub>2</sub> toxicity; 2) research into the chronic effects of pollutants in man and the relationship between onset of acute morbidity and death; 3) study of experimental emphysema in laboratory animals and possible effects of SO<sub>2</sub>, oxides of N, and particulates; 4) investigation of the conditions and concentrations of aromatic hydrocarbons that may produce lung cancer; and 5) study of the combined effects of environmental contaminants. Available results indicate that monthly morbidity is quite high in a selected group of out-patients and may give sufficient data to correlate with air quality. In the animal studies, no pattern is found indicating any effect which may be relatable to inhalation of the dusts used, with or without adsorbed gas. Benzo(a)pyrene particles instilled intratracheally in hamsters induce a high incidence of carcinomas.

08801

Hogger, Dieter

EFFECTS OF THE MOTOR VEHICLE EXHAUST GASES ON HUMANS, ANIMALS AND PLANTS. ((Auswirkungen der Motorfahrzeugabgase auf Menschen, Tiere und Pflanzen.)) Text in German. Z. Praeventivmed., Vol. 11, p. 161-178, March-April, 1966. 20 refs.

The various toxic components in automobile exhaust gases are reviewed. To determine the amount of carbon monoxide inhaled by the population, the carbon monoxide hemoglobin content of 331 policemen and 597 automobile drivers was determined during a test for alcohol. The nonsmoking policemen did not exceed the 5% limit, but 25% of smoking policemen and 40% of the drivers did. The amount of lead in the street, in window sill dust, and in the street air was well as in the blood of office workers, metal workers and garage workers was determined in Zurich between 1948-1963. While the amount of lead in the dust of the street, air, and window sills increased significantly by 1955, the amount found in the



blood increased only slightly. Soot is considered deleterious as a carrier of other water soluble toxic substances into the lungs. The hygienic limit of 0.5 cc./cu m for oxides of nitrogen is only seldom exceeded. Sulfur dioxide emissions are negligible. Hydrocarbons and polycyclic hydrocarbon emissions from motor vehicles contribute only a few percent to the rise in lung cancer. The paraffin and olefin hydrocarbons are nontoxic to humans, animals and plants, while ethylene is highly toxic to plants. While in Europe oxidants do not contribute significantly to air pollution, compounds such as ozone and peroxyacetylnitrite contribute to air pollution in tropic and subtropic climates with a high concentration of motor vehicle traffic, particularly under adverse meteorological conditions. The psychological problems caused by air pollution are discussed and it is concluded that the psychological effects cannot be dismissed lightly.##

08897

Felmeister, Alvin, Mohammad Amanat, and N. D. Weiner

INTERACTION OF NITROGEN DIOXIDE--OLEFIN GAS MIXTURES WITH LECITHIN MONOMOLECULAR FILMS. Environ. Sci. Technol., 2(1):40-43, Jan. 1968. 15 refs.

The interaction of nitrogen dioxide-olefin gas atmosphere with saturated lecithin monomolecular films were investigated using surface pressure measurements. Films of dipalmitoyl lecithin, a saturated phospholipide, showed no interaction with any of the test atmospheres used. Films of egg lecithin, an unsaturated phospholipide, showed significant changes in the surface pressure - surface area curves in the presence of all atmospheres containing nitrogen dioxide. The observed effects appear to be the result of a chemical interaction of NO<sub>2</sub> with the double bonds of the egg lecithin rather than a simple physical penetration of the film. Biological implications are discussed. (Authors' abstract.)

09002

Smith, T.

THE PULMONARY TOXICOLOGICAL MANIFESTATIONS OF TERPENE PARTICLES. Intern. J. Bioclimatol. Biometeorol. Suppl. (Leiden), Vol. 11, 171p., 1967.

In 1964, at the Washoe Medical Center in Reno, Nevada, asthmatic patients had questionnaires completed as to their residence, sites of visitation, and vegetation in their immediate surroundings during the 24-hr. period immediately prior to attack. Attacks were seasonal and occurred primarily when the number of terpene particles in the atmosphere were at their highest levels, as determined with gas chromatography. Rats were then exposed to measured quantities of terpene particles liberated into altitude chambers under controlled atmospheric conditions. They were sacrificed, autopsied, and the lungs studied using gross, microscopic, and angiographic techniques in order to correlate pathologic changes with those occurring in the asthmatic man. When normal white rats were

subjected to approximately 20-30 parts of alpha-pinene for the first time, the animals became lethargic within 5 min., severely agitated in 10-15 min., convulsed in 20 min., and died within 30 min. At autopsy, they had lost much tracheal mucosa and evinced severe pulmonary and cerebral edema. If removed from the toxic alpha-pinene within 25 min., and placed in either O2 or open air, they recovered; 24 hr. later, the trachea and large bronchi were largely denuded of mucosa. Focal areas of inflammation occurred which involved the basement membranes and submucosal glands. If the animals were placed into the chamber for the second or third time, death occurred earlier. (Author's abstract, modified)##

09024

Fried, Josef and Dorothy E. Schumm

ONE ELECTRON TRANSFER OXIDATION OF 7,12-DIMETHYLBENZ(A)ANTHRACENE, A MODEL FOR THE METABOLIC ACTIVATION OF CARCINOGENIC HYDROCARBONS. J. Am. Chem. Soc., 89(21):5508-5509, Oct. 11, 1967. ((15)) refs.

In the study of carcinogenicity of polycyclic aromatic hydrocarbons, there is a basic question of whether it is the hydrocarbon itself or some metabolite produced in vivo that is the primary trigger for biological activity. A chemical model system is described which is converting the potent 7,12-dimethylbenz(a)anthracene (DMBA) into biologically more active products. The action of one electron transfer agents, manganese dioxide, ferricyanide and Ce(IV) on DMBA was investigated. Fractionation of the manganese dioxide products yielded in addition to DMBA, five compounds, which were identified with several procedures. The biological activity of each was investigated using an E. coli bacteria phage assay.##

09055

Anghileri, L. J.

EFFECT OF OTHER HYDROCARBONS ON THE 'IN VITRO' BINDING OF 3,4-BENZOPYRENE BY PLASMA PROTEINS. Naturwissenschaften (Berlin), 54(10):249-250, 1967. 1 ref.

The effect of other polycyclic hydrocarbons on the in vitro binding of 3,4-benzopyrene (3,4 BP) by plasma proteins has been assayed. The procedure is described. The plasma proteins albumin, alpha-globulin, and beta globulin, and radioactive 3,4-BP were combined with each of the following hydrocarbons: 1,2-benzopyrene, 1,2,3,4-dibenz-anthracene, 9,10-dimethyl-1,2-benzanthracene and 20-methyl-cholanthrene, then taken through the various assay procedures. The samples were finally counted in a liquid scintillation spectrophotometer. The distribution of 3,4 BP in the different plasma fractions was studied by starch gel electrophoresis. Under these experimental conditions the 20-mc decreases considerably the binding of 3,4 BP (approximately to 1/7 in albumin and to 1/5 in alpha and beta globulins). The other tested hydrocarbons decrease the binding in the following order of decreasing activity: DMBA; 1,2,3,4-DBA; Py; 1,2 BP.##

09060

Ludwig, John H.

SOME RAMIFICATIONS OF AIR CONTAMINATION. Public Health Rept. (U.S.), 75(5):413-419, May 1960. 4 refs. (Presented at the 47th National Safety Congress and Exposition, Chicago, Ill., Oct. 20, 1959.)

The ramifications of air pollution are discussed in terms of health effects, urbanization, and economic losses. Particulates, benzo(a)pyrene, sulfur oxides and photochemically reactive species are discussed.##

09074

Lester, David and Leon A. Greenburg

ACUTE AND CHRONIC TOXICITY OF SOME HALOGENATED DERIVATIVES OF METHANE AND ETHANE. Arch. Ind. Hyg. Occupational Med., Vol. 2, p. 335-344, 1950. 6 refs.

The effect of inhalation of dichlorodifluoromethane, trichlorofluoromethane 1, 1-difluoroethane, 1-chloro-1,1-difluoroethane, 1,1-difluoroethylene, fluoroethylene, and 1,1-difluoro-1,2-dibromoethane were studied in rats. All of the compounds with the exception of vinyl and vinylidene fluoride are anesthetic. 1,1-difluoroethane, 1-chloro-1,1-difluoroethane and 1,1-difluoro-1,2-dibromoethane are pulmonary irritants. No damage to the liver was observed from inhalation of these compounds. The toxic effects of the compounds are discussed in relation to their boiling points. (Authors' summary, conclusion, modified)

09090

World Health Organization Expert Committee on Insecticides, Geneva, Switzerland

SAFE USE OF PESTICIDES IN PUBLIC HEALTH. (SIXTEENTH REPORT.) World Health Organ. Tech. Rept. Ser., No. 356:1-65, 1967.

The report of the WHO Expert Committee on Insecticides which met in Geneva, Switzerland, in September 1966 is presented. In vector control programs DDT has been in use for over 20 years. The concern that has been expressed in recent years about contamination of the environment by this very stable and persistent insecticide should not, in the opinion of the Committee, be considered sufficient reason for substituting other insecticides for indoor residual spraying against mosquitos. Where vectors have developed resistance to DDT it has become necessary to introduce alternative insecticides. The Committee reviewed those compounds and is of the opinion that with one exception - malathion (OMS-1) - those insecticides so far developed as indoor residual sprays are likely to present a greater hazard in use than DDT. The Committee urges health authorities to take a realistic view of the hazards presented by these new insecticides. The insecticides now under trial for use in vector control programs belong to the organophosphorus and

carbamate groups of anticholinesterases. Recovery from severe poisoning by either type of insecticide will be complete, provided that prolonged asphyxia is avoided by proper treatment. While bearing in mind the importance of good public relations throughout a control or eradication program, the Committee considers that the demonstration of non-symptomatic enzyme depressions in the inhabitants or the spraymen should not preclude the use of entomologically effective compounds capable of controlling or eradicating malaria and other serious vector-borne diseases. The occurrence of symptoms with compounds of the carbamate group may indicate the need for a review of safety procedures and application techniques rather than for a discontinuation of the program. While the deliberations of the Committee were confined to compounds and procedures in use in public health, many of the points raised are applicable to some uses of similar compounds in agriculture and food storage.##

09316

Parker, D. R.

APPLICATION OF TRICHLOROACETIC ACID LEVEL IN URINE AS  
A MEASURE OF TRICHLOROETHYLENE VAPOR EXPOSURE. Sandia Corp.,  
Albuquerque, N. Mex., 9p., July 1967. 7 refs.  
CFSTI: SC-M-67-431

Trichloroacetic acid is a natural metabolite of trichloroethylene which is readily recoverable from urine specimens. The amount of trichloroacetic acid excreted in the urine is generally a function of the trichloroethylene vapor exposure. Although the day-to-day excretion levels fluctuate significantly, they can be used as an aid in evaluating an individual's exposure to trichloroethylene vapor when a series of samples are analyzed. (Author's abstract)

09435

Tye, Russell and Klaus L. Stemmer

EXPERIMENTAL CARCINOGENESIS OF THE LUNG. II. INFLUENCE OF  
PHENOLS IN THE PRODUCTION OF CARCINOMA. Nat. Cancer Inst.,  
39(2):178-186, Aug. 1967. 8 refs.

After examining the contribution of the phenols to the pulmonary carcinogenic potency of the tar aerosol, a modest evaluation of the hydrocarbon carcinogens was made by class. The acidic fractions (including phenols) were separated from two somewhat different coal tars. Various blends and an original tar produced aerosols to which 5 groups of male C3H/HeJ mice were exposed 2 hours, 3 times weekly, for 55 weeks. Animals were killed at intervals. The lungs and tracheas of all mice were examined grossly and microscopically for neoplasms, or relevant morphologic changes. After 46 weeks, 32 survivors in groups 2 and 4, which received similar aerosols containing phenols, had 4 incidences of adenocarcinoma, 19 of intrabronchial adenoma, and 10 of squamous metaplasia. In 20 survivors of group 3, which received the same tar without phenols, there was no incidence of adenocarcinoma; 11 had intrabronchial adenoma and 2 had squamous metaplasia. (Authors' summary, modified)##

McCarroll, James, Michael Lebowitz, Doris Wolter,  
Eric Cassell and Donovan Thompson

AIR POLLUTION AND ACUTE RESPIRATORY ILLNESS. Preprint, Washington Univ., Seattle, School of Medicine, ((28))p., 1967. (Presented at a joint meeting of the Pacific Northwest Section, American Industrial Hygiene Association and Northwest Association of Occupational Medicine, Portland, Oregon, Nov. 12, 1967.)

A three year study was conducted in New York City to determine what variations in the health of a normal urban population might be related to variations in their environment. The population studied included whites, Negroes, and Puerto Ricans from upper, middle, and lower income groups, and was divided into four categories: children (those under 15 years of age); adults; heavy cigarette smokers; and non-cigarette smokers. The total number of participants in the study was 1747 and each was observed for an average of 45 weeks. A questionnaire was developed containing approximately 120 items regarding variations in health. Each family was visited each week by a trained health interviewer who orally asked the questions in the questionnaire; questions were asked for each of the seven preceding days. An air pollution monitoring station was established in the center of the study area and measurements were made of SO<sub>2</sub>, particulates, carbon monoxide, and hydrocarbons. Also, monitoring records of a variety of other pollutants were obtained from the City. Continuous records were maintained on common meteorologic variables. The association between the daily prevalence rates of various health symptoms and the levels of air pollution are examined by several methods. The multiple correlation coefficients and the multiple regression coefficients of some of the symptom prevalence rates with air pollutants and meteorological factors are summarized. It is concluded that: a) there are associated relationships between symptoms in a normal urban population and a variety of environmental factors and b) no one factor, including air pollution, acts alone to produce most of the common illnesses.##

09713

Kutscher, W., R. Tomingas, and H. P. Weisfeld

INVESTIGATIONS INTO DUST-CAUSED DAMAGE, ESPECIALLY CARCINOGENIC EFFECTS. REPORT 8: INVESTIGATION OF HUMAN LUNGS FOR THEIR DUST AND BENZOPYRENE CONTENT IN THE HEIDELBERG AREA. ((Untersuchungen über die Schädlichkeit von Russen unter besonderer Berücksichtigung ihrer cancerogenen Wirkung. 8. Mitteilung: Untersuchung von Humanlungen auf ihren Staub- und Benzopyrengehalt im raum Heidelberg.)) Text in German. Arch. Hyg. Bakteriол. (Munich), 151(7):666-668, Nov. 1967. 3 refs.

This continuation of a study of the industrial area around Mannheim concerns only the dust levels in the lungs. The lungs of 10 persons (aged 22-73) who had lived most of their lives in the Heidelberg area were autopsied. Similar to findings in previous work, traces of benzopyrene occurred in 3 cases. Dust content ranged from 0.35-1.30 g. in 9 cases, the tenth exhibiting 2.28 g. (Average of 9, 0.92 g.).

Wykes, Arthur A. and Juanita H. Landez

TOXICOLOGY OF BORON HYBRIDES--STUDIES OF ALTERATIONS IN TISSUE AMINES TOXIC DECABORANE-14 (B10H14) AND PENTABORANE-9 (B5H9) AS MODIFIED BY HYDRAZINES AND PROPYNYLAMINES. Air Force School of Aerospace Medicine, Brooks AFB, Tex., Aerospace Medical Div., Task 630207, SAM-TRV-66-112, 10p., Dec. 1966. 20 refs. CFSTI,DDC: AS 648537

Investigations of the influence of the toxic boron hydrides, decaborane-14 and pentaborane-9, on biogenic amine metabolism were undertaken to assist in the elucidation of the toxic mechanisms and sites of action of boron hydrides in animals. Brain and heart tissue serotonin and norepinephrine were found to be significantly depleted after treatment of test subjects with the boron hydrides. The testing of a number of potential antidotes for the treatment of the toxic symptoms and biogenic amine changes due to exposures to boron hydrides has resulted in the discovery of several new antidotal drugs for the toxic effects of decaborane-14. Pargyline (N-methyl-N-benzyl-2-propynylamine), a potent nonhydrazide monoamine oxidase (MAO) inhibitor, provides protection against the depletion of rat brain and heart norepinephrine, as well as the reserpine-like sedation and ataxia observed in decaborane-intoxicated rats. In contrast, several close analogs of pargyline do not protect against the depletion of tissue norepinephrine due to decaborane poisoning. JB-516 (1-phenyl-2-hydrazinopropane), a potent hydrazine-related MAO inhibitor, greatly potentiates the toxic effects of decaborane-14, as does iproniazid (1-isonicotinyl-2-isopropyl hydrazine). Doses of the B6-vitamin pyridoxine also appear to counteract the toxic effects decaborane-14. Monoamine oxidase inhibition and elevation of tissue amines per se by a drug do not appear to be required properties for the drug to decrease or eliminate the toxic actions of boron hydrides. Followup studies, which include investigations of the mode of action of pargyline and pyridoxine as protective agents in boron hydride-intoxicated animals, are in progress. (Authors' abstract)

10105

M. Wasserman, D. H. Curnow, P. N. Forte, Y. Groner

STORAGE OF ORGANOCHLORINE PESTICIDES IN THE BODY FAT OF PEOPLE IN WESTERN AUSTRALIA. Ind. Med. Surg., 37(4):295-300, April 1968. 37 refs.

Between May 1965 and November 1966, 58 samples of human adipose abdominal tissue were collected from routine autopsies in Perth, Australia. None of the persons aged 14 to 93, with 82% above 50 years, had any known occupational exposure to pesticides. In 46 specimens analyzed by the Schechter-Haller spectrophotometric method, the average concentration of total DDT-derived material was 9.5 plus or minus 2 ppm. The mean value of DDT was 3.6 plus or minus 1 ppm, and of DDE was 5.9 plus or minus 2 ppm. DDE averaged 62% of the total DDT-derived material. In 12 samples analyzed by gas-liquid chromatography, the average concentration of total DDT-derived material was 9.3 plus or minus 2 ppm. Isomers of BHC averaged 0.68 ppm and dieldrin 0.67 ppm. Comparable data from Canada, America, Czechoslovakia, England,

France, Germany, Hungary, Spain, India, and Israel are tabulated. The average concentration of dieldrin found in body fat of Western Australians (0.67 plus or minus 0.1 ppm) is rather high when compared with values found in other populations (0.002-0.31 ppm).##

10118

Weete, J. D., J. L. Laseter, and D. J. Weber

HYDROCARBONS FOUND IN WAXY LAYERS FROM SPORES OF BASIDIOMYCETES. Preprint, Houston, Univ., Tex., (18)p., (1968). 10 refs.

Paraffinic material was extracted from spores of six basidiomycetes and analyzed by gas chromatography. The individual hydrocarbons were characterized as the eluted from the chromatographic column by a combustion gas chromatograph-mass spectrometer. The hydrocarbon pattern was distinct for each species analyzed with odd-chain hydrocarbons predominating in every case. The predominate n-alkane peaks were: C27 for *Ustilago maydis*, C29 for *Puccinia graminis*, C29 and C31 for *Urocystis agropyri*, C27 and C35 for *Ustilago nuda*, C29 and C31 for *Ustilago avenae*, and C29 for *Sphacelotheca reiliana*. The concentration of normal and branch-chain hydrocarbons varied from 4 ppm to 146 ppm. The hydrocarbons are part of the waxy outer layer of spores and the significance of this layer is discussed. (Authors' abstract)

10239

Bohlig, H.

PATHOLOGICAL SYMPTOMS DUE TO INHALATION OF ASBESTOS DUST. ((Krankheitserscheinungen nach Asbeststaubinhalation.)) Text in German. Zentr. Arbeitsmed. Arbeitsschutz, 16(12):353-355, Dec. 1966.

In a brief literature review, in which authors are mentioned but no references cited, the problem of asbestos dust as a carcinogenic substance is surveyed. Despite greatly increased preventive measures taken in many asbestos plants, and the resultant reductions in cases of asbestosis, problems of asbestos inhalation have acquired new significance during the past five years. The retrospective examination of mesothelioma autopsy material in various countries has implicated asbestos dust as a malignant-tumor inducing agent, not only in asbestos workers but even in others. The well-known 'pleura-plaques' of asbestosis and diffuse mesotheliomas have been observed in individuals who had never had occupational contact with asbestos but who had resided in the vicinity of asbestos plants or mines. It can be stated with assurance that pollution of the ambient air (emission) by asbestos factories - which were relatively late in utilizing the asbestos dust of their dedusting installations instead of simply releasing it to the atmosphere - has been a causative factor in a significant increase in the rate of appearance of both pleural plaques and mesotheliomas. Whether or not the quantities of asbestos dust released into the atmosphere from brake linings of automobiles are also responsible for these malignancies is a question which has yet to be determined; however, asbestos was detected histologically in the lungs of city dwellers not exposed occupationally in the

following percentages: Pittsburgh, 41.0%; Miami, 27.9%; Cape Town 26.4%. Individuals endangered by asbestos, in addition to those just cited, include persons who have occasional contact with asbestos in construction or other activities (such as roofers, insulation specialists). The properties of asbestos ores, including their benzopyrene content, are briefly mentioned.##

10241

Cuthbert, J.

THE COMMUNITY HAZARDS OF ASBESTOS. ((Die Gefahren des Asbest fur die Allgemeinheit.)) Text in German. Muench. Med. Wochschr. (Munich), 109:1369-1372, April-June 1967.

The inhalation of asbestos is far more dangerous than is generally recognized by the public, since even a transient period of exposure can lead to disease (interstitial fibrosis of the lung, lung cancer, mesothelioma, endothelioma of the pleura and the peritoneum, painful dermal warts) and death many years later. Electron microscopic studies have shown that for every asbestos fiber recognizable under an ordinary (light) microscope, there are hundreds of tiny unrecognized particles, which dust experiments with guinea pigs have shown to be just as deadly as the larger fibers. While the asbestos industry has taken energetic measures toward the prevention of classical forms of asbestosis by dust elimination in its plants (vacuum removal of the dust, use of gas masks, automation of manufacturing processes), such prophylactic measures have not prevented the gradual long-term development of cancer in persons who come into occasional, slight, or temporary contact with asbestos. This group certainly includes wives of asbestos workers and all persons living within 1.5 km. of an asbestos plant; these persons tend to succumb to mesothelioma after many years of such contact. A number of examples are given, including those of carpenters and construction workers, who do not realize that their relatively brief contact in sawing or handling asbestos materials can lead to lung cancer many years later. The great increase in asbestos production and in asbestosis in recent years is tabulated; the need for utilization of alternate materials in industry, and for further research on biological effects is emphasized. The presence in asbestos of carcinogenic oils and other components, including benzopyrene and chromium, is mentioned.##

10456

Wayne, Lowell G. and Leslie A. Chambers

BIOLOGICAL EFFECTS OF URBAN AIR POLLUTION. Arch. Environ. Health, 15(6):871-885, June 1968. 14 refs.

Rodents exposed to the ambient atmosphere of Los Angeles throughout their lives have been studied in comparison with animals maintained in smog-filtered atmospheres. In aging inbred mice of certain strains, there was an increased incidence of pulmonary adenoma. In one strain mortality of males (but not females) during the first year of life was increased. Severe smog episodes caused lung tissue alterations at the ultrastructural level, especially in mice older than 15 months. Severe episodes produced transient



increases in pulmonary resistance in old guinea pigs but no demonstrable chronic or cumulative effects on this parameter. In guinea pigs sensitized by prior stress treatment, urinary excretion of 17-ketogenic steroids was enhanced by ambient atmosphere exposure. After two or three years of exposure, rabbits exhibited reduced activity of glutamic oxalacetic transaminase in blood serum. (Authors' abstract)

10613

Anthony A. Thomas

SPACE CABIN TOXICOLOGY. In: NASA, Marshall Space Flight Center 5th Annual Meeting, Air Force Systems Command, Wright-Patterson AFB, Ohio, p. 207-217, March 3, 1967. 18 refs.

NASA: N68-17369

Space cabin toxicology is a new and challenging area of research in life support. The unique problem of this branch of toxicology is the truly uninterrupted continuous nature of exposure to chemical toxicants. Fundamental research in the last two years has answered the following most urgent basic questions. Continuous exposure can lead to a "summation of interest" type of toxic effect because daily recuperative periods from exposure are non-existent. The exotic atmospheric environment can influence the outcome of toxic damage; reduced barometric pressure and oxygen-rich atmosphere are influencing factors. All cabin materials can and must be screened by analytical and biological methods to increase the health and performance of the crew in future manned space missions. To answer these questions, experiments were conducted with animals in controlled atmosphere chambers at reduced pressure. Various contaminant materials were introduced for long exposures times. The tests themselves lasted up to eight months, thus giving a good indication of the effects of long-term exposure to a "space cabin" atmosphere.##

10987

Mountain, Isabel M., E. J. Cassell, Doris W. Wolter, J. D. Mountain, Judith R. Diamond, and J. R. McCarroll

HEALTH AND THE URBAN ENVIRONMENT. VII. AIR POLLUTION AND DISEASE SYMPTOMS IN A "NORMAL" POPULATION. Arch. Environ. Health, 17(3):343-352, Sept. 1968.

The effect of each of several pollutants on the health of urban families on the lower East Side of New York City has been assessed. Prevalence of certain symptoms on one day of the week (Monday) was assessed according to level of each pollutant (low, medium, or high). Prevalence was treated as a binomial variable (number of "yes" responses/number of "yes" and "no" responses) whereas pollutant level was a continuous variable (but ordered, by thirds), according to the method of Armitage. In summer, in children under 8 years of age, prevalence of respiratory symptoms was directly related to increasing levels of particulate matter and of carbon monoxide. (Authors' abstract)##

E. M. Roth, W. H. Teichner, and A. O. Mirarchi

CONTAMINANTS STANDARDS. (SECTION 13.) In: Compendium of Human Responses to the Aerospace Environment, Volume III, Sections 10-16, Emanuel M. Roth (ed.), Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex., CONTRACT -NAS-115, p. 1-115, Nov. 1968. 233 refs.  
CFSTI: NASA CR-1205(III)

Toxicological problems in space operations cover three situations: (1) the acute, short term, high-level exposure either in ground support or space cabin conditions; (2) the 8-hour work day exposure found in manufacturing and ground support situations; and (3) continuous, long term exposure to trace contaminants, such as would be anticipated in extended space missions. In view of the necessity for provisional limits of manned space flights of 90 to 1000 days duration the following criteria for trace contaminant control in manned spacecraft have been derived: Contaminants must not produce significant adverse changes in the physiological, biochemical, or mental stability of the crew. The spacecraft environment must not contribute to a performance decrement of the crew that will endanger mission objectives. The spacecraft environment must not interfere with physical or biological experiments nor with medical monitoring. Based on these criteria air quality standards for prolonged manned missions have been established. The following topics are discussed: kinetics of contaminants in space cabins; toxicological factors; toxicology in the spacecraft environment; source of contaminants; particulates and aerosols; microbial contaminants. Tables presenting chemical analysis of all contaminants with standard levels for space cabins are listed.##

Stout, B. M., Jr. and Roger E. Flora

KANAWHA VALLEY AIR POLLUTION STUDY HEALTH EFFECTS. II. CONDUCTION OF THE STUDY. Preprint, West Virginia Univ., Morgantown, Div. of Allergy and Div. of Preventive Medicine, ((19n8n8p., ((1967?))

A method for obtaining information concerning the eye and nasal symptoms of a sample of hypersensitive persons by daily telephone calls was explored. These symptoms were correlated with air pollution measurements taken within one half mile of the residence of these reactors. Pollutants measured were sulfates, soluble benzene compounds, and particulates. Results showed that 35% persons studied reported repeated nose symptoms and 22% reported eye symptoms. A history of bronchitis was obtained in 21%, but 66% brought up phlegm several times a year. Asthma was reported by 2% and 43% had a history of dyspnea. Thirty-seven per cent had allergies, 36% of these having had allergy skin tests.##

11260

Stout, B. M., Jr. and Roger E. Flora

KANAWHA VALLEY AIR POLLUTION STUDY HEALTH EFFECTS. III. SYMPTOM RESPONSE TO DAILY MEASURES OF AIR POLLUTION. Preprint, West Virginia Univ., Morgantown, Div. of Allergy and Preventive Medicine, ((21))p., ((1966)) 3 refs.

Daily surveys were made on persons living in the "Kanawha Valley W. Virginia for effects of particulates, sulfates and benzene soluble compounds on the eyes and nose. The "Kanawha Valley" contains industrial plants where the products are synthetic rubber, urethane foam, vinyl, sulfuric acid, solvents, agricultural chemicals, ammonia, anti-freeze, chlorine and its derivatives, paint components, organic esters, plasticizers, polyethylene, rayon, aeres yarn and ferroalloys. No indication of positive correlation of symptom prevalence with levels of pollution as measured in this study could be detected.##

11261

Stout, B. m., Jr. and Roger E. Flora

KANAWHA VALLEY AIR POLLUTION STUDY HEALTH EFFECTS I. DESIGN OF THE STUDY. Preprint, West Virginia Univ., Morgantown, Div. of Allergy and Preventive Medicine, ((14))p., ((1966?)) 13 refs.

A method for studying human response to air pollution was explored. Hypersensitive reactors to air pollution were selected for the study. Daily information on symptoms involving the eye and nose were obtained by telephone interviews from persons living in the valley under study in W. Virginia. An outline of plans for the study was: 1) to obtain a panel of hypersensitive reactors; 2) to follow these reactors through 12 months prospective study by daily contact by telephone interview; 3) to correlate their reactions with certain measurements of daily air pollution.##

11272

Mnatsakanyan, A. V.

EFFECT OF LOW CONCENTRATIONS OF CHLOROPRENE IN THE ATMOSPHERE ON SUPRARENAL FUNCTION IN CHILDREN. Hyg. Sanit. 31(13):115-117, Jan. 1965. ((7)) refs.

The qualitative and quantitative composition of alcohols contaminating the air around factories producing synthetic fatty alcohols and synthetic fatty acids, is described for the first time. Such air may contain volatile lower alcohols, as well as less volatile higher alcohols. Since aliphatic alcohols differ in their toxic properties, the maximum permissible atmospheric concentration should be established for each alcohol separately.##

Kotin, P.

THE INFLUENCE OF PATHOGENIC VIRUSES ON CANCERS INDUCED BY INHALATION. Public Health Service, Bethesda, Md., National Institutes of Health, pp. 485-499, ((1966)). 27 refs.

Squamous carcinomas were induced in C58 Black mice after successive infections with three mouse-adapted strains of influenza virus and continuous exposure to an aerosol of ozonized gasoline. The progression of the pathological process, from the initial proliferative response, to influenza virus, through squamous metaplasia with keratinization, to the development of squamous cancer, has been histologically described. The last two classes of change were observed exclusively in mice concurrently exposed to the influenza virus and hydrocarbon aerosols.##

11299

Crocker, T. Timothy and B. J. Nielsen

PRIMATE, CANINE AND RODENT TRACHEOBRONCHIAL EPITHELIAL RESPONSE TO POLYCYCLE HYDROCARBONS AND AIR POLLUTANT EXTRACTS IN ORGAN CULTURE: A PROGRESS REPORT. Preprint, California Univ., San Francisco, Cancer Research Inst, 15p, 1968. (Presented at the Air Pollution Medical Research Conference, Denver, Colo., July 22-24, 1968, Session III: Pathogenetic Role of Atmospheric Pollutants, Paper 1.)

Chemicals known to cause experimental lung cancer in lower animals are present in urban air, tobacco smoke, automobile exhausts and industrial smoke. In order to learn whether man (or other primates) can be expected to be more or less susceptible than rodents or canines upon exposure to these materials, a test system is needed that would expose respiratory mucosa of all species to the suspected chemicals, under uniform conditions. Tracheobronchial structures of rodents, dogs and monkeys were maintained for 2 to 3 weeks in organ culture. Polycyclic hydrocarbons known to be carcinogenic by various methods of testing in rodents were added to organ culture media and produced abnormal histologic states of respiratory epithelia. Among these are: (1) basal cell hyperplasia, (2) replacement of differentiated columnar cells either by one or more layers of undifferentiated pleomorphic cells or by stratified cells of a squamous epithelial type, (3) excessive height and crowding of columnar cells to form redundant epithelial folds, and (4) loss of all or most epithelial cells. Weakly carcinogenic and non-carcinogenic hydrocarbons did not produce these abnormal states. Whole benzene-soluble extracts of solids from filters used to collect air pollutants were applied in this system, and one or more of the abnormal states described above were induced. Effects of benzo(a)pyrene and of a composite of air pollutant extracts are compared in evaluating the biologic responsiveness of rodent, canine and primate respiratory epithelia to a pure compound or a crude extract of material under consideration as having possible effects on health.##

Emik, L.O. and R.L. Plata

DEPRESSION OF RUNNING ACTIVITY IN MICE BY EXPOSURE TO POLLUTED AIR. Preprint, California Univ., Riverside, Statewide Air Pollution Research Center, 12p., 1968. 6 refs. (Presented at the Air Pollution Medical Research Conference, Denver, Colo., July 22-24, 1968, Session IV: Animal Toxicology, Paper 1.)

Mice in activity wheels were exposed continuously to diluted raw or irradiated and unirradiated auto exhaust for a period of 8 weeks, using a diurnal cycle simulating Los Angeles conditions in heavy smog. Those in irradiated exhaust showed an immediate depression greater than those in raw exhaust, each gradually recovering and finally surpassing the controls by the end of the experiment. A balanced half each of control and irradiated exhaust groups was switched to the other exposure for the second 4 weeks. The controls later placed into irradiated exhaust ran significantly less than any other group. On a daily basis, no significant treatment effects were found although the LAF males always ran significantly (P less than .01) farther than their BALB chamber mates. The exhaust atmospheres appeared to modify the diurnal cycles of activity, generally flattening the usual night peak, but no detailed analyses were made. The mice exposed to ozonized gasoline fumes gradually recovered their control level of activity when continually exposed for several weeks. With this background of experience, mouse activity was included as one measure of the effects of ambient air pollution exposure.##

11309

Ishikawa, S., D. H. Bowden, V. Fisher, and J. P. Wyatt

THE EMPHYSEMA PROFILE' IN TWO MIDWESTERN CITIES IN NORTH AMERICA. Preprint, Manitoba Univ., Winnipeg, Dept. of Pathology and Saint Louis Univ., Mo., Dept. of Anatomy, 11p., 1968. 7 refs. (Presented at the Air Pollution Medical Research Conference, Denver, Colo., July 22-24, 1968, Session VI: Emphysema, Paper 3.)

In a comparative study there was considerably more emphysema in St. Louis than Winnipeg and the anatomic emphysema was found much earlier and appeared to progress more rapidly. In neither city were cases of severe emphysema observed in non-smokers. From these basic observations on these two cities, which have striking differences in the degree of environmental pollution, it appears that smoking is not the only factor concerned in the development of emphysema. The importance of environmental pollution is further strengthened by the fact that the incidence of severe emphysema in comparable groups of cigarette smokers is four times as high in St. Louis as it is in Winnipeg. These findings suggest that the development of emphysema may be related to a synergistic effect of smoking and environmental pollution. The sharp distinction between the emphysema profiles of these two cities further emphasizes the epidemiologic value of correlating various parameters of urban living with patterns of lung pathology.##

Dubrovskaya, F. I., M. S. Katsenelenbaum, Ya. K. Yushko, G. V. Bulychev. and V. A. Korolova

ATMOSPHERIC AIR POLLUTION WITH DISCHARGES FROM SYNTHETIC FATTY ACIDS AND ALCOHOLS PRODUCING INDUSTRIES AND THEIR EFFECT ON THE HEALTH OF THE POPULATION. ((Zagryazneniye atmosfernogo vozdukha vybrosami proizvodstva sinteticheskikh zhirnykh kislot i spirtov i vliyaniye ikh na zdordov'ye naseleniya.)) Translated from Russia. *Gigiena i Sanitariya*, 26(12):3-8, Dec. 1961. 5 refs.

Investigations of the atmosphere in Shebekino have revealed it to be intensely polluted up to a radius of 3 Km from a synthetic fatty acids and alcohol plant in the Shebekino Industrial Complex. Its discharges contain fatty acids, hydrocarbons, acetone, methanol and formaldehyde. Investigations showed that that combustion of exhaust gases occurred at low efficiency, with hydrocarbons, acids and acetones only 30% burned. The concentrations of pollutants in escaping gases, and of saturated and unsaturated hydrocarbons, ketones, acetone, and fatty acids in atmospheric air, are tabulated. Construction inadequacies of the furnace used were blamed for the low efficiency of combustion. A complete medical examination of the children in Shebekino shows their health to be somewhat affected by the atmospheric pollution. Diseases of respiratory tract prevail among other affections. It has been determined experimentally that the threshold value of olfactory perception of valericianic acid in most people fluctuates from 0.5 to 1.0 mg per m<sup>3</sup>.##

11484

Krasovitskaya, M. L. and L. K. Malyarova

LONG-TERM EFFECT OF LOW CONCENTRATIONS OF ETHYLENE AND TRICHLOROETHYLENE ON NEWBORN ANIMALS. ((0 khronicheskom deistvii malykh kontsentratsii etilena i trikhloroetilena na organizm novorozhdennykh zhivotnykh.)) Hyg. Sanit. (English translation of: *Gigiena i Sanit.*), 33(4-6):146-149, April-June 1968. ((3)) refs.

CPSTI: TT 68-50449/2

Adult albino rats (aged 2 1/2 months) and newborn ones, respectively designated as series I and II were exposed to ethylene and trichloroethylene continuously for 98 days. The experiment included 12 groups of rats, 13 to 15 animals in every group. Animals of both series were exposed to identical concentrations (3 and 1 mg/cu m ethylene; 4, 1 and 0.5 mg/cu m trichloroethylene). Adult animals weighing 110-130 g were used in Series I and newborn rats were used in experimental series II. The initial physical development parameters of the newborn animals were practically the same. By the fifth day of exposure the weight increments in all the experimental groups (8.7-9.8 g) differed significantly from those in the controls (7.0-7.6 g). A statistically significant differences in weight persisted throughout the exposure in all the experimental groups, with the exception of animals exposed to trichloroethylene in a concentration of 0.5 mg/cu m. The experimental animal's physical development also lagged somewhat with respect to the appearance of the coat,

dentition, and the opening of eyes. From the age of six weeks, series II animals exhibited definite changes with respect to other indices also. Blood pressure measurements revealed hypotension in animals exposed to 1 and 4 mg/cu m trichloroethylene. The experimental animals also exhibited changes in subordinative chronaxy. Inversion of the chronaxial ratio between flexors and extensors was found in animals exposed to 3 mg/cu m ethylene and 4 and 1 mg/cu m trichloroethylene. A change in the cholinesterase activity of whole blood was found in animals exposed to 3 mg/cu m ethylene and 4 and 1 mg/cu m trichloroethylene during the last stages of the exposure period. All these indices returned to normal following a recovery period. Observations of physical development showed that the effect of poisonous substances on newborn rats became obvious in the earliest stages of exposure. The adult experimental animals did not differ from the controls with respect to weight even on exposure to relatively high concentrations.##

11489

Gol'dberg, M. S.

BIOLOGICAL EFFECTS OF ATMOSPHERIC POLLUTANTS AND HYGIENIC STANDARDS FOR ATMOSPHERIC POLLUTANTS OUTSIDE THE USSR.

((Problema biologicheskogo deistviya atmosfernykh zagryaznenii i ikh gigienicheskogo normirovaniya za rubezhom.)) Hyg. Sanit. (English translation of: Gigiena i Sanit.), 33(4-6):245-250, April-June 1968. ((13)) refs.

CFSTI: TT 68-50449/2

A brief discussion is presented of a few achievements in the biological effects of pollutants and standards in the U.S.A., Great Britain, and Germany. Studies being conducted on the effects on man of prolonged exposure to low concentrations of atmospheric pollutants are mentioned. Air pollution episodes in New York (1953) and London (1952) are briefly mentioned. Also discussed is the problem of the effect of the dispersity of dust particles containing 3.4 benzpyrene upon carcinogenic activity.##

11539

MacEwen, J. D. and R. P. Geckler

COMPARATIVE STUDIES OF 90-DAY CONTINUOUS EXPOSURE TO O<sub>3</sub>, NO<sub>2</sub> AND CCL<sub>4</sub> AT REDUCED AND AMBIENT PRESSURES. (FINAL REPORT.) Aerosjet-General Corp., Azusa, Calif., Contract AF 33(657)-11305, Proj. 6302, Task 630201, AMRL-TR-67-68, 67P., Feb. 1968. 25 refs.

CFSTI, DDC: AD 669079

Ninety-day continuous animal exposures to ozone, nitrogen dioxide and carbon tetrachloride at Threshold Limit Values were conducted under ambient pressure and 100% oxygen-reduced pressure (5 psia) conditions. Four species, dogs, monkeys, rats, and mice were exposed to each material. Guinea pigs were also used for ozone exposures due to their reported susceptibility to this pulmonary irritant. Minimal biologic responses were observed with exposure to each of the compounds tested and, consequently, lower tentative exposure limits are recommended for space cabin

environments. The recommended limits, based on the time period tested, are 1 ppm for nitrogen dioxide, 0.01 ppm for ozone, and 0.5 ppm for carbon tetrachloride. (Authors' abstract)##

11593

Thomas, A. A.

MAN'S TOLERANCE TO TRACE CONTAMINANTS. Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio, AMRL-TR-67-146, 38p., Jan. 1968. 9 refs.

CFSTI, DDC: AD 669356

Atmospheric contaminants in sealed cabins originate from a multitude of sources: off-gassing from cabin materials, production of contaminants by the life support system components, continuous exposure, a combination of physiological stress from problem increases with progressing mission duration and can become the limiting factor for man's tolerance to extended space flight. Several important aspects must be considered: truly uninterrupted, continuous exposure, a combination of physiological stress from the use of artificial atmospheres and the chemical stress imposed by the trace contaminants, and the great potential of synergistic toxic effect by various constituents of the highly complex mixture of many contaminants. Superimposed on these factors are the other aggravating characteristics of prolonged space flight: logistics problems of life support and psychological effects of isolation on performance. Clearly, these factors must be weighed singly and in combination to allow safe design of future manned systems. Validation of human tolerance to trace contaminants can be accomplished by prolonged animal exposures coupled with mathematical model verification. Tradeoffs in life support system design can extend tolerance to contaminants and long range logistic tradeoffs should be considered by utilizing extra-terrestrial resources for contaminant removal purposes. (Author's abstract)##

11632

Vaughan, Thomas R., Jr., Lesta F. Jennelle and Trent R. Lewis

EFFECTS OF CHRONIC EXPOSURE TO LOW LEVELS OF AIR POLLUTANTS ON PULMONARY FUNCTION IN THE BEAGLE. Preprint, Public Health Service, Cincinnati, Ohio National Air Pollution Control Administration, ((19))p., ((1968)). 29 refs.

One hundred and four beagles have been exposed for 18 months to natural and photochemically reacted auto exhaust, oxides of nitrogen and oxides of sulfur. No differences in single breath carbon monoxide diffusing capacity, dynamic pulmonary compliance or total expiratory pulmonary resistance were found between exposed and control animals. Removal of reactive gases in the upper airway was studied during brief exposures in an additional small group of animals. Under these conditions, 100% removal of O<sub>3</sub> and SO<sub>2</sub>, 90% removal of NO<sub>2</sub>, 73% removal of NO and no removal of CO or hydrocarbon were found. (Authors' abstract)##



11682

11682

Alvin Felmeister, Mohammad Amanat and Norman D. Weiner

INTERACTION OF PROTEIN AND LIPOPROTEIN MONOLAYERS WITH NITROGEN DIOXIDE-TRANS 2-BUTENE GASEOUS MIXTURES. Preprint, Columbia Univ., New York, Coll. of Pharmacy, ((8))p., ((1968)). 4 refs.

The interactions of pollutant atmospheres with oriented protein and lipoprotein films was studied. A gas train assembly, Teflon coated trough, and Wilhelmy plated method of surface pressure measurement was used. The films were then exposed to a standard atmosphere (i.e., air flowing at the rate of 300 ml/min) or to the following test atmospheres, all flowing at this same rate of 300 ml/min: (a) 0.33% nitrogen dioxide in air; (b) 0.08% trans 2-butene in air; and (c) 0.33% nitrogen dioxide and 0.08% trans 2-butene in air. Significant changes in the  $\pi$ -A curves for the pure protein films were observed in the presence of all atmospheres containing nitrogen dioxide, while the trans 2-butene did not interact with the film, nor did it appear to influence the nitrogen dioxide film interaction. However, whereas exposure of unsaturated phospholipid films to nitrogen dioxide containing atmospheres resulted in a large expansion of the film, exposure of bovine albumin film to these same test atmospheres resulted in a significant contraction of the film. The data obtained suggest that the effect of NO<sub>2</sub> on the lipoprotein films studied, appears to be a function only of the phospholipid component of the film. In general, membrane lipoproteins contain a large proportion of unsaturated phospholipids attached to structural and functional protein. In vivo interaction of the supporting phospholipid with nitrogen dioxide, or other reactive pollutants, could result in an expansion of the exposed cell membrane. This expansion would then lead to a change in the conformation of the attached protein. In the case of a functional protein, changes in conformation would be accompanied by changes in enzyme activity.##

12175

L. S. Jaffe

REVIEW ON CHEMICAL MUTAGENESIS. Preprint, Public Health Service, Washington, D. C., Div. of Air Pollution, ((10))p., Oct. 4, 1963. 19 refs.

Chemical mutagenesis is the process whereby the somatic cells of an organism are induced to produce a change (mutation) by chemical means or by exposure to chemical substances, wherein as a result of this exposure the cell themselves or the daughter cells, formed upon dividings, function less efficiently or differently from the parent cells. In chemical mutagenesis we are concerned with the influence of certain chemicals found in air pollution to form deleterious mutations in the somatic cells of the individual (or animal population) causing it to age more quickly; to change the appearance and nature of the cells anatomically or in function; or to act carcinogenetically and form cancers in the organism. The prime effects of chemical cancers mutagenesis are of three broad categories: (1) a change in the aging process induced by chemical means; (2) change in the nature and appearance of the cell and/or its function (metaplasia); (3) carcinogenesis.##

12272

Yuldashev, T.

TOXICITY OF ETHYLENE OXIDE IN LOW CONCENTRATIONS. In: The Biological Effects and Hygienic Importance of Atmospheric Pollutants, Book 10. Translated from Russian by B. S. Levine, U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 17, pp. 33-39, 1968.

CFSTI: PB 180522T

In exposure tests ethylene oxide (EO) as a poison affected all body organs and systems, principally the central nervous system. The EO odor perception threshold for most sensitive test persons was found to be 1.5 mg/cu m; threshold eye sensitivity to light 1.0 mg/cu m; and threshold of electrical cerebral activity 0.65 mg/cu m. It is recommended that 0.3 mg/cu m of EO adopted as the limit of its maximum concentration in atmospheric air. Chronic, 24-hr. exposure of white rats to the inhalation of air containing 0.3 mg/cu m of EO for 83 days produced changes, affected the animals' flexor-extensor chronaxy ratio and the chloride and residual nitrogen blood contents. It is suggested that the average daily maximal allowable EO concentration in atmospheric air be set at 0.03 mg/cu m. (Author's conclusion, modified)##

12276

Gusev, I. S.

COMPARATIVE TOXICITY STUDIES OF BENZENE, TOLUOL, AND XYLOL BY THE REFLEX ACTIVITY METHOD. In: The Biological Effects and Hygienic Importance of Atmospheric Pollutants, Book 10. Translated from Russian by B. S. Levine, U.S.S.R. Literature on Air Pollution Occupational Diseases, Vol. 17, pp. 60-67, 1968.

CFSTI: PB 180522T

The odor threshold and the effect on brain electropotentials of benzene, toluene, and zylene were determined. Experimental methods used are described. The author proposes the following conclusions: (1) Odor perception thresholds decreased with increase in the number of methyl groups in the benzene ring. Odor thresholds were: 2.8 mg/cu m benzene; 1.5 mg/cu m toluene; and 0.6 mg/cu m zylene. (2) Concentrations of odor perception thresholds used as indexes in evaluating effects on cerebral electrical activity decreased benzene, toluol, xylol in the following order: (3) Benzene and toluol enhanced the electrical potentials, while xylol had the opposite effect, causing a decrease in the electrical activity of the cerebral cortex. Return to normal electrical brain activity in toluol and xylol poisoning proceeded slowly. (4) 1.5 mg/cu m of benzene, 0.6 mg/cu m of toluol, and 0.2 mg/cu m of xylol are subthreshold concentrations as shown by results of electrical potential brain tests. These concentrations are recommended as maximal permissible single-exposure concentrations for atmospheric air. (Author's conclusion, modified)##

12284

Gusev, M. I. and A. A. Minayev

AN HYGIENIC STANDARDIZATION OF ALPHAMETHYLSTYRENE IN ATMOSPHERIC AIR. In: The Biological Effects and Hygienic Importance of Atmospheric Pollutants, Book 10. Translated from Russian by B. S. Levine, U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 17, pp. 139-145, 1968.

CFSTI: PB 180522T

The toxic effects of alphas-methylstyrene (AMS) were investigated, and the maximum average-daily allowable concentration of this vapor was determined in experiments using white rats. On the basis of the data obtained, it is concluded that: (1) Alphas-methylstyrene vapors in concentration of 5 mg/cu m and lower had no effect on the behavior, weight, and general blood picture (leucocyte, erythrocyte, hemoglobin count) of the test animals. (2) An AMS concentration of 5 mg/cu m depressed the central nervous system (increased reflex time), altered the bio-chemical reactions (reduced the content of nucleic acids in the blood and of coproporphyrin in the urine), and changed the luminescent properties of the leucocytes. Functional changes were confirmed by pathohistological changes in lungs, liver, heart, and kidneys. (3) In concentration 0.5 mg/cu m AMS altered mg/cu m had no effect. (4) The maximum average tolerance allowable concentration of AMS vapors in atmospheric air can be set at the level of its accepted single-exposure allowable concentration of 0.04 mg/cu m which is the inactive level in chronic inhalation exposure of the experimental animals.

12580

Holma, B.

THE INITIAL LUNG CLEARANCE OF DI-DISPERSE (2 MICRON AND 7 MICRON) POLYSTYRENE PARTICLES IN RABBITS. Arch. Environ. Health. 17(6):871-873, Dec. 1968. 3 Refs.

The difference in the simultaneous initial course of lung clearance of 2 micron and 7 micron monodisperse polystyrene particles has been studied in rabbits. This lung function was registered with a fixed detector system during the first two hours after the animals had been exposed to the test aerosol via a tracheal tube. The results point out the importance of frequent and early data of the lung retention of studied particles for the evaluation of the function of lung clearance. (Author's Abstract) ##

12955

Peters, John M., Jere Mead, and Willem F. Van Ganse

A SIMPLE FLOW-VOLUME DEVICE FOR MEASURING VENTILATORY FUNCTION IN THE FIELD. RESULTS ON WORKERS EXPOSED TO LOW LEVELS OF TOLUENE DIISOCYANATE. Am. Rev. Respirat. Diseases, 99(4):617-622, 1969. 10 refs.

A new, simple, portable device for measuring the maximum expiratory flow-volume (MEFV) curve was discussed. The ventilatory capacity of 35 workers exposed to toluene diisocyanate was assessed with this device. Measurements were made on Monday morning and afternoon, and on Tuesday morning. The results showed a significant qualitative and quantitative depression of the MEFV curve during the working day which did not return to baseline levels on Tuesday morning. This device is well suited for survey work in the field and is particularly useful when serial measurements of the same individual are made. {Author summary modified}

12969

Golubev, A. A.

EFFECT OF CERTAIN INDUSTRIAL IRRITANTS ON CHANGE OF PUPIL DIAMETER IN THE RABBIT. (Ob izmenenii diametra zrachka krolika pod vliyaniem nekotorykh promyshlennykh yadov razdrazhayushchego deystviya). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 4:58-59, 1969.

The effects on pupil size in the rabbit were determined over a 30-min period for the following industrial irritants (molar threshold concentration given in parentheses): ethanol (2), dioxane (2), methylethylketone (1/4), epichlorohydrin (1/4), acetic anhydride (1/8), crotonaldehyde (1/16), ethylene glycol (1), and xylene (1/132). Indications by the method described correlate well with the usual means of determining irritative effects (dioxane is an exception for which this method indicates a higher irritative effect). It is noted that this method is effective at concentrations which cause no visible changes in either the conjunctiva or cornea of the rabbit.

13657

Filov, V. A.

KINETIC MODEL OF THE ACCUMULATION OF GASEOUS SUBSTANCES IN THE ORGANISM DURING PERIODIC INHALATION. (O kineticheskoy modeli nakopleniya v organizme gazoobraznykh veshestv pri ikh periodicheskom vdykhanii). Text in Russian. Doklady Akad. Nauk SSSR, 184(6):1458-1460, 1969. 9 refs.

A mathematical model was constructed to determine the concentration of an inhaled gas in tissues of an individual exposed to the gas during his working days. An equation was developed which defined the concentration in tissues at the nth working day in terms of the concentration of the substance in the inhaled air, the time of exposure, the days of exposure, and constants related to the distribution of a particular gas between tissue and air. When the equation was tested against chloroform and ethyl alcohol, for which most of the constants were known, the result corresponded with experimental data. The equation was also successful in predicting tissue concentration of benzene and carbon disulfide in the fatty tissue of rabbits exposed for various periods to these gases.

Feldstein, M.

TOXICITY AND ANALYSIS OF AIR POLLUTANTS. J. Forensic Sci., 14(3):337-351, July 1969. 44 refs.

The emission of solids, liquids, and gases from industrial operations, power and heat generation using fossil fuels, combustion of organic waste materials, and auto exhaust constitute the major sources of air pollution. Carbon monoxide, as a community air pollutant, is emitted to the atmosphere from most combustion operations where incomplete combustion of organic matter occurs. Exposures to 30 ppm for four to six hours may result in blood carboxyhemoglobin concentrations as high as 8% of the total pigment. Nitrogen dioxide is the primary reactant in photochemical smog, and is found to cause acute pulmonary edema. Physiological response to low concentrations of both SO<sub>2</sub> and SO<sub>3</sub> is similar and involves bronchial constriction. The response with SO<sub>3</sub> is 4 to 20 times greater in experimental animals than with SO<sub>2</sub> on an equal concentration basis. It is now believed that there is no tolerable dose of a carcinogen. Skin tumors were produced in animals by as little as 0.4 micrograms of benzpyrene. Part of the reason for increased lung cancer is ascribed to carcinogens present in air pollution. Several other pollutants and the various ways of analyzing pollutants are also discussed.

13886

Epstein, Samuel S. and H. Shafner

CHEMICAL MUTAGENS IN THE HUMAN ENVIRONMENT. Nature, 219(5152): 385-387, July 27, 1968. 13 refs.

Preliminary data are presented on the feasibility of mutagenicity testing in mice based on screening a wide variety of environmental pollutants. In the dominant lethal test, treated males were mated with groups of females. The females were subsequently dissected at mid-term of pregnancy to evaluate the incidence of dominant lethal mutations. Such effects conveniently reflect mutagenic activity and represent fetuses killed in utero by mutations directly induced in male germ cells. The possibility of systemic drug effects in females was thus excluded. Test materials were freshly prepared and injected intraperitoneally. A mutagenic index (M.I.), reflecting the incidence of dominant lethal mutations in an experimental group of animals, was calculated. The index does not reflect anti-fertility effects or the distribution of deciduomata in affected animals. It was found that organic extracts of atmospheric particulate pollutants displayed control M.I. levels. The dominant lethal test described appeared to be a practical screening procedure, especially because 80% of gene mutations in man are attributable to dominant autosomal traits. Modification of the test procedures to evaluate the role of chronic low-level exposure to environmental mutagens, either singly or in combination, is in progress.

Lindberg, Walter

AIR POLLUTION IN NORWAY. III. CORRELATIONS BETWEEN AIR POLLUTANT CONCENTRATIONS AND DEATH RATES IN OSLO. (Den alminnelige luftforurensning i Norge. III. Korrelasjoner mellom luftforurensninger og dødelighet i Oslo.) Translated from Norwegian. Oslo Univ. (Norway), p. 78-102, 1968. 92 refs.

Extensive data are presented to show the correlation of air pollution in Oslo, Denmark and death rates. The data include causes of death, types of pollutants, SO<sub>2</sub> concentration, and meteorological factors. The results indicate a casual connection between mortality and air pollution. More investigations are recommended.

13960

Deynega, V. G.

THE SIGNIFICANCE OF THE ADRENALS IN THE EFFECT OF METHANE-OXYGEN HYPOXIC GAS MIXTURES. (O znachenii nadpochechnikov pri vozdeystvii metano-kislorodnoy gipoksicheskoy gazovoy smesi). Text in Russian. Gigiena Truda i Prof. Zabollevaniya, 13(3): 57, 1969.

Groups of white rats were exposed to a hypoxic mixture of gas with a composition approximating that of firedamp after various preliminary treatments. The gas mixture consisted of 87% methane, 4% ethane, trace amounts of propane, butane, nitrogen, krypton, and 6% oxygen. The control group was untreated; the second group consisted of 10 rats which were adrenalectomized; the third group consisted of 9 rats which were laparotomized with the adrenals left intact; the fourth group consisted of 9 rats which received 30 mg/kg hydrocortisone 20 min before being exposed to the firedamp gas; and the fifth group consisted of 11 rats which received 40 units/kg of ACTH 20 min prior to exposure. Behavior of the animals, frequency of respiration, oxygen consumption, and survival time were monitored in all groups. After a few minutes, the animals developed increased motor activity, respiration increased in frequency, and there were other signs of irritability. After 1-2 hrs, the animals were sedated, respiration was still rapid, and death resulted in about 4 hrs. Survival time was half as long in the adrenalectomized rats as in the controls and oxygen consumption was increased. There was a slight increase in resistance to the hypoxic gas in laparotomized animals. Survival time in animals given hydrocortisone was significantly higher--429 plus or minus 27 min versus 237 plus or minus 16 min in the controls. ACTH had no effect on survival.

14119

Heuss, Jon M. and William A. Glasson

HYDROCARBON REACTIVITY AND EYE IRRITATION. Environ. Sci. Technol., 2(12):1109-1116, Dec. 1968. 21 refs.

Twenty-five hydrocarbons and nitric oxide were irradiated in a smog chamber. Eye irritation and various chemical reaction rates and product yields were used to measure hydrocarbon reactivity. Although the chemical measurements of reactivity correlated with one another to a fair degree, there was no correlation between any of the chemical measurements and eye irritation. A correlation was found between hydrocarbon structure and eye irritation; a hydrocarbon reactivity scale based on eye irritation is presented. The most potent precursors of eye irritation were benzylic hydrocarbons and aromatic olefins. A new and extremely potent eye irritant, peroxybenzoyl nitrate, a lachrymator 200 times as potent as formaldehyde, was identified as a product from the irradiation of benzylic hydrocarbons and aromatic olefins. (Author abstract modified)

14422

Shabad, L. M.

BLASTOGENIC SUBSTANCES IN THE HUMAN ENVIRONMENT AND SOME MECHANISMS GOVERNING ORIGINATION OF CANCER. (O blastogenykh veshchestvakh v okruzhayushchey cheloveka srede i nekotorykh mekhanizмах vozniknoveniya raka). Text in Russian. Vestn. Akad. Med. Nauk SSSR, 24(6):3-13, 1968. 17 refs.

During a study of atmospheric pollution by carcinogenic hydrocarbons, aircraft engines were discovered as a source of contamination. Both carbon black and exhaust gases contained considerable amounts of benzopyrene (BP). The amounts of this substance detected in the ground of airfields decreased with distance away from the runways and landing strips. A study of soil contamination with BP showed it was capable of passing into plants and was liable to destruction by soil bacteria. Weeds and silt found downstream in a river flowing near a big city contained more BP than the upstream portion. Experiments showed it was possible to remove BP from the water. Certain medicinal preparations may be a source of carcinogenic hazards to man. The mechanism of action in carcinogenic substances is in its deposition in the tissues. Tests with transplacental blastogenesis demonstrated that embryonic tissues display a high sensitivity to various carcinogenic substances and are apt to stimulate the growth of embryonic tissue organ cultures and produce tumors in them. (Author summary modified)

14494

Imamura, S., K. Nomiyama, and H. Matsui

PUBLIC NUISANCE DUE TO ORGANIC SOLVENTS AND PROPANE GAS (LPG). (Yuki yo zai oyobi ekika gas ni yoru kogai no ichi rei). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):89, April 1969.

Because of complaints about offensive odors emanating from a factory producing propane gas and organic solvents on days when wind direction was southeasterly, simultaneous investigations were undertaken to measure mercaptan, butyl acetate, and toluene levels inside and outside the factory and the effect of these

compounds on factory workers and residents of the area. The surveys were carried out on a day when the prevailing wind was southeasterly. Workers and residents were examined for subjective and clinical symptoms, the latter including liver swelling, pharyngeal inflammation, inflammation of the eye and conjunctiva, and the urobilinogen, albumin, sugar, and hippuric acid content of the urine. In the factory, methyl mercaptan levels did not exceed 0.2 ppm and butyl acetate 20 ppm. Outside the factory, toluene did not exceed 0.1 ppm, methyl mercaptan 0.2 ppm, and butyl acetate 5 ppm. At an exit of an organic solvent washer, 100 ppm toluene was found but was attributed to a defect in the washer's design. Comparison of the subjective and clinical symptoms with those of a control group suggests that the rate of positive urobilinogen and abnormal discharge of hippuric acid in urine of people living near the factory is higher. Residents living within 30 m downwind of the factory exhibited an abnormally high discharge of hippuric acid. Workers also showed higher rates of positive urobilinogen and an abnormal discharge of hippuric acid.

14596

Arkhipova, O. G.

MECHANISM OF ACTION OF THE NEW ANTICKNOCK COMPOUND MANGANESE CYCLOPENTADIENYLTRICARBONYL ON THE ORGANISM. English translation of: Gigiena Truda i Prof. Zabolevaniya (Moscow), No. 4:T51-T54, 1963. 5 refs.

It has been suggested that manganese cyclopentadienyltricarbonyl (MCT) be used as an antiknock compound in internal combustion engines to replace tetraethyl lead. Investigations which give a general description of the changes that occur in the organs and systems of organisms following the administration of MCT are reported. The compound was administered by inhalation to rabbits and white rats. Results showed that the MCT is a toxic substance of polytropic action; MCT vapor disturbs the function of the nervous system and kidneys, and reduces the osmotic resistance of the erythrocytes. It affects the normal source of the oxidation process and the processes of oxidative phosphorylation. Oxygen inhalation has favorable effect in acute MCT intoxication.

14711

Dontenwill, W., H. Elmenhorst, G. Reckzeh, H. P. Harke, and L. Stadler

STUDIES ON THE REMOVAL AND CATABOLISM OF CANCEROGENIC HYDROCARBONS IN THE RESPIRATORY TRACT OF GOLDEN HAMSTERS EXPOSED TO SMOKE. (Experimentelle Untersuchungen ueber die Beeinflussung von Abbau und Abtransport cancerogener Kohlenwasserstoffe im Bereich des Respirationstraktes durch passive Berauchung von Goldhamstern). Text in German. Z. Krebsforsch., 72(1):63-64, 1969. 2 refs.

Three groups of male golden Syrian hamsters were studied: (1) hamsters not exposed to smoke which received a single intratracheal injection of 500 micrograms of 3,4-benzopyrene in carboxymethylcellulose; (2) hamsters exposed three times



a day, 5 days a week, for 10 min to cigarette smoke (equivalent to 30 cigarettes each time), and receiving an intratracheal injection of benzopyrene after four weeks of exposure; and (3) hamsters exposed for four weeks to cigarette smoke prior to and following administration of benzopyrene until killed. The times from administration of benzopyrene to killing of the animals were 3 min, 4 hrs, and 7, 4, 8, and 12 to 20 days. The results show that there is no clear difference in the removal from the lungs and catabolism of 3,4-benzopyrene in smoke-exposed and non-exposed animals.

14724

Dontenwill, W., H. Elmenhorst, G. Rechzeh, H. P. Harke, and L. Stadler

EXPERIMENTAL INVESTIGATIONS ABOUT THE INTAKE, TRANSPORT, AND METABOLISM OF CANCEROGENIC HYDROCARBONS IN THE RESPIRATORY TRACT. (Experimentelle Untersuchungen ueber Aufnahme, Abtransport und Abbau cancerogener Kohlenwasserstoffe im Bereich des Respirationstraktes). Text in German. Verhandl. Deut. Ges. Pathol. (Stuttgart), vol. 52:401-408, April 1968. 3 refs.

While the various methods of subcutaneous and cutaneous testing of carcinogens are standardized, the intravenous methods are not. Therefore, studies were conducted to standardize the experimental techniques and to gain information on the relationship of dose and effect, absorption and metabolism of various carcinogens in the lung. Benzopyrene (BP) and soot were administered to hamsters as suspensions (150 mg DMBA + 150 mg Fe<sub>2</sub>O<sub>3</sub> + 10 ml NaCl solution; 150 mg BP + 150 mg Fe<sub>2</sub>O<sub>3</sub> + 10 ml NaCl solution; and 1% BP + 1% carboxymethylcellulose (CMC) + 98% NaCl solution) and solutions (BP and DMBA in polyethylene oxide and BP in sesame oil). The Saffiotti method was used. Column chromatography and fluorimetry were used for determination of the carcinogenic substances in the organs and the blood. The effects of the carcinogens on the lung depended to a large extent on the type of solution and residence time. Dissolved carcinogens remained in the lungs just for a short time so that the carcinogenic effect was diminished. Suspended carcinogens were slowly dissolved in the lung and very slowly absorbed. Thus, their long residence time enhances the carcinogenic effect. Only the benzopyrene-CMC suspension was reproducible; the hematite-benzopyrene suspension fluctuated widely so that only about 50% of the theoretical amount reached the lung.

15345

Hayata, Yoshihiro, Kenkichioho, and Yuji Saito

AIR POLLUTION AND LUNG CANCER. (Taiki osen to haigan). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(9):9-15, Sept. 1969. 16 refs.

The relationship of lung cancer to cigarette smoking was investigated among workers in an industrial city with special emphasis on the types of cancer peculiar to some occupations. Among the total number of subjects with lung cancer (4648), 88.3% of the males and 21.1% of the females were cigarette smokers. The relationship of cancer types to smoking habits was the following: 25.4% of the non-smokers, 44.2% of the light smokers, and 47.8% of the heavy smokers had squamous carcinoma; 49.8% of the non-smokers, 32.2% of the light smokers, and 25.6% of the heavy smokers had adenocarcinoma; and 24.8% of the non-smokers, 23.6% of the light smokers, and 26.6% of the heavy smokers had amorphous-type carcinoma. Squamous carcinoma originates in the basal cells of the bronchial mucosa due to specific irritations. A cigarette smoker's bronchial mucosa, when cancerous, typically contains a mixture of partly metasticizing, partly destroyed and desquamating cells, and amorphous cells, and presents a means of identifying cancer due to smoking. The highest death rates from cancer were found in the most industrialized cities, such as Tokyo, Fukuoka, and Yokohama. 3,4-Benzopyrene is considered a carcinogen; in Okunoshima, where mustard gas has been produced for 19 years, a tremendous number of bronchial cancer cases was found. Another study of the mining industry showed a relationship between organic dusts and pneumonia and lung cancer.

15490

Holland, George J., David Benson, Albert Bush, George Q. Rich, and Robert P. Holland

AIR POLLUTION SIMULATION AND HUMAN PERFORMANCE. Am. J. Public Health, 58(9):1684-1691, Sept. 1968. 35 refs.

The effect of short-term exposure to moderate levels of photochemical air pollutant constituencies on the efficiency of various types of human motor performance was determined. Reaction time, vital capacity, and submaximum work performance on the bicycle ergometer were measured in 14 college student volunteer subjects. The subjects were randomly assigned to one of two groups according to the Latin square method of experimental design. They served alternately on two occasions as either control subjects in a normal atmospheric environment or as experimental subjects in an air pollution environment. In order to simulate the conditions of the Los Angeles Basin, a test facility was designed. Irradiated exhaust gases from an automobile were pumped into an exercise booth near the reaction tunnel. A ventilation system was used to replace the exhaust gases with filtered atmospheric air during the control experiments. Air samples were analyzed for carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, oxidants, hydrocarbons, aldehydes, and formaldehyde. It did not appear from the study that the performance of fine neuromuscular tasks such as reaction time or cardiorespiratory work efficiency were significantly altered by short-term exposure to moderate levels of air pollution. More study is required to elucidate the effects of air contaminants on other types of human psychomotor performance, especially maximum work capacity. Many atmospheric pollutants may have an insidious qualitative biochemical effect on human physiological processes which can only be identified through careful longitudinal study. Future studies involving higher levels of contamination with more precise measures of airway resistance are recommended.

Schlipkoeter, H. W.

DANGERS OF THE METROPOLITAN CITY AIR. (Gefahren der Grossstadtluft). Text in German. Oeffentl. Gesundheitswesen (Stuttgart), 29(3):117-126, March 1967. 37 refs.

Differentiation between the amount of fine dust and coarse dust makes it feasible to obtain information on possible health perils, since it is known that primarily the fine dust penetrates into the human body, while the coarse dust deposits on buildings and objects. The dust concentration fluctuates with the wind conditions; it varies with the seasons and over the course of a week. The fine dust shows a maximum at the beginning of the week; the coarse dust, in the middle of the week. It is much more difficult to assess objectively the harms of odors. Test persons have to render their subjective opinion on the intensity of odors. In order to determine the effect of gases, dusts, and liquid aerosols on humans, the physical disposition and age must be taken into consideration. Several tests were conducted to get an estimate of the amount of benzopyrene retained by a human during his lifetime. It was found that only a maximum of 0.06 microgram of benzo(3-4)pyrene (BP) was retained by the lungs. To test how fast the benzopyrene content is dissolved, white rats received 20 mg of soot containing 12 microgram BP/g dust. In the first three days, 80% of the BP content separated from the soot while 20% remained adsorbed on the soot for more than 20 days. Tests also showed that sudden high air pollution concentrations (at temperature inversions) speeded the death of humans. The increase of the mortality rate of such conditions but no higher mortality over a longer period of time (e.g., 2 years) leads to this assumption.

16252

Munson, Edwin S., W. Reynolds Maier, and Donald Caton

EFFECTS OF HALOTHANE, CYCLOPROPANE AND NITROUS OXIDE ON ISOLATED HUMAN UTERINE MUSCLE. J. Obstet. Gynaecol. Brit. Commonwealth, 76(1):27-33, Jan. 1969. 14 refs.

The spontaneous contractility of isolated human non-gravid uterine muscle strips was studied during exposure to various concentrations of halothane, cyclopropane, and nitrous oxide. Mean contractility values for 10 per cent cyclopropane and 50 per cent nitrous oxide were not significantly different from control values. Halothane in 0.37 per cent concentration produced a significant reduction in contractility. Further reduction in contractility was proportional to the halothane concentration. It is predicted that inhibition of contractility would occur at a halothane concentration (partial pressure) of 1.2 per cent. At an equivalent anaesthetic concentration of cyclopropane (15 per cent) contractility was 57 per cent of the control value. The results showed no significant reduction in the resting tension of non-gravid muscle strips during exposure to halothane in concentrations capable of affecting marked reductions in contractility. It was concluded that at equivalent anaesthetic concentrations, halothane is a more potent depressant of non-

gravid uterine muscle than nitrous oxide or cyclopropane. Of the agents studied, cyclopropane was the least depressant. (Author summary modified)

16345

Biersteker, K.

POLLUTED AIR. ORIGIN, MEDICAL SIGNIFICANCE AND COMBATING OF POLLUTED OUTSIDE AIR. (Verontreinigde Lucht. Ontstaan, medische betekenis en bestrijding van verontreinigde buitenlucht). Assen, Van Gorcum, 1966, 214p., 339 refs. Translated from Dutch. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 275p., July 29, 1969.

Factors affecting emissions are considered, together with trends in emissions in the Netherlands and Rotterdam. The qualitative and quantitative significance of air pollutants as potential disease agents in Rotterdam is evaluated. The maximum sulfur dioxide concentration so far recorded in Rotterdam is 1600 micron cu m; the maximum smoke concentration, 500 micron/cu m. No epidemiological significance is attributed to measured concentrations of fluorides, nitrogen dioxide, carbon monoxide, or lead. Concern is shown for the role of benzpyrene and other carcinogens in the etiology of lung cancer. Distinctions are made between acute, sub-acute, and chronic air pollution. During acute air pollution, SO<sub>2</sub> and smoke concentrations in Rotterdam show five-fold increases. Sub-acute pollution occurs when wind speeds drop below 2 m/sec. Chronic air pollution is present on all other days, especially in winter. Though the effects of pollution can also be categorized as chronic, acute, and sub-acute, the level of air pollution is still too weak to cause illness. Methodologies employed in determining the relationship between air pollution and human mortality and morbidity are reviewed, and hypotheses developed to describe the effects of pollution on illness and death in Rotterdam. Refinements in analytical methods are urged so that the factors influencing increased chronic non-specific lung disease mortality and lung cancer mortality can be identified. It is also suggested that emission standards be supplemented by regulations making it possible to restrict emissions when meteorological data and monitoring station readings point to certain dangers.

16356

Lichtenstein, E. P., K. R. Schulz, T. W. Fuhremann, and T. T. Liang

BIOLOGICAL INTERACTION BETWEEN PLASTICIZERS AND INSECTIDICES. J. Econ. Entomol., 62(4):761-765, Aug. 1969. 10 refs.

The toxicity of polychlorinated bi- or triphenyl plasticizers, both singly and in combination with dieldrin or DDT, was investigated in tests on *Drosophila melanogaster* Meigen and house flies. Many of the more volatile plasticizers were toxic to both test insects, but to a lesser extent than dieldrin or DDT. As measured by the percent mortality of the insects over a 24- or 48-hr exposure period, dieldrin was the most toxic compound. Approximately 25 and 30 times more DDT and 8000 and 1000 times more plasticizers were required to obtain mortalities

comparable to those achieved with dieldrin. The toxicity of the plasticizers increased with a decrease in their chlorine content. The more highly chlorinated and less volatile plasticizers were nontoxic, even when used at dosages of 2000 micrograms with *D. melanogaster* and 20 micrograms/ house fly. Though no appreciable insect mortalities were observed with plasticizers alone, they significantly increased to toxic effects of both dieldrin and DDT. While no conclusions can be drawn concerning the combined effects of plasticizers and insecticides in tissues of higher animals, the potential hazards of plasticizers, especially in combination with other synthetic chemicals, should not be disregarded.

16542

Saruta, Namio, Noburu Ishinishi, Yasushi Kodama, and Eizaburo Kunitake

EFFECTS OF GASEOUS POLLUTANTS ON HUMAN HEALTH. (Yugai gasu ni yoru taiki osen no jintai ni oyobosu eikyo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(7):445-450, Aug. 15, 1966. 12 refs.

In London, the average daily death rate has increased 1.3- to 2.6-fold on days of dense smogs. For instance, the death rate during the smog episode of 1952 was 2.6 times higher than average. About 6000 persons, mostly over 40, who had chronic respiratory difficulties were affected by the smog. The symptoms they exhibited were severe cough, throat pain, labored respiration, harsh voice, fever, headache, and vomiting. The death rate due to air pollution in London or other northern European countries is of particular interest because heavy smoggy days are frequently characterized by the absence of wind. This has not been the case in Japan. A comparative medical survey of industrial and rural areas showed a higher incidence of respiratory organ disease and lung cancer than in industrial areas. Though suggesting that lung cancer has a close relationship with air pollution, the finding should be reconfirmed in connection with cigarette smoking, since 3,4-benzpyrene, supposedly responsible for causing lung cancer, is contained in both smoke dust and cigarette smoke.

## G. EFFECTS – PLANTS AND LIVESTOCK

00009

O. C. Taylor

"OXIDANT" AIR POLLUTANTS AS PHYTOTOXICANTS. California Univ., Riverside, Air Pollution Research Center. (Paper 64-91). 1964. 13 pp.

This report attempts to outline some of the advances made in the identification and study of oxidizing toxicants other than ozone in the "smog" complex and to indicate some of the avenues of research that are prerequisites to the establishment of effective control measures. Assuming that the total elimination from the atmosphere of oxidant-forming pollutants is not economically feasible, it is essential that investigations be continued to determine acceptable levels of the pollutants, to find resistant plant materials and to search for chemical additives that might offer protection to the vegetation.##

00184

H. E. Heggstad, F. R. Burleson, J. T. Middleton, and E. F. Darley

Six tobacco varieties representing a range in susceptibility to naturally occurring ozone fleck in field plots at Beltsville, Maryland, were: (1) fumigated with ozone, (2) fumigated with ozonated hexene-1, and (3) exposed to ambient air at Riverside, California. Prior to fumigation, all plants were grown in a greenhouse with carbon-filtered air. Injury caused by ozone to tobacco in fumigation studies could not be distinguished from naturally occurring fleck in fields at Beltsville. The susceptibility of the six varieties to ozone fleck was very similar at Riverside and Beltsville. When fumigated with ozonated hexene-1, however, the injury occurred only on lower leaf surfaces and the reactions of varieties were very different. Some injury to the lower leaf surface of young leaves, perhaps caused by peroxyacetyl nitrate (PAN) was noted when plants were exposed to unfiltered ambient air in a Riverside greenhouse. No injury occurred to any of the varieties of *N. tabacum* grown in the greenhouse with carbon-filtered air. The sequence of damage by ozone and ozonated hexene-1 was from oldest to youngest leaves. Ozone caused more damage to leaves at the bottom of the plant, whereas ozonated hexene-1 injury was more severe about mid-plant. Although ozone injury occurred on tobacco exposed to ambient air at Riverside and Beltsville, some differences in leaf damage and plant sensitivity at these two widely separated geographic locations are discussed. (Author)##

00229

J.T. Middleton A.J. Haagen-Smit

THE OCCURRENCE, DISTRIBUTION, AND SIGNIFICANCE OF  
PHOTOCHEMICAL AIR POLLUTION IN THE UNITED STATES, CANADA, AND  
MEXICO. J. Air Pollution Control Assoc., 11(3):129-134,  
Mar. 1961. (Presented at the 53rd Annual Meeting, Air  
Pollution Control Association, Cincinnati, Ohio, May 22-26,  
1960.)

The cracking of rubber, production of elevated oxidant and the  
occurrence of both ozone and oxidant plant damage are shown to be  
manifestations of photochemical air pollution. Geographic areas  
considered are Los Angeles, San Francisco, Washington, D.C.;  
urban and non-urban areas.##

00235

F.W. Oliver

ON THE EFFECTS OF URBAN FOG UPON CULTIVATED PLANTS. J. Roy.  
Hort. Soc. 16, 1-59, 1893. (The Second Report presented to  
the Scientific Committee of the Royal Horticultural Society,  
Feb. 14, 1893.)

Author discusses the effect of foreign material emissions  
associated with fog as they might cause damage to plants. The  
categories covered by author are: Remedial Measures to be  
Taken; Behavior of Different Classes of Plants (i.e. ferns,  
Monocotyledons, Dicotyledons); Effect of Reduced Illumination;  
Changes which the Chlorophyll Undergoes in Leaves Injured by  
Fog; Behavior of Flowers toward Fog and Certain of Its  
Ingredients; Action of Pyridine and of Allied Bodies; and  
Action of Pyridine and of Allied Bodies; and Action of Acid  
and Other Vapors.##

00316

A. R. Gregory

EFFECTS OF AIR POLLUTION ON EDIBLE CROPS. North Carolina  
Univ., Chapel Hill, Dept. of Environmental Sciences and  
Engineering. May 1964. pp. 21-3.

The effects of air pollution on edible crops should be  
differentiated at the onset from the effects of air pollution  
on vegetation in general. For example, sulfur dioxide  
has a very pronounced effect on pine needles, but pine needles  
are a minor food source. It has been variously estimated  
by different authorities that the annual loss of vegetable  
produce amounts to 40 to 60 million dollars. Although this  
over-kill type of damage is very real to the vegetable producer  
and is of great economic interest, it is of less concern

to those in public health. Their concern is with the damage that alters the contents of crops but does not alter the appearance sufficiently to prohibit their sale. This results in threats to public health through the insidious route of the gastro-intestinal tract. The alterations in edible crops that are usually not apparent to the consumer fall into two categories: (1) loss of nutrients such as vitamins, proteins, essential fatty acids, etc. and (2) the addition of some substance to the food which is toxic when absorbed from the gastro-intestinal tract. The loss of nutrients has been established in many cases. Some of the substances which have been shown to produce nutrient damage to produce are: ozone, nitroolefins, peroxyacyl nitrates, nitrogen oxides, and ethylene. Of probably greater importance to health now and assuredly in the future is the addition of some toxic substance to the produce. With the advent of possible atomic power plants, Be was studied for toxicity and found to be extremely toxic. It was found that Be taken up into bush beans was not only toxic itself, but decreased the Cu content. In this way it fell into the category of primary toxicant and also into the category of nutrient depletor. Many other compounds also fall into both categories. With the many new insecticides, herbicides and larvicides being manufactured, it has become imperative to be aware of the problem of both the effect on edibles of a toxicant and also its effect on the plant, that is, loss of minerals, vitamins, etc.##

00601

S. Kotaka, A.P. Krueger P.C. Andriese

EFFECT OF AIR IONS ON IAA CONTENT OF BARLEY SEEDLINGS.  
Plant Cell Physiol. (Tokyo) Vol. 6:711-9, 1965.

Exposure of barley seedlings (*Hordeum vulgare*) growing in sand and liquid cultures to either negatively- or positively-ionized air results in increased growth in terms of integral elongation, and fresh and dry weight increase. Using large quantities of tissue and a modified method it was found that free and bound IAA contents were not significantly modified by exposure of seedlings to ionized air. It might be supposed that an equilibrium between free and bound IAA was not modified by exposure to air ions. (Author abstract)##

00696

A. F. W. Cole and M. Katz

SUMMER OZONE CONCENTRATIONS IN SOUTHERN ONTARIO IN RELATION TO PHOTOCHEMICAL ASPECTS AND VEGETATION DAMAGE. J. Air Pollution Control Assoc. Vol. 16(4):201-206, Apr. 1966. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965, Paper No. 65-113.)



This paper describes an air pollution investigation at Port Burwell, Ontario to determine the pollutant responsible for fleck damage. The study was part of a cooperative project with groups representing the Canada Department of Agriculture, the Meteorological Branch of the Canada Department of Transport, the Air Pollution Control Branch of the Ontario Department of Health, and Imperial Tobacco Co. of Canada Ltd. In 1960 and 1961 the air pollution phase of the project was undertaken by the Occupational Health Division of the Department of National Health and Welfare.##

00737

J.T. Middleton, L.O. Emik, O.C. Taylor

AIR QUALITY CRITERIA AND STANDARDS FOR AGRICULTURE.  
J. Air Pollution Control Assoc., 18(10):476-480, Oct. 1965.  
(Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 19659)

Air pollution damage to crops is not only important for the damage it causes agriculture but because vegetation damage is a harbinger of air pollution problems affecting man and his well-being. Some of the effects of varying dosages of ethylene, fluoride, ozone, PAN, and sulfur oxides on plants and animals are given. Knowledge of the response of certain plants and animals to specific air pollutants permits the establishment of air quality standards for certain of these pollutants. The importance of environmental conditions on host responses to these several toxicants is also presented to illustrate the need of stipulating environmental conditions as well as toxicant dosages when establishing air quality criteria and standards for the protection of the agricultural resource.##

00950

W. M. Dugger, Jr., J. Koukol, and R. L. Palmer

PHYSIOLOGICAL AND BIOCHEMICAL EFFECTS OF ATMOSPHERIC OXIDANTS ON PLANTS. J. Air Pollution Control Assoc., 16(9):467-471, Sept. 1966. (Presented at the 59th Annual Meeting, Air Pollution Control Association, San Francisco, Calif., June 20-25, 1966, Paper No. 66-47.)

Photochemically produced oxidants in the atmosphere cause injury to plants primarily through inhibition of basic metabolic processes. Plants vary in their response to the oxidants and this variation must be dependent in part on the variation in metabolic activity with age or environmental conditions for growth, to a large degree not understood. Data are presented in this paper to show: (1) The changes in permeability of leaf tissue to exogenous substrate and in catabolic utilization of this substrate after exposure of plants to ozone but before visible symptoms appear; (2) The change in leaf carbohydrates as a result of exposure to ozone; (3) The protective effect of red light (700 millimicrons) during exposure of bean plants to peroxyacetyl

nitrate (PAN); (4) The correlation of sulfhydryl (SH) content in bean leaf tissue with age of plants and light regime; and (5) Effect of light regime and age of plants on incorporation of C14 from C14-Pan by bean leaf tissue. (Author abstract)##

00961

I. J. Hindawi and A. P. Altshuller

PLANT DAMAGE CAUSED BY IRRADIATION OF ALDEHYDES. Science 146(3643):540-542, Oct. 23, 1964.

The report that damage to petunia has been correlated with the presence of aldehydes in the atmosphere is discussed in relation to recent laboratory findings. Laboratory investigations have shown that irradiation of formaldehyde in air will not cause plant damage to the varieties of petunia, pinto bean, and tobacco wrapper used, even when nitrogen oxide is added to the system. Irradiation of propionaldehyde in air does cause damage to these plants. Addition of nitrogen oxide to the irradiated propionaldehyde-in-air system does not markedly increase damage. (Author abstract)##

01179

F. B. Abeles

THE EFFECT OF ETHYLENE ON AUXIN TRANSPORT (TECHNICAL MANUSCRIPT 279). Army Biological Labs., Frederick, Md., Directorate of Biological Research. Jan. 1966. 12 pp.  
DDC: AD 476769

Ethylene was found to have no effect on auxin transport in hypocotyls, coleptiles, or leaf petioles. (Author abstract)##

01809

J.T. Middleton

TRENDS IN AIR POLLUTION DAMAGE. Arch. Environ. Health 8, 19-23, Jan. 1964. (Presented at the Sixth Annual Air Pollution Medical Research Conference, San Francisco, Calif., Jan. 28-29, 1963.)

Plant damage from particulates, oxidants, ozone, ethylene, fluoride and sulfur dioxide are discussed. The trends in California are emphasized. The relevant literature is reviewed.##

J.T. Middleton

PLANT DAMAGE: AN INDICATOR OF THE PRESENCE AND DISTRIBUTION OF AIR POLLUTION. Bull. World Health Organ. (Geneva) 34, (3) 477-80, 1966.

Air pollutants may damage plants and cause death or destruction of tissue with visible pathological symptoms, reduce growth, productivity, and commodity quality, and interfere with biological processes without causing visible injury symptoms. The contaminants responsible for damage may be either particulate or gaseous in nature. The solid particles released into the atmosphere are sometimes the cause of soiling of fruits and vegetables, tissue damage to exposed leaves and fruits, growth reduction; in addition, they add a toxic burden to forage crops used as feedstuffs for livestock. Liquid particles, such as acid aerosols and toxic mists, are sometimes responsible for leaf spotting. The greatest amount of damage to animals and vegetation is usually caused by gaseous air contaminants, which directly injure plants and indirectly injure animals by the toxic effects produced after the animal has consumed contaminated forage and food supplements. This discussion of plant damage symptoms and responses has been directed to the qualitative aspects necessary for assessing the presence and distribution of pollution. As to the evaluation of the concentration and duration of exposure to specific pollutants, experimental systems are available, or can be designed, to meet these specific quantitative needs once the presence of given pollutants has been determined.##

02537

G. Seidman

EFFECTS OF AIR POLLUTION ON PLANTS. African Violet Mag. 18, (3) 44-7, Mar. 1965

The first indication of an air pollution problem is often the injury that appears on comparatively sensitive vegetation. Some plants are more resistant than others to a given phytotoxicant. Plant injury from air pollution is caused primarily by the major gaseous pollutants (sulfur dioxide, fluoride gases, ethylene, and the components of the photochemical smog complex) and is produced in various ways in urban or industrial areas. These major pollutants and several of the minor pollutants are discussed in this paper.##

03116

G. Tendron

EFFECTS OF AIR POLLUTION ON ANIMALS AND PLANTS. European Conf. on Air Pollution, Strasbourg, 1964. pp. 25-69.

There is no doubt as to the effects of air pollution on plants and animals, particularly in the case of a few specific and very dangerous pollutants which are emitted in considerable quantities. In certain regions of Europe, life depends on immediate steps being taken to protect flora and fauna. There is no doubt that they will need to be mainly of a technical nature. It is a matter of reducing the discharge of polluted waste and attenuating, if not completely eliminating, the dangers involved. The necessary technical research must be organised in such a way as to cover all the different aspects of animal and plant life, the safety of which is indissolubly bound up with that of human life. In the Netherlands, a team of workers succeeded in arresting the devastation of horticultural crops by fluorine emissions thanks to the use, during the period of growth, of a raw material which when processed did not give off toxic fumes. In France, the Association for the Prevention of Air Pollution has set up a study group known as the "Committee for studying the effects of air pollution on cultivated plants and animals" to standardise working methods throughout the country. Mention should also be made of the Norwegian and British studies of the preventive effects of various fluorine alleviators and the research being done in the Federal Republic of Germany on the stimulation of plant nutrition by industrial emissions, as well as on countering the effects of such emissions by the addition of fertilisers. These few achievements show the importance of rational organisation and cooperation in research.##

03292

F. R. Burleson, E. R. Stephens, and E. A. Cardiff.

THE PRODUCTION OF PURE PEROXYACYL NITRATES. Preprint.  
(Presented at the Sixth Conference on Methods in Air Pollution Studies, California Dept. of Public Health, Berkeley, Calif., Jan. 6-7, 1964.)

Some naturally occurring photochemical products of "smog" were first identified as "compound X" by Stephens et al in 1956. In 1960, the first member of the series was recognized as peroxyacetyl nitrate (PAN) by Stephens et al. The C3 homologue, peroxypropionyl nitrate (PPN) was reported in synthetic mixtures by Stephens in 1961. Both the C2 and C3 homologues were detected in ambient air by Darley et al in 1963. only from synthetic preparations. The first 3 organic N compounds have been synthesized and purified at the Air Pollution Research Center, University of California, Riverside, for the past several years. Plant fumigations have demonstrated that these compounds are capable of inducing injury symptoms indistinguishable from those caused by photochemical smog. They are also powerful eye irritants. They have been identified (as a class) in artificially irradiated dilute auto exhaust, and in artificially irradiated mixtures of realistic concentrations of pure hydrocarbon plus oxides of nitrogen. The three purified synthetics have been used in plant fumigation studies, in eye irritation studies, in physical and chemical studies designed to confirm the structure of the compounds, and in instrument design and calibration. The principal problem in this preparation is the extreme instability of these compounds.##

M.D. Thomas

EFFECTS OF AIR POLLUTION ON PLANTS. World Health Organ.  
Monograph Ser. 46 (Air Pollution), 1961. pp. 233-78.

The literature on the effects of air pollution on plants has been reviewed with special reference to those pollutants that present major problems - viz., SO<sub>2</sub>, HF, London type smog, and Los Angeles type smog. The others, which are definitely of minor importance, are referred to more briefly. SO<sub>2</sub> has long been recognized as an air pollutant because it arises from the combustion of nearly all fuels, especially coal, and from the roasting of sulfide ores. It is phytotoxic in concentrations above 0.1 x 0.2 p.p.m., depending on the length of exposure. Below about 0.4 p.p.m., the gas tends to be oxidized in the cells as rapidly as it is absorbed, and interference with functions such as photosynthesis is slight. Toxic concentrations of sulfate are finally accumulated. Chronic rather than acute injury, if any, is generally manifested with these small concentrations. Above about 0.4 p.p.m., acute injury occurs more frequently, owing to the reducing properties of sulfate in the cells. Temporary interference with photosynthesis or "invisible injury" can occur to some extent, but these concentrations cause acute injury if maintained for more than short periods, and recovery is rapid when the fumigation is stopped. HF behaves somewhat similarly to SO<sub>2</sub>, except that with a few species of plants it is effective in causing lesions and interfering with photosynthesis in concentrations 2 or 3 orders of magnitude smaller than in the case of SO<sub>2</sub>. With most species it is up to 10 times as effective as SO<sub>2</sub>. Fluoride accumulated in the cells in sublethal amounts interferes with photosynthesis as does sulfite, but whereas the latter is deactivated by simple oxidation to sulfate, the former must be removed by translocation, volatilization, or some obscure chemical reaction, which makes much slower the recovery of the plant functions after HF fumigation. There appears to be a concentration of HF for each species below which "invisible injury" does not occur. The Los Angeles type smog is fairly well understood as to its mode of formation and its phytotoxic effects, but the actual compounds that cause these effects are still unknown. The smog causes characteristic leaf lesions which are quite different from those produced by other pollutants, including ozone, which may be a constituent of the smog. It also causes some "invisible" injury. Visible damage to crops in Southern and Northern California was estimated at over \$5 000 000 and \$1 100 000 respectively, annually, in 1956. (Author summary modified)##

03472

C. S. Brandt

AIR POLLUTION EFFECTS ON VEGETATION. Conn. Med. 27, (8)  
484-6, Aug. 1963.

The effects of air pollution particularly of sulfur dioxide, fluorides and photochemical smog on plants are briefly reviewed. The characteristic symptoms of air pollution injury to plants can be useful tool in field surveys. Great care must be exercised in using plants as indicators of air pollution, because many factors affect the symptoms, development, and interpretation of plant indicators.##

03573

W. N. Arnold.

THE LONGEVITY OF THE PHYTOTOXICANT PRODUCED FROM GASEOUS OZONE-OLEFIN REACTIONS. Intern. J. Air Water Pollution 2, 167-74, 1959.

Gaseous mixtures of an olefin and ozone were blown at constant rate through a 32 ft. tube of uniform cross section. A small aquatic plant was placed at prescribed intervals within the tube. The phytotoxics produced from the ozonization of both 3-heptene and 2-pentene were shown to be unstable. The distribution of plant damage within the exposure tube indicated the longevity of the phytotoxiant. The reduction in chlorophyll content of fumigated plants was used as a quantitative measure of damage. The results suggest that the decay of the phytotoxiant follows a first order or pseudo-first order reaction. The half-life of the phytotoxiant from ozonated 3-heptene is 1/4 hr while the phytotoxiant from ozonated 2-pentene has a much shorter half-life. This difference in stability can be explained in terms of the "zwitterion" mechanism. (Author abstract)##

03595

E. F. Darley, E. R. Stephens, J. T. Middleton, and P. L. Hanst

OXIDANT PLANT DAMAGE FROM OZONE-OLEFIN REACTIONS. Intern. J. Air Water Pollution 1, 155-62, 1959 and Proc. Am. Petrol. Inst., Sect. III 38, 313-22, 1958. (Presented at the 23rd Midyear Meeting, American Petroleum Inst. Division of Refining, Los Angeles, Calif, May 15, 1958.)

The reaction of ozone with five-, six-, and seven-carbon olefins is quite rapid even in the gas phase at concentrations of a few p.p.m. These reaction mixtures produce a toxic material which causes damage symptoms on pinto bean plants which are indistinguishable from those attributed to oxidant-type air pollution. Ozonides, formed in small yield by this reaction, are stable materials which do not damage pinto beans in any way even at concentrations higher than those arising in ozone-olefin reaction mixtures or in outdoor air. Evidence was obtained that the toxic material is unstable even at low concentrations in air. Its half-life appears to be no more than a few min. This result suggests that either a transitory ozone-olefin complex or an

unstable zwitter ion formed by its decomposition is the actual toxic substance. Attempts to confirm this by adding excess aldehyde or sulfur dioxide to scavenge the toxicant were not successful. (Author abstract)##

03596

E. F. Darley, W. M. Dugger, J. B. Mudd, L. Ordin,  
O. C. Taylor, and E. R. Stephens

PLANT DAMAGE BY POLLUTION DERIVED FROM AUTOMOBILES. Arch. Environ. Health 6, 761-70, June 1963. (Presented at the Fifth Session, Air Pollution Research Conference on "Effects of Motor Vehicle Emissions on Visibility and Vegetation," Los Angeles, Calif., Dec. 6, 1961.)

Emissions from motor vehicles are now known to be the principal source of the raw materials contributing to photochemical air pollution in California. Some of the products of the reaction, ozone, peroxyacyl nitrates, and the unidentified products of ozone-olefin reactions, are very damaging to the leaves of a variety of crop plants. The injury that was once confined to Los Angeles County now occurs in many states and causes economic loss estimated in excess of \$25,000,000 annually. Ethylene, one of the compounds found in the exhaust, is also very injurious to several crops. The ability of a given toxicant to incite injury is dependent on the age of the leaf and the conditions of illumination under which the plant is grown prior to, during, and after fumigation. In addition, the growth of plants, even in the absence of visible injury, is materially affected. Evidence is presented to indicate that the chemical and physical systems within the plant are disrupted by the phytotoxicants. (Author summary)##

03608

J. T. Middleton, J. B. Kendrick, Jr., E. F. Darley

AIR-BORNE OXIDANTS AS PLANT-DAMAGING AGENTS. Proc. Nat. Air Pollution Sym., 3rd, Pasadena, Calif., 1955. pp. 191-8.

The relative susceptibility of some plants to oxidants and determination of the plant-damaging effects of hydrocarbon, ozone, and ozonated olefins are compared. The response of pinto beans to air-borne oxidants occurring in the Los Angeles area are described. The survey data were subjected to further analysis by comparing the percent of plants damaged at five stations with the oxidant mean and maximum ranges observed. Data is presented and show that the mean percent of plants damaged increased with increasing oxidant maximum. Author states that the experiment described is the first of its kind designed to determine the relationship between plant damage and oxidant level in the naturally polluted Los Angeles Basin. The results of the study show that the frequency of damage to plants is associated with the oxidant concentrations for both oxidant maximum and daily oxidant mean.##

03609

J. T. Middleton, J. B. Kendrick, Jr., E. F. Darley

AIR POLLUTION DAMAGE TO AGRICULTURAL CROPS. Lasca Leaves  
5(1):6-11, Jan. 1955.

Significant damage of celery, spinach and lettuce was noted in 1945 in the vicinity of Los Angeles. Since these symptoms were different from damage usually associated with recognized pollutants, such as sulfur dioxide, fluoride, chlorine and ammonia, investigations were made which revealed that the toxicants causing this silvering and slight glazing followed sometimes by a bronzed discoloration, are oxidized hydrocarbons. This phenomenon occurred only during periods of reduced visibility due to inversions. Research being conducted at the University of Riverside was concerned with how agricultural crops can be grown in an area receiving polluted air masses, and to investigate chemical behavior of pollutants using plants as assay method. These laboratory investigations revealed that concentrations of oxidized hydrocarbons as low as 0.1 ppm cause plant damage. These observations corroborated those made in the field showing that damage to crop is directly proportioned to the length of the pollution period. Methods for protection of plants are being studied and briefly discussed in this paper.##

03610

J. T. Middleton, J. B. Kendrick, Jr., E. F. Darley

AIR POLLUTION INJURY TO CROPS. Calif., Agr., 7(11):11-12,  
1953.

Economic losses from air pollution injury on plants in Los Angeles County alone exceeded \$500,000 since 1949 when losses were estimated to be \$479,495. The components identified causing this damage were certain olefinic peroxides, found when ozone reacts with the vapors of unsaturated hydrocarbons derived from gasoline and other petroleum products. Research is in progress to develop methods for the economic production of agricultural crops in areas affected by air pollution.##

03611

J. T. Middleton

CLEAN AIR FOR GOOD CITRUS. Western Citrus Grower 1(6):6-9,  
June 1958. (Found in Western Fruit Grower 12, (6), June  
1958.)

The adverse effects of polluted air on citrus crops are reviewed. Included in the discussion are the effects of sulfur dioxide, ozone, oxidants and fluorides. It is concluded that abatement measures must be taken to protect agricultural areas.##



J. T. Middleton, E. F. Darley, R. F. Brewer

DAMAGE TO VEGETATION FROM POLLUTED ATMOSPHERES. J. Air Pollution Control Assoc. 8, 9-15, May 1958. (Presented at the 22nd Midyear Meeting, American Petroleum Inst. Division of Refining, Philadelphia, Pa., May 14, 1957.)

Damage to vegetation from polluted atmospheres has been recognized for more than a century. Early interest in air pollution centered largely on smoke and fumes from industrial wastes, particularly those of chemical manufacture, smelting, ceramic production, and coal and petroleum combustion effluents. Vegetation damage has increased with industrialization and urban development. Whereas the principal plant toxicants recognized several decades ago were sulfur dioxide and fluorine, in the last decade a new group of airborne phytotoxicants has been described and identified as oxidants. The principal source of these oxidants is believed to be photolysis reaction products of auto exhaust. Atmospheric contaminants responsible for damage to vegetation may be described as particulates - such as dusts and acid aerosols - and gases - such as sulfur dioxide, halogens, oxidized organics, ozone, nitrogen dioxide, hydrogen sulfide, ammonia, and carbon monoxide. Of these diverse pollutants, gases generally cause more damage to plants than do particulates.##

J. T. Middleton A. O. Paulus

THE IDENTIFICATION AND DISTRIBUTION OF AIR POLLUTANTS THROUGH PLANT RESPONSE. A.M.A. Arch. Ind. Health 14, 526-32, Dec. 1956. (Taken from a paper presented at the 17th Annual Meeting, American Industrial Hygiene Association, Philadelphia, Pa., Apr. 23-27, 1956.)

This paper presents an annual summary of monthly tabulations showing plant damage occurring in 12 of 51 counties. Regional tabulations show that plant damage is limited to the San Francisco Bay area and the coastal plain of southern California. The areas reporting plant damage are those of greatest population density. The toxicants responsible for plant damage are recognized in decreasing order of importance as oxidized hydrocarbons, ethylene and fluorides. Sulfur dioxide is of unusual occurrence and its distribution usually associated with specific industrial wastes. It is generally believed that ozone is present in the urban areas of Los Angeles and San Francisco and responsible for a significant part of the total atmospheric pollution. The wide-spread distribution of ethylene and smog, or reaction products from the oxidation of hydrocarbons, emphasizes the need for regional, research and abatement programs.##

03615

J. T. Middleton

PHOTOCHEMICAL AIR POLLUTION DAMAGE TO PLANTS. Ann. Rev.  
Plant Physiol., No. 12:431-448, 1961.

The toxic components in photochemical air pollution are typically the oxidation products of hydrocarbons and result either from the dark reaction of ozone and olefins or the photolytic reaction of nitrogen oxides and hydrocarbons in the presence of sunlight. This paper describes the occurrence and distribution of photochemical air pollution, enumerate some of the raw materials and products of these oxidation systems responsible for plant damage, and indicate the biochemical, physiological, and pathological effects of these contaminants upon plants.##

03616

J. T. Middleton, A. S. Crafts, R. F. Brewer, O. C.  
Taylor

PLANT DAMAGE BY AIR POLLUTION. Calif. Agr. 9-12, June 1956.

In many of the important growing areas of California the production and quality of vegetables and crops are adversely affected by air-borne toxicants such as ethylene, fluorides, herbicides, oxidized hydrocarbons, ozone and sulfur dioxide. Injury to plants by oxidized hydrocarbons (smog) is distinctly different from crop damage by the other above named precursors. Leaves of celery, lettuce, spinach, and some other vegetables, and of flower crops and African violets usually show silvering and glazing on their lower surfaces, sometimes followed by a bronze or reddish discoloration. Examples of the plant damage are shown in color photographs. Visible injury to all crops in the Los Angeles areas has caused losses exceeding \$3,000,000 annually since 1953. This does not include economic losses from reduced growth and lowered production in the absence of visible injury.##

03617

J. T. Middleton

RESPONSE OF PLANTS TO AIR POLLUTION. J. Air Pollution  
Control Assoc. 6, (1) 7-9, 50, May 1956.

This article compares the relative susceptibility of some plants to oxidants to determine the plant-damaging effects of hydrocarbon, ozone, and ozonated olefins, and to describe the response of the pinto bean to air borne oxidants occurring in the Los Angeles area. Plants vary in their susceptibility

to the reaction products from the oxidation of hydrocarbons. The pinto bean has been selected as a test plant for measuring the mechanisms of damage and some of the effects of oxidized hydrocarbons upon the life processes. Controlled fumigations have shown that the severity of plant damage varies with the air temperature. The atmosphere in Los Angeles and San Francisco has allegedly high concentrations of ozone. Yet typical crop damage there is reproduced only by ozonated olefins and not by ozone alone. Glasshouse grown crops can be protected from damage by passing air through activated carbon filters. The response of plants to air pollution depends upon the type of pollutant present, its concentration, and the length of exposure to it. The specific symptoms incited by exposure to oxidants can be used to determine the presence of ozonated olefins and ozone in polluted air masses.##

03618

E. R. Stephens, E. F. Darley, O. C. Taylor, W. E. Scott

PHOTOCHEMICAL REACTION PRODUCTS IN AIR POLLUTION. Intern. J. Air Water Pollution 4, (1/2) 79-100, 1961. (Presented at the 25th Midyear Meeting, American Petroleum Inst. Division of Refining, Detroit, Mich., May 11, 1960.)

When low concentrations of simple olefins and nitrogen oxides in air are irradiated with artificial sunlight, the olefin molecule splits at the double bond. One end forms a carbonyl compound, and the other yields a variety of products. Among these is a highly oxidized, unstable organic nitrogen compound previously described as compound X or peroxyacetyl nitrite (PAN) and detected in polluted atmospheres. This compound has now been purified by gas chromatographic techniques, and its chemical, physical, and physiological properties have been examined. At concentrations well below 1 p.p.m. in air, this compound produces damage symptoms on plants, similar to those observed from oxidant air pollution but different in some respects from the phytotoxicant from ozone-olefin reactions. PAN is the first pure compound isolated from photochemical reaction mixtures which has been found to produce the characteristic oxidant damage symptoms. It is also a strong eye irritant at concentrations in the 1 p.p.m. range and is therefore probably responsible, along with acrolein and formaldehyde, for the eye irritation in photochemical air pollution. (Author abstract)##

03627

G. W. Todd

EFFECT OF OZONE AND OZONATED 1-HEXENE ON RESPIRATORY AND PHOTOSYNTHESIS OF LEAVES. Plant Physiol. 33, (6) 416-20, Nov. 1958.

The treatment of Pinto bean leaves with either ozone or ozonated hexene gas in air caused a rise in the respiration rate up to more than four times that of untreated control leaves. Plant responses to the two gases were similar. The rate of photosynthesis of treated bean leaves was less than that of controls. Both the amounts of stimulation of respiration and the inhibition of photosynthesis were directly related to the development of visible injury symptoms in certain tissues of the bean leaves. No stimulation of bean leaf respiration or inhibition of photosynthesis occurred unless visible injury developed. However, ozone caused a rise in the respiration rate of Valencia orange leaves with no concomitant development of visible injury. Citrus leaves gave no response until ozone concentrations approached those required to produce visible injury symptoms. Treatment with ozonated hexene at concentrations eliciting changes in respiration and photosynthesis in bean leaves caused no change in these processes in citrus leaves. A comparison of ozone- and ozonated hexene-treated bean leaves showed that the respiratory quotients were not different from that of the control leaves. (Author abstract) ##

03629

03629

G. W. Todd

PHYSIOLOGICAL RESPONSES OF PLANTS TO AIR POLLUTANTS. J. Appl. Nutr. 10, 456-8, 1957. (Presented at the 20th Annual National Convention, American Academy of Nutrition, Los Angeles, Calif., 1956.)

The mechanisms whereby plants are damaged and the various ways in which they may show manifestations after fumigation by air pollutants are reviewed. The discussion is primarily concerned with the effects of ozone, ozonated unsaturated hydrocarbons, naturally-occurring air pollutants in the Los Angeles basin, and to a small extent hydrogen fluoride.##

03630

G. W. Todd and M. J. Garber

SOME EFFECTS OF AIR POLLUTANTS ON THE GROWTH AND PRODUCTIVITY OF PLANTS. Botan. Gaz. 120, (2) 75-80, Dec. 1958.

Fumigations with ozonated hexene caused a repression in growth of bean plants (varieties Red Kidney and Bountiful) even though they showed no visible symptoms of injury. This effect was evident from measurements of linear growth, leaf area, fresh and dry weights, and fruit production. Both primary and trifoliolate leaves failed to enlarge as much as control leaves when treated with ozonated hexene, although the treatment seemed to have little or no effect on the number of leaves initiated. Primary leaves on treated plants aged and were lost prematurely. Stems of plants treated with ozonated hexene consistently had a higher water

content than did stems of control plants. The leaves did not show this relationship. The height growth of pea plants (variety Alaska) was slowed temporarily by as little as a single half-hour fumigation with ozonated hexene, although treated plants fully recovered and were growing normally 1 or 2 days later. Ozone alone caused no repression of growth, and repeated fumigations of pea plants with 1-hexane elicited no response. (Author summary)##

03783

D. H. F. Atkins, R. C. Chadwick, and A. C. Chamberlain

DEPOSITION OF RADIOACTIVE METHYL IODIDE TO VEGETATION. Health Phys. 13, (1) 91-2, Jan. 1967.

It is well established that a proportion of radio-iodine released from irradiated fuel elements or other sources may appear as methyl iodide. Methods for removing methyl iodide from gas-cooled reactor systems have been developed, but it is desirable to know the possible hazards of release of radio-iodine as methyl iodide to the atmosphere. As regards the inhalation of effluent by persons in the vicinity, it makes little difference whether the iodine is elemental or as methyl iodide, since experiments with human volunteers have shown that the uptake of methyl iodide vapour by the lung is substantial and rapid. However, the hazard from contamination of milk supplies depends on the transfer of iodine vapour from the air to grass. To enable the hazard from release of methyl iodide to be assessed, two experiments were done to determine the velocity of deposition of methyl iodide, tagged with radio-iodine to vegetation. Both laboratory and field experiments indicate that methyl iodide is very poorly absorbed by vegetation. Although care was taken to remove any elemental iodine from the sources used, it is possible that the observed small uptake was due to traces of iodine. For assessment of hazards, the grass-milk route of entry is unlikely to be serious compared with the inhalation route for methyl iodide. There is, however, the possibility that prolonged exposure of a cloud of methyl iodide to sunlight might lead to dissociation and formation of elemental iodine, which would then be available to plants.##

04256

M. S. Burakhovich

ATMOSPHERIC POLLUTION BY DISCHARGES FROM CHEMICAL PLANTS. (Zagryaznenie atmosfernogo vozdukha vybrosami khimicheskikh predpriyatii.) Hyg. Sanit. 31, (9) 437-40, Aug. 1966. Russ. (Tr.)

CPSTI: TT 66-51160/7-9

The purpose of the investigations was the determination of one-time concentrations of injurious substances in the ambient air of populated areas within a radius of 3000-4000 m. from two chemical

plants. Among the substances included in the determinations were: nitrogen oxides, methanol, ammonia, hydrogen sulfide, formaldehyde, and cyclohexane. The effect of emissions from a power plant, on coniferous forests, was also studied. Needles from dried trees contained greater concentrations of sulfur compounds than needles from healthy trees.##

04544

H. E. Stokinger

EFFECT OF AIR POLLUTANTS ON WILDLIFE. Conn. Med. 27, (8)  
487-92, Aug. 1963.

A review of information derived from both field and laboratory investigations of the effects of air pollutants on terrestrial animals indicates that (1) of all known air pollutants, economic poisons pose the greatest current threat to the health of wildlife. (2) Inorganic substances, (certain heavy metals and fluorides), account for limited and local injury to wildlife based on known effects on domestic animals. (3) The hazard to wildlife is chiefly from ingestion of the "fallout" of the air pollutant. (4) Relative species susceptibility to specific air pollutants is far from clear, but it would appear that the mammals are considerably more susceptible than birds. (5) Laboratory studies have revealed three rather general phenomena associated with exposure to air pollutants: a. Synergism, the exalted or potentiated toxic effect of combination of certain air pollutants: its converse, antagonism, in which the summated toxicity is either far less than predicted or nonexistent. b. Tolerance and cross tolerance to pulmonary edema-producing agents. c. The immunochemical response.##

04984

P. W. Zimmerman

IMPURITIES IN THE AIR AND THEIR INFLUENCE ON PLANT LIFE.  
Proc. Natl. Air Pollution Symp., 1st, Pasadena, Calif., 1949  
pp. 135-41

The fact that several impurities in the air influence plant life has been fairly well established. The toxic impurities most frequently encountered are sulphur dioxide, hydrogen fluoride, chlorine, hydrogen sulphide, ammonia, esters of growth-regulating substances, and constituents of manufactured illuminating gas. To aid in identifying characteristic effects, several species of plants have been subjected to these gases under controlled experimental conditions.##

H. M. Hull F. W. Went

LIFE PROCESSES OF PLANTS AS AFFECTED BY AIR POLLUTION. Proc. Natl. Air Pollution Symp., 2nd, Pasadena, Calif., 1952. pp. 122-8.

Either natural smog or artificial smog produced by the ozonization of 1, n-hexene or gasoline was used. Plants used included: alfalfa, var. Chilian; sugar beet, var. U.S. 22/3; endive, var. Pink Ribbed; oats, var. Kanota; spinach, var. Viroflay; and tomato, var. San Jose Canner. A sensitive biological assay for detection of phytotoxic constituents in the atmosphere is described. Differential sensitivity of cotyledons and young foliage leaves to smog injury was observed. The growth of alfalfa, and especially of endive, has been greatly increased by carbon filtration of the atmosphere. Tomato plants' growth was very significantly greater in the carbon-filtered air. An iron-zinc-steel wool filter was practically as efficient as the activated carbon, as indicated by the luxurious growth of all five plants. The effect of smog on growth, transpiration, and stomatal behavior was examined. The effects of temperature, illumination, humidity, and soil moisture on the sensitivity of the plants to smog was studied. The effect of ferrous sulphate, stannous chloride and sucrose sprays upon the plants' susceptibility to smog injury was studied. The sensitivity of several different species of plants and of different types of spinach to smog damage was investigated.##

R. A. Bobrov

THE ANATOMICAL EFFECTS OF AIR POLLUTION ON PLANTS. Proc. Natl. Air Pollution Symp., 2nd, Pasadena, Calif., 1952. pp. 129-34.

The damaging effects on the leaf anatomy of susceptible crop plants were investigated. The leaf was considered to be the logical point of departure, since it almost invariably manifests physical response to smog within a very brief exposure period. The structure of the normal leaves was very carefully observed in order to enable detection of even the slightest alteration in cell shape. From careful comparative studies made of the cellular structure of normal and damaged leaves, it was possible to establish the microscopic anatomy of smog damage. Regardless of the macroscopic picture of damage, microscopic studies indicate that the reaction of the cell to hydrocarbon-ozone products is the same in all susceptible plants. The plants studied were table beet, sugar beet, romaine lettuce, spinach, Swiss chard, endive, oats, and corn.##

W. M. Noble

THE RELATION OF PLANT DAMAGE TO FUEL COMPOSITION. Preprint.  
(Presented at the Joint Research Conference on Motor  
Vehicle Exhaust Emissions and Their Effects, Los Angeles,  
Calif., Dec. 5, 1961.)

Plants exposed to irradiated auto exhaust gases containing initially less than 0.5 ppm of olefins and less than 2 ppm of NO exhibit the same symptoms of damage as do plants exposed to the atmosphere in the Los Angeles area. The plants used in these studies were *Poa annua* and *petunia*, var. *Rosy Morn*. The symptoms observed were banding, necrosis, glazing, silvering, and cellular plasmolysis in substomatal regions. Exposure time was 1 hour. Exposures were initiated at half hour intervals. *Poa annua* was the most useful plant because of its greater range, simplicity of evaluation, and uniformity and also because a larger number of plants could be used in a given space. The length of exposure required for the production of maximum damage appears to be related to the reaction rate of the fumigants, which depends in part on fuel bromine number and on the concentrations of the fumigants. Differences in concentrations also produced marked differences in the degree of damage. (Author abstract)##

05342

Darley, E. F., Nichols, C. W. and Middleton, J. T.

IDENTIFICATION OF AIR POLLUTION DAMAGE TO AGRICULTURAL CROPS. (AIR POLLUTION RESEARCH REVEALS CHEMICAL TOXICANTS INJURING VEGETATION IN POPULOUS AREAS OF CALIFORNIA.) Calif. Dep. Agri. Bull., 55(1):11-19, 1966.

The subject of this paper is the damage air pollution does to the plants that feed us, clothe us and please our aesthetic sense. This damage is considerable. Estimates of visible damage to agricultural crops amount annually to about \$8 million in California and approximately \$18 million along the Atlantic seaboard. Damage to vegetation has increased with industrialization and urban development. Several decades ago sulfur dioxide and fluorine were recognized as the principal plant toxicants. These two gases continue to be very important but within the last 20 years a new group of toxicants has been identified. These are products of atmospheric photochemical reactions between hydrocarbons and nitrogen oxides. The principal products of these reactions are ozone and the peroxyacyl nitrates (PANs). The distribution of plant damage in California shows that it occurs only in recognized geographical areas which, in each instance, are located within airsheds. Because damage to plants is often the first indication of air pollution, it is important that the surveillance of pollution damage to agriculture be continued. Such information will help communities, in their planning, to take cognizance of the relationship between the air resource and the community needs for commercial and industrial development, energy



production, fuel usage and transportation, agriculture, and forest and recreation land. The air contaminants responsible for damage may be either particulate or gaseous in nature. The greatest amount of damage to animals and vegetation is usually caused by gaseous air contaminants which directly injure plants and indirectly injure animals by the toxic effects produced after the animal has consumed contaminated forage and food supplements.

05344

Darley, E. F., and Middleton, J. T.

PROBLEMS OF AIR POLLUTION IN PLANT PATHOLOGY. Ann. Rev. Phytopathol. 4, 103-118, 1966.

Air quality affects plant growth and development. Whereas oxygen is necessary for aerobic plant respiration and carbon dioxide is necessary for photosynthesis in green plants, a number of pollutants may alter plant metabolism and incite disease. It is the purpose of this paper to enumerate some of the principal air pollutants which adversely affect plant growth and reproduction, to describe the diseases incited by them, and to identify some of the problems of air pollution in phytopathological research. A primary responsibility of the pathologist is to alert agriculturists of impending air-pollution problems, so that social action may be taken to insure the continued productivity of crop, pasture, and forestry enterprises. Another responsibility, because plants are early indicators of an air pollution problem, is to assist public health and resource agencies in the planning, conduct, and evaluation of air-pollution abatement programs. Plant pathologists must become increasingly concerned with the effects of air quality on plant growth.

05421

Merriman, G. M.

FLUORIDES AND OTHER CHEMICAL AIR POLLUTANTS AFFECTING ANIMALS. In: Agriculture and the Quality of Our Environment. Brady, N. C. (ed.), American Association for the Advancement of Science, Washington, D. C. AAAS-Pub-85, p. 91-95, 1967. 11 refs. (Presented at the 133rd Meeting, American Association for the Advancement of Science, Washington, D. C., 1966.)

A review of air pollution problems involving animals is presented. One pattern of procedures useful in investigating and controlling the effects of chemical air pollution upon animals was developed during United States and British studies of effects of fluoride effluents upon cattle. Generally the effluents collected upon the surfaces of vegetation and exerted their effects only after ingestion by animals. The investigational procedures included methods of detecting pollutant effects upon animals, diagnosis and evaluation of effects, consideration of pollutant sources, and pollutant control as related to animal well-being. All procedures depended on research with laboratory and farm animals.##

05420

Daines, R. H., I. A. Leon, and E. Brennan

AIR POLLUTION AND PLANT RESPONSE IN THE NORTHEASTERN UNITED STATES. In: Agriculture and the Quality of Our Environment. Brady, N. C. (ed.), American Association for the Advancement of Science, Washington, D. C. AAAS-Pub-85, p. 11-31, 1967. 56 refs. (Presented at the 133rd Meeting, American Association for the Advancement of Science, Washington, D. C. Dec. 1966.)

A review of pollutants that have been found to elicit plant response is confined to the discussion of acid gases, primary products of combustion, and products of reactions occurring in the atmosphere. Other topics discussed include: plant response as an indicator of meteorological conditions and the fuels used for heat, light, and power.##

05485

W. M. Noble

AIR POLLUTANTS. Lasca Leaves. 15 (1), 7-18 (Jan. 1965).

After years of careful study, some of the components of smog have been sorted out. The more important ones, their effects on vegetation, and a list of sensitive and resistant plants are discussed. The components are peroxyacetyl nitrate, ozone, ethylene, hydrogen fluoride, sulfur dioxide and aerosols.##

05610

W. W. Heck

PLANT INJURY INDUCED BY PHOTOCHEMICAL REACTION PRODUCTS OF PROPYLENE-NITROGEN DIOXIDE MIXTURES. J. Air Pollution Control Assoc. 14(7):255-261, July 1964. (Presented at the 56th Annual Meeting, Air Pollution Control Association, Detroit, Mich., June 9-13, 1963.)

Plants developed typical ethylene injury symptoms when fumigated for 21 to 48 hr with ethylene or various combinations of ethylene, acetylene, propylene and nitrogen dioxide. When propylene and nitrogen dioxide were included in the gas mixture and the mixture irradiated typical oxidant symptoms were recorded. Slight to severe necrotic spotting, due to nitrogen dioxide, was noted in a 48 hr fumigation at one ppm nitrogen dioxide and in a 21 hr fumigation at 3.5 ppm nitrogen dioxide. Twelve hour fumigations using irradiated mixtures of ethylene, acetylene and propylene at three concentrations (2, 4, and 8 ppm) each in combination with one ppm of nitrogen dioxide gave typical oxidant damage with only the propylene-nitrogen dioxide mixtures. From reported oxidant injury symptoms the propylene-nitrogen dioxide irradiated mixture

produced plant injury which is typical of both ozone and PAN. The presence of other phytotoxicants was not discounted but the severity of injury, under the conditions used, made it difficult to evaluate other possible types of oxidant damage. The production of the phytotoxicants using various ratios of propylene-nitrogen dioxide mixes was determined using the plants as biological indicators. A ratio of one ppm NO<sub>2</sub> to 2-3 ppm propylene produced the highest concentration of the phytotoxicants. The effects of varying light and temperature conditions during the fumigation period indicated that plants must be in the light before they are sensitive to oxidant damage and that a temperature above or below normal will reduce oxidant injury. Results stress the need for studying the interrelations of oxidant injury and various environmental factors. (Author's summary)##

05666

Brewer, R. F. Guillemet, F. B. and Creveling, R. K.

INFLUENCE OF N-P-K FERTILIZATION ON INCIDENCE AND SEVERITY OF OXIDANT INJURY TO MANGELES AND SPINACH. Soil Sci. 92, (5) 298-301, Nov. 1961.

The study reported in this paper was designed to further study the influence of nitrogen supply and explore the possible effects of potassium and phosphorus supply on the sensitivity of plants to oxidant damage. Several Mangel seed (Burpee No. 5131) were planted in 1-gallon cans filled with a previously fertilized soil-sand-peat mixture. After emergence the plants were thinned to one plant per can. Twelve different treatments, each replicated 8 times, were used in a 3 x 2 x 2 factorial design consisting of 3 levels of N and 2 each of P and K. Two months after emergence, half the plants, chosen at random, were placed in a special greenhouse fumigation chamber and exposed to ozonated hexene. The remaining mangels were placed in a duplicate fumigation chamber which received activated-carbon-filtered air to remove ambient oxidants. At the end of 2 days, during which the one group of plants was exposed to two 6-hour fumigations with an average organic oxidant concentration of 0.01 ppm., all the plants (fumigated and controls) were returned to the smog-free greenhouse where they were grown. Thirty-six hours after fumigation was stopped the plants were systematically examined for incidence and severity of damage. A similar experiment was conducted using spinach as the test plant. A statistical analysis of the mangel fumigation data indicate that the severity of injury was very significantly increased as the nitrogen level was increased. There were also highly significant interactions of nitrogen with phosphorus and between phosphorus and potassium on severity of injury. The results of differential fertilization on the sensitivity of spinach to ozone injury indicate that increasing the nitrogen supply very significantly increased both the incidence and the severity of ozone injury. fertilization on the sensitivity of spinach to ozone injury.

05723

J. B. Kendrick, Jr., E. F. Darley, and J. T. Middleton

CHEMOTHERAPY FOR OXIDANT AND OZONE INDUCED PLANT DAMAGE.  
Intern. J. Air Water Pollution 6, 391-402 (1962).

A number of common fungicides, as well as antioxidants from the rubber industry, were dusted and sprayed onto leaves of test plants to determine their efficacy, as well as their mode of action, in protecting plants from subsequent exposure to ozone and oxidants generated from ozonated hydrocarbons. Not all chemicals were equally effective. Some protected against both ozone and oxidants, some protected against one but not the other, while some gave no protection. The most effective materials were dithiocarbamates, mercaptobenzothiozole and their derivatives, while the least effective were amine derivatives. The degree of protection was directly related to concentration of chemical. Longevity of protection was related to accumulated periods of exposure to toxicants. Over a 10-hour accumulated exposure period plants were significantly protected, although the degree of injury gradually increased with exposure time. In contrast, when several days lapsed between application and exposure, the chemical was as effective as when applied on the day of exposure. Action of the protectant was local and not systemic; the toxicant appeared to be deactivated at the leaf surface. Leaves remained free of injury only when the chemical was applied to the lower leaf surface and then only on that portion actually covered with chemical. Some degree of protection was achieved in field tests against atmospheric oxidants as well as against those generated in the laboratory. (Author abstract)##

05724

J. B. Kendrick, Jr., E. F. Darley, J. T. Middleton,  
and A. O. Paulus

PLANT RESPONSE TO POLLUTED AIR. Calif. Agr. 10 (8), 9-10  
(Aug. 1956).

Field observations and controlled fumigation experiments have shown that plants differ in their response to atmospheric contamination by ethylene, herbicides, fluorides, sulfur dioxide, and smog, or oxidized hydrocarbons. Controlled experiments have also shown that plant response to air pollution varies with species and variety of plant, age of plant tissue, soil fertility levels, soil moisture, air temperatures during the prefumigation growth period, and presence of certain agricultural chemicals on leaves. Plants also vary in their susceptibility to sulfur dioxide, with alfalfa, barley, and cotton damaged at comparatively low levels, and citrus, corn, celery, and melons damaged at much higher levels. Field observations show that young leaves are seldom marked during periods of aggravated air pollution. The young, unexpanded leaves are typically uninjured; the mature, expanded leaves are severely injured; and the old, somewhat chlorotic leaves are rarely damaged. In grasses, where the youngest tissue is at the base of the leaf, injury first occurs at the tip, grading off in intensity of injury toward the base of the leaf. Old chlorotic leaves on grasses are seldom injured. Several groups of chemical compounds are capable of preventing injury to plants caused by oxidized hydrocarbon fumigations when the chemicals are applied to the lower surface of leaves. These chemicals belong to the

dithiocarbamate, benzothiazole, and thiuram sulfide groups, and have been used extensively as agricultural fungicides for the control of many fungus diseases. Two of the best chemicals for this purpose are zineb--zinc ethylenebisdithiocarbamate -- and thiram--tetramethyl thiuramdisulfide. The degree of protection is directly related to the amount of active ingredient contained in the spray or dust preparations. Protection is achieved only when the underside of leaves are adequately covered. Both groups of chemicals when properly applied to laboratory test plants protect leaves from damage from both ozone and ozonated hexene. Pinto bean leaves dusted with zineb in the laboratory and exposed to naturally polluted air near Los Angeles were protected from serious injury.##

05756

Rasmussen, R. A. and Went, F. W.

VOLATILE ORGANIC MATERIAL OF PLANT ORIGIN IN THE ATMOSPHERE. Proc. Natl. Acad. Sci. (U.S.) 53, (1) 215-20, Jan. 1965. (Presented before the National Academy of Sciences, Apr. 27, 1964.)

Quantitative data on the actual concentration of plant volatiles in air are given. Using a sensitive gas chromatograph mounted in a mobile trailer laboratory, the presence in air of many organic compounds in molecularly disperse state can easily be measured. The hydrogen flame detector, which responds only to organic molecules, has a sensitivity of better than 1:10 to the 9th power, using 5-cc air samples. Whereas in cities gasoline and other man-produced organic vapors constitute the bulk of the organic volatiles in the air, in the countryside, away from highways and human activities, plant products predominate. Among these, alpha- and beta-pinene, myrcene, and isoprene were identified. Their concentration depends on meteorological conditions and density and activity of plant cover; during summer usually more than 10 to the minus 8th power organic volatiles occur in country or forest air; during winter this decreases to 2 x 10 to the minus 9th power. After one or more dark rainy days plants release less terpene. Upon the death of cells large amounts of terpenes are released, explaining the aromaticity of drying hay or of forests during autumn. High concentrations of terpenes in the air were associated with the dying of leaves in autumn, and with the mowing of meadows. A world production for plant volatiles released to the atmosphere is estimated to be 438 x 1,000,000 tons per year. (Author conclusions)

05777

G. W. Todd B. Propst

CHANGES IN TRANSPIRATION AND PHOTOSYNTHETIC RATES OF VARIOUS LEAVES DURING TREATMENT WITH OZONATED HEXENE OR OZONE GAS. Physiol. Plantarum 16, 57-65, 1963.

Measurements were made on the rates of photosynthesis and transpiration of bean, tomato and coleus leaves during and immediately following fumigation with either ozone or ozonated hexene gas. Both fumigants caused marked decreases in the rate of photosynthesis in all 3 species although in tomato and coleus leaves, the reduction in photosynthesis took place only during fumigation with ozonated hexene gas and afterwards the rate returned to normal. Ozone fumigation caused decreases in transpiration but the decrease was not as large as that obtained for photosynthesis. Transpiration in tomato and coleus leaves showed little response to ozonated hexene gas although bean leaves responded in much the same way as they did when they were treated with ozone alone. The white portions of coleus leaves (where the green outer orrction had been removed) were used for similar fumigations and an increase in respiration and a decrease in transpiration with ozonated hexene was noted. There were no changes in transpiration from leaves following ozone fumigations. Increases in respiration after ozone and ozonated hexene fumigations were obtained for bean, tomato and intact coleus leaves as had been reported previously for bean leaves. It was postulated that part of the decrease in growth (not accompanied by visible injury) obtained when plants were treated with ozonated hexene gas might be due directly to the reduction in photosynthesis. It would not appear in the species tested that the more resistant species close their stomates and thereby prevent the fumigant from entering. (Author summary)##

05778

Todd, G. W. and Arnold, W. N.

AN EVALUATION OF METHODS USED TO DETERMINE INJURY TO PLANT LEAVES BY AIR POLLUTANTS. Botan. Gaz. 123, (2) 151-4, Dec. 1961.

An evaluation was made of three methods of analyzing the damage of plant leaves after exposure to ozone or ozonated hexene gas. A visual estimate was made of the amount of leaf surface damaged. The same plants were used for measurements of the change in fresh weight and of chlorophyll content. The latter two measurements were chosen because injury results in desiccation of parts of the leaf and a loss of pigmentation. Also these would be a measure of the actual amount of functional leaf material which was damaged. It was found that losses in fresh weight were nearly proportional to losses of chlorophyll in injured leaves. The visual-rating system appeared to be sensitive in the lower range of injury but rather insensitive at the upper end of the range. The visual-damage index appears to be logarithmic with respect to both chlorophyll and fresh-weight changes. It was concluded that a measurement of the change in either fresh weight or chlorophyll content would give a better estimate of impairment of leaf function, since the visual-damage system tends to overestimate the damage inflicted, particularly when only a small amount of leaf surface is involved. (Author summary)

B. L. Richards, J. T. Middleton, and W. B. Hewitt

AIR POLLUTION WITH RELATION TO AGRONOMIC CROPS: V. OXIDANT STIPPLE OF GRAPE. Agron. J. 50, 559-61 (1958). (Presented at the 50th Anniversary Meeting, American Society of Agronomy, Nov. 20, 1957.)

Small, brown to black, discrete, punctate lesions occur on the upper leaf surface of grape grown in areas polluted by air-borne oxidants. The lesions are typically restricted to the palisade layer and may be easily distinguished from other grape disorders because of their stippled appearance. The disease can be incited in grape by fumigation with ozone. Toxic ozone levels occur in the polluted air mass above the Los Angeles and San Francisco areas where oxidant stipple is found. Stipple has not yet been seen in the grape producing areas in the Coachella, Napa, Sacramento, and San Joaquin valleys of California. Oxidant stipple can be distinguished from smog-type oxidant injury due to oxidized organics in that the upper leaf surface is stippled in grape and there is no common and pronounced silvering or glazing of the lower leaf surface as found on herbaceous crops and weeds in and adjacent to affected vineyards. Leaf injury to grape due to foliar fluoride accumulation can be readily distinguished because it is marginal red to brown in color, necrotic, and commonly exhibits zonate markings. Stipple can also be easily separated from foliar salinity and drought injury, both of which produce marginal and intercostal leaf necroses similar to those induced by fluorides. Although ozone occasionally may cause leaf injury to some plants particularly grasses, grown in areas receiving naturally polluted air, it is unusual to note ozone damage to agricultural crops; oxidant stipple of grape is, therefore, a unique disease both in its symptomology and etiology.##

06078

G. D. Clayton T. S. Platt

EVALUATION OF ETHYLENE AS AN AIR POLLUTANT AFFECTING PLANT LIFE. Am. Ind. Hyg. Assoc. J., 28(2):151-9 (Apr. 1967).

A comprehensive survey of the literature reveals that ethylene has been clearly implicated as an air pollutant only for certain greenhouse plants. Ethylene is produced naturally by some biologic systems and may cause some plant damage. Most studies have been in closed systems with shifts in gas concentrations occurring. Adequate data are lacking on the response of field-grown plants to ethylene as an air pollutant. (Author's abstract) ##

06498

L. Ordin, and B. Propst

EFFECT OF PHOTOCHEMICALLY PRODUCED OXIDANTS ON GROWTH OF AVENA COLEOPTILE SECTIONS. Plant Physiol., 36(3), 326-30, (May 1961).

Avena coleoptile sections incubated in solutions through which photochemically produced oxidant mixtures, ozone or peroxyacetyl nitrate (PAN) are passed, display subsequent repressed growth in fresh solutions to which auxin has been supplied. Treatment by oxidant recording as 1.4 ppm derived from an irradiated mixture of trans-2-butene and NO<sub>2</sub> results in about 50% inhibition of elongation. About 1.5 ppm PAN also inhibits growth to the same degree or more. Approximately 170 ppm ozone produced comparable magnitudes of inhibition. In all cases basal respiration was inhibited little or not at all. Although the concentrations dealt with here are about tenfold above those found in the atmosphere (200-fold for ozone) the results may be helpful in the interpretation of mechanisms of growth inhibition in the field. There are probably several reasons why high concentrations of PAN are required to produce growth inhibition in Avena coleoptiles while much lower concentrations affect more sensitive intact plants. Although the coleoptile is cutinized and has few stomata, suggesting a transport barrier, there are indications that root tissue which is neither cutinized nor suberized to any great extent may be even less sensitive. Thus the answer is more likely to lie either in the resistance of the cellular membranes themselves to the uptake of the oxidants or in the presence of reducing agents in the cell or, simply, less sensitive enzyme systems. It was found that intact seedlings in the gas stream are not more sensitive than sections floating in water during gas exposure. The lack of illumination during exposure may also be a factor, since even sensitive petunia plants exposed in the dark to 0.5 ppm oxidant derived from an irradiated mixture were not damaged.##

06499

L. Ordin and B. Propst

EFFECT OF AIR-BORNE OXIDANTS ON BIOLOGICAL ACTIVITY OF INDOLEACETIC ACID. Botan. Gaz. 123(3), 170-5 (Mar. 1962).

This investigation concerns the effects of some of the known atmospheric pollutants, namely ozone, peroxyacetyl nitrate (PAN), and ultraviolet-irradiated mixtures of olefin and NO<sub>2</sub> on indoleacetic acid in vitro. It is apparent from the results that air-borne oxidants such as PAN and ozone can inactivate IAA in vitro. Whether such a mechanism of inactivation is of importance in the living plant cannot be answered fully at present. Ascorbic acid prevented the inactivation of IAA by chemically reducing the oxidant level in the solutions. The residual ascorbate, or its decomposition products, in the growth solutions exerted a slight subsequent inhibitory action on coleoptile growth. This observation does not agree with the results of other investigators.



Since the concentration of ascorbate was much higher in the present experiments than that used by other investigators, it is possible that the growth-stimulating range was exceeded in the present investigation. The failure of IAA activity to recover despite low residual amounts of PAN or ozone in solution and, more particularly, despite the addition of ascorbate to the previously treated solutions indicates that the inactivation is not similar to that caused by H<sub>2</sub>O<sub>2</sub> or peroxides. In the peroxide-induced inactivation, there is an apparent interference with the bioassay rather than an irreversible change. In the case of inactivation by ozone or PAN the change is irreversible as shown by the changes in ultraviolet spectra. Some light on this irreversible inactivation is shed by the ultraviolet spectra. They show that the change in IAA caused by ozone and PAN is probably a ring alteration.##

06546

W. W. Heck, E. G. Pires, and W. C. Hall

THE EFFECTS OF A LOW ETHYLENE CONCENTRATION ON THE GROWTH OF COTTON. J. Air Pollution Control Assoc. 11(12), 549-56 (Dec. 1961). (Presented at the 54th Annual Meeting, Air Pollution Control Association, New York City, June 11-15, 1961.)

The present study was designed to determine the effects of a low level of ethylene on cotton grown under controlled conditions, during the entire growth period of the plants. The chambers were designed as gas-tight compartments with controls for the following conditions: light, temperature, humidity, water, air flow, and gas concentration. Plants were grown for one month and the chambers then opened for an eight hour period. The following quantitative data were obtained for all plants: plant height; the number of cotyledons, leaves, squares (flower buds), flowers, bolls, laterals, and nodes; the number of plant parts abscised; and the leaf size in square inches. Preliminary experiments indicated that cotton was very sensitive to ethylene air pollution. Thus it was decided to grow plants from the seedling stage through maturity at an ethylene level which might readily prevail in the vicinity of a polyethylene industrial plant. The level of 0.6 ppm was chosen as a possible mean level of ethylene air pollution.##

07167

Abeles, Frederick B.

INHIBITION OF FLOWERING IN XANTHIUM PENSYLVANICUM WALLN. BY ETHYLENE. Dept. of the Army, Fort Detrick, Md. Biological Sciences Lab., Project 1L013001A91A, Technical Manuscript 376, 5p., April 1967. 11 refs. CFSTI: AD 813720

In this report ethylene inhibited the formation of flowers in cocklebur (*Xanthium pensylvanicum* Walln.) plants that were exposed to an inductive dark period. Indoleacetic acid had been shown earlier to have this same effect. The two large apical beaks were cut from cocklebur fruits (Chicago strain) and the fruits were washed in running water for 24 hours and planted in 4-inch pots of soil; seedlings were grown for 3 weeks at 25 C on a 16-hour light cycle (1,500 ft-c) supplied by daylight fluorescent bulbs. The plants were induced to flower by exposure to 16 hours of darkness in 10-liter desiccators containing 0, 1, 10, or 100 ppm ethylene. After the induction period, the plants were returned to the growth chamber; the sizes of the inflorescences were measured 8 weeks later. Ethylene evolution from the plants was measured by gas chromatography. Because it stimulates ethylene evolution from cocklebur leaves, the results suggest that the effect of auxin may be an ethylene effect.##

07446

A. Ongun, J. B. Mudd

BIOSYNTHESIS OF GALACTOLIPIDS IN PLANTS. Preprint, California Univ., Riverside, Dept. of Biochemistry and Statewide Air Pollution Research Center, ((36))p. 1967. 25 refs.

Spinach chloroplasts very actively incorporated radioactivity from UDP-galactose C14 into lipids. Among the products formed, monogalactosyl and digalactosyl diglycerides together with a third compound, tentatively identified as the trigalactosyl diglyceride, contained 95% of the total identified as the trigalactosyl diglyceride, contained 95% of the total lipid radioactivity. Chloroplasts from young leaves showed higher enzymic activity than those obtained from mature leaves. Dissociation of the enzymes from the acceptors was accomplished by acetone powder preparation of the chloroplasts. It was shown that diolein could serve as an efficient acceptor for the monogalactosyl diglyceride synthesis but not for the digalactosyl diglyceride synthesis. Monogalactosyl diglyceride, naturally found in chloroplasts, was shown to be the acceptor for the second galactosylation. Incubation of radioactive digalactosyl diglyceride with the acetone powder of spinach chloroplasts resulted in the formation of trigalactosyl diglyceride when cold UDP-galactose was used as the substrate. Evidence indicated that two enzymes were involved in galactolipid synthesis in spinach chloroplasts. The enzyme responsible for the synthesis of monogalactosyl diglyceride was more tightly bound to the membranes than the enzyme synthesizing digalactosyl diglyceride. Particles from etiolated pea leaves as well as other non-chlorophyllous tissues were shown to contain active enzymes that synthesize the galactolipids. A light induced increase in the enzyme activity was observed in pea leaves. (Authors' summary)##

Shabad, L. M.

ON THE DISTRIBUTION AND THE FATE OF THE CARCINOGENIC HYDROCARBON BENZ(A)PYRENE (3,4 BENZPYRENE) IN THE SOIL. Z. Krebsforsch. (Berlin), 70(3):204-210, Jan. 5, 1968. 20 refs.

Soil samples from seven areas of Moscow were taken and 10 gm. portions extracted with benzene, followed by fluorometric analysis to determine the quantities of benz(a)pyrene (BP). No BP was found in the control samples taken from resting land near a water reservoir but the highest level of (191,00 gamma/kg.) was found in soil near large factories which were known to discharge large quantities of carcinogenic hydrocarbons. Within Moscow, soil was slightly polluted, with 436.5 gamma/kg. found in a district with old buildings with an asphalt plant, and 104.5 gamma/kg. in a district with new housing. An industrial suburb had 81.4 gamma/kg. and a field near Moscow had 79.3 gamma/kg. The suburb was polluted by a railroad station and the field was very close to a well-traveled highway. Thus, soil pollution depends on the overall pollution of the environment and may serve as an indicator of the level of BP air pollution. Some investigators have found air pollution to spread at least 3 km. around factories, with intensity dependent upon wind direction. The level of BP on vegetation was also examined. Plants from the vicinity of the factory were found to carry 600-5900 gamma/kg. of BP before washing, and slightly less (40-1900) after washing. More BP was found in plants with broad, level leaves than in those with narrow, vertical ones. Three test strains of soil bacteria actively destroy BP CONTENT IN SOIL SAMPLES taken near an oil refinery. The amount of transformed BP can reach 535 in four days. Thus, carcinogenic hydrocarbons can fall on soil, appear in water, can be accumulated in soil or disappear, can be destroyed by soil microorganisms, or pass into plants.

Laseter, John Luther

DISTRIBUTION AND NATURE OF SURFACE WAX IN FUNGAL SPORES AND MECHANISMS OF WAX BIOSYNTHESIS IN BRASSICA OLERACEA. Thesis (Ph. D) Houston Univ., Tex., June 1968, (8) p.

Normal alkanes were common in surface waxes of all Basidiomycete chlamydospores and uredospores analyzed as well as the conidiospores for the Ascomycete studied. The spore samples were extracted with organic solvents, the extracts fractionated by silica gel chromatography and then analyzed by gas chromatography and by a gas chromatographic-mass spectrometric technique. Odd carbon-numbered alkanes predominated. Carbon numbers ranged from C14 to C37. The major n-alkane components and total hydrocarbons present were C27 for *Ustilago maydis* (40 ppm), C29 for *Puccinia graminis* (105 ppm), C29 and C31 for *Urocystis agropyri* (126 ppm), C27 and C35 for *Ustilago nuda* (58 ppm), C29 and C31 for *Ustilago avenae* (53 ppm) and C29 for *Sphacelotheca reiliana* (146 ppm). The conidiospores of *Aspergillus niger* had n-C25 as the predominant alkane and a total of

5-10 ppm hydrocarbons present. For the most part the alkanes present in fungal spores were similar to the distribution known to occur in many higher plants; however, each spore type possessed a different distribution pattern. (Author's abstract)

11010

Smith, M. E.

THE INFLUENCE OF ATMOSPHERIC DISPERSION ON THE EXPOSURE OF PLANTS TO AIRBORNE POLLUTANTS. *Phytopathology*, 58(8):1085-1088, Aug. 1968.

Variations in atmospheric dispersion and the typically nonuniform distribution of pollutant sources cause wide fluctuations in pollutant concentrations at a fixed point on the ground. These variations in concentrations are usually correlated with other meteorological parameters, time of day, and the levels of other pollutants. The details of this variability differ strikingly, depending upon the relative location of the plants and the sources and upon the climatology of the area in which the problem exists. An outline of the magnitude and time scales of these fluctuations is presented. Specific correlations with other factors that may be important in designing meaningful dosage tests for pollutants are indicated. Without tests that simulate conditions in the normal atmospheres laboratory experiments will be misleading, and apparent sensitivities may bear little relation to the response of the plant in the field.##

11072

Heck, Walter W.

FACTORS EFFECTING THE RESPONSE OF PLANTS TO OXIDANT AIR POLLUTANTS. Preprint, Dept. of Agriculture, Washington, D. C., Agricultural Research Service and Public Health Service, Washington, D. C., National Air Pollution Control Administration, 9p., ((1968)). 6 refs.

The effects of oxidants in general, including ethylene and NO<sub>x</sub> on plants are discussed. The problems of chronic plant damage and synergistic effects, such as those discovered for ozone-SO<sub>2</sub> mixtures, are considered and are shown to be difficult to detect and evaluate. Projections of ozone concentration producing injury in various plants are presented, and the topics of crop yield reduction and land use are briefly covered.##

11100

Abeles, F. B., and H. E. Gahagen, III

ABSCISSION: THE ROLE OF ETHYLENE, ETHYLENE ANALOGUES, CARBON

DIOXIDE, AND OXYGEN. (TECHNICAL MANUSCRIPT.) Dept. of the Army, Frederick, Md., Plant Sciences Lab., Proj. 1B522301A061, TM-462, 15p., June 1968. 25 refs.

For beans, ethylene was the most effective abscission accelerant examined, with decreasing activity shown by propene, carbon monoxide, dioxide, acetylene, vinyl fluoride, 1-butene, and 1,3-butadiene. Carbon dioxide inhibited abscission, but its effect was overcome by ethylene. Oxygen was required for abscission as an electron acceptor for respiration and not as a potentiator or activator of the ethylene attachment site. The molecular requirements for abscission were similar to those shown by other workers for other biological processes under the influence of ethylene. (Authors' abstract)##

12042

Heggestad, H. E.

DISEASES OF CROPS AND ORNAMENTAL PLANTS INCITED BY AIR POLLUTANTS. Phytopathology, 58:1089-1097, Aug. 1968. 80 ref.

Air pollution injury to crop and ornamental plants is increasing in the U.S.A. Estimates of annual losses to agriculture from air pollutants, which ranged from \$150 to \$500 million during the decade 1951-1960, are now \$500 million. Although most of the loss is due to growth suppression or chronic injury, it is the acute injury that suggests the nature of the air pollutant and reveals the distribution of the problem. Each pollutant tends to produce its own pattern of injury, leaving graphic records of air pollution episodes. Photochemical oxidants, ethylene, sulfur dioxide, fluoride, and other pollutants produce marked reactions in various types of plants. The recent developments and current research trends in the assessment of these reactions are reviewed.##

12045

Johnson, H.

THE HIGH COST OF FOUL AIR. The Progressive Farmer, 4 pp., April 1968.

The President's Science Advisory Committee reported in 1965 that air pollution damage to plants had been observed in 27 states, the District of Columbia, Canada, and Mexico. Total damage each year to crops in the United States is estimated at \$500 million. Weather fleck damage to tobacco, which is caused by ozone, has caused substantial crop loss in all producing states. Sulfur dioxide, fluorine, ethylene, and photochemical smog are known to be harmful to plants. A research program to solve unanswered questions, and a program to enforce the cleaning up of pollution sources is urgently needed.##

14968

Daines, Robert H., Eileen Brennan, and Ida Leone

AIR POLLUTANTS AND PLANT RESPONSE. J. Forestry, 65(6):381-384, June 1967. 15 refs.

The effects of a number of acid gases and photochemically-produced pollutants on plants are described. A great variation in susceptibility to damage by such gases as fluorides and SO<sub>2</sub> exist both among plant species and within a single species. Injury from these gases occurs primarily to younger leaves, with little or no damage shown by old leaves. Symptoms usually consist of marginal and tip necrosis with accompanying discoloration of the affected areas. Limited studies with chlorine suggest that it is less phytotoxic than hydrofluoric acid, requiring about 0.1 ppm to injure the more sensitive plants. Among the photochemically-produced pollutants, ozone has been known for many years to be toxic to a wide variety of plant species; ozone toxicity symptoms appear as flecks, stipple, streaks, spots, and tip necrosis. Injury appears on mature leaves, with the oldest leaves of young plants and middle-aged leaves of old plants being most susceptible. Peroxyacetylnitrate (PAN) and its analogues are highly phytotoxic, producing symptoms called 'silver leaf' and 'leaf banding' in California, the northeastern U. S., and other urbanized areas. Like ozone, these compounds are believed to cause severe annual economic losses in crop damage. Investigations of damage caused by other photochemical pollutants, namely ozonated hydrocarbons, bisulfite reaction products, and nitrogen dioxide, are briefly summarized, and the major sources of all the pollutants discussed are noted.

16357

Otto, Harry W. and Robert H. Daines

GENESIS OF PHYTOTOXIC AIR POLLUTANTS AND THEIR IDENTIFICATION AND MEASUREMENT BY CHEMICAL AND PHYTOLOGICAL METHODS. IEEE (Inst. Elec. Electron. Engrs.) Trans. Geosic, Electron., GE-8(1):59-69, Jan. 1970. 105 refs. (Presented at the First Annual International Geoscience Electronics Symposium, Washington, D. C., April 1969.)

Phototoxic air pollutants derived from combustion of fossil fuels and from subsequent photochemical reactions in the atmosphere are discussed. Among the major pollutants that adversely affect vegetation are sulfur dioxide, ozone, peroxyacyl nitrate (PAN) and analogs, nitrogen oxides, and ethylene. The chemical methods currently employed to measure the occurrence of these pollutants frequently lack specificity and sensitivity to specific pollutants. In the absence of collaborative testing, their reliability, precision, and accuracy remain uncertain. Because the plant kingdom serves as a constant atmospheric monitor, the chemical methods should be supplemented by a study of plant response. Each pollutant has its own spectrum of responding plant species and each produces a characteristic response for each species affected.

While man-made monitoring devices record exact chemical concentrations unaffected by environmental factors and pollutant mixtures, a plant responds biologically not only to concentrations, but also to all other environmental factors that alter response, i.e., humidity, soil moisture, light, temperature, etc. In addition, the plant also responds to the total impact of the pollution mixture.

## H. EFFECTS - MATERIALS

00115

R. L. Ajax, C. J. Conlee, and J. B. Upham

THE EFFECTS OF AIR POLLUTION ON DYED FABRICS. J. Air Pollution Control Assoc. 17,(4) 220-4, April 1967.

This report details results from the first 6 months of a 2-year study begun in February 1965 by The American Association of Textile Chemists and Colorists and the Public Health Service to evaluate the effects of air pollution upon dyed fabrics. Groups of 69 dye-fabric combinations representing widely used dyes have been exposed in light-free cabinets to ambient environments at urban and rural sites at Chicago, Washington, D.C., Tacoma, and Los Angeles, and at urban sites at Cincinnati, Phoenix, and Sarasota. Results from consecutive 3-month seasonal exposures and controlled-environment exposures utilizing irradiated and nonirradiated automobile exhaust for short duration show an extreme fading on one quarter of the dyed-fabrics, a higher fading at urban compared with rural sites on susceptible fabrics, and a marked effect upon the dyed fabrics by the photochemical by-products of automobile exhaust. (Author abstract)##

01467

J. S. Harington

CHEMICAL STUDIES OF ASBESTOS. Ann. N.Y. Acad. Sci., Vol. 132:31-47, Dec. 31, 1965. (Presented at the Biological Effects of Asbestos Conference, New York City, Oct. 19-21, 1964.)

The present paper reports the results of chemical investigations of the organic matter and metals in different types of asbestos. The primary oils which exist in natural association with crocidolite and amosite have been found to occur in larger amounts than reported earlier, although the content of benzo(a)pyrene and other polycyclic aromatic hydrocarbons remains low. Secondary oils, the composition of which is fairly well known, may contaminate asbestos in various ways. Insulation materials, recently shown to be a carcinogenic hazard to workers handling them, also contain considerable amounts of extractable materials though their significance, like that of the asbestos oils, is at present unknown. The possibility that metal constituents may play a role in asbestos carcinogenesis was suggested by the results of the spectrochemical analysis of the three main types of asbestos, and by their chemical composition. Consideration was also given to the possibility that radioactivity may play some part in the carcinogenic process.##



01983

A. P. Altshuller, A. F. Wartburg, I. R. Cohen, and  
S. F. Sleva

STORAGE OF VAPORS AND GASES IN PLASTIC BAGS. Intern. J. Air  
Water Pollution 6, 75-81, 1962.

Plastic bags of "Scotchpak" are satisfactory over 24 hr periods for storing synthetic and atmospheric samples of aliphatic hydrocarbons and acrolein, but not for storing formaldehyde, ozone, nitrogen dioxide. Plastic bags of "Mylar" are satisfactory for storing synthetic mixtures containing formaldehyde over 24 hr periods and ozone, nitrogen dioxide, and sulfur dioxide for at least several hour periods. Formaldehyde in atmospheric gases can be stored for several hours. New bags of these materials should be conditioned for several hours using the gases of vapors of interest at the same or somewhat higher concentrations than are to be used in the investigations to follow. Bags which are so treated should serve as convenient storage containers for the gases studied, as well as many other chemical species over periods of many hours. However, very appreciable losses of many of these gases may occur when present as part of combustion gas mixtures collected in such plastic containers. (Author abstract)##

02060

Z. Travnicek.

EFFECTS OF AIR POLLUTION ON TEXTILES, ESPECIALLY SYNTHETIC FIBRES. Proc. (Part I) Intern. Clean Air Cong., London, 1966. (Paper VII/4). pp. 224-6.

The Czechoslovak Knitting Industries Research Institute's laboratory for atmospheric defectochemistry of fibres has investigated the deterioration of fibres due to atmospheric pollutants. By analyzing witnesses' reports, by inspecting textiles damaged in the open and, above all, by operating special simulation apparatuses it has been established that apart from hot particles textiles, especially those of some synthetic fibres, can be destroyed by sulphur dioxide, especially if the latter is absorbed to solid carrier aerosols, by nitrogen oxides, by some substances contained in automotive exhaust gases, by various acid fumes, by strong oxidizers and by solvent vapours. Exhaust gases cross-link the fibre-forming polymers while, at the same time, degrading them. Light stabilizers in fibres also act as preventers of damage by exhaust fumes, to a certain degree. Dyestuffs can be efficient in a similar way. Automotive exhaust gases are sometimes more destructive if present in great dilutions in air irradiated by sunlight. In this case, a formation of strong oxidizers from residual olefins and nitrogen oxides is suspected. (Author abstract)##

02074

G. F. Bol'shakov, P. I. Davydov, T. G. Potapenko,  
P. Yu. Bachinskiy, and N. M. Slavachevskaya.

INFLUENCE OF NATURAL AND SYNTHETIC SULPHUR- AND NITROGEN-CONTAINING COMPOUNDS ON THE THERMOOXIDIZING STABILITY OF DIRECT DISTILLATION OF FUELS. Gostoptekhizdat (Moscow) (FTD-MT-64-215). 5, 149-82, 1963.

CFSTI, DDC AD 611071

Synthetic sulfur- and nitrogen-containing organic compounds basically lower the thermooxidizing stability of directly distilled fuels, with the exception of 2-phenyl-2-mercaptobutylamine, 1,2,3,4-tetrahydroquinoline; certain derivatives of ionol; and the product, obtained by the interaction of styrene with phenol. TS-1, T-1, and DA tars contain compounds, which, in small concentrations, are able to improve effectively the thermooxidizing stability of fuels. These are basically - heterocyclic compounds, containing thiol, amine, and phenyl groups.##

02380

J. B. Upham.

MATERIALS DETERIORATION AND AIR POLLUTION (PRESENT STATUS OF THE PUBLIC HEALTH SERVICE'S PROGRAM). J. Air Pollution Control Assoc. 15, (6) 265, June 1965. (Presented at the 57th Annual Meeting, Air Pollution Control Association, Houston, Tex., June 21-25, 1964, Paper No. 64-31.)

Four separate studies dealing primarily with atmospheric corrosion are presently in progress and constitute the first phase of an over-all program to assess materials deterioration due to air pollution. The objectives of these studies and the methodology used are described, and limited preliminary data are reported. From the findings of these and subsequent studies we hope to determine the role of air pollution in the deterioration of many materials. (Author summary)##

03215

M. Kobayashi, T. Mikani, and Y. Senoa.

EFFECTS OF AIR POLLUTION AND ITS PREVENTION ON INTERNATIONAL TELECOMMUNICATION SYSTEMS. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo) 3, (6) 45-51, Mar. 1966.

The effects of inorganic gases, organic gases, and soot on pure palladium are investigated. Palladium is used at the contacts in crossbar switches and wire spring relays and pollutants cause poor electrical connection.##

03524L

S. Miller

OZONE RESISTANCE BARRIER MATERIAL. Army Tank-Automotive Center, Warren, Mich. (Rept. 4811.) Mar. 28, 1960. 6 pp.  
DDC: AD 477 540

In order to establish the efficacy of plastic barrier material in delaying ozone deterioration on rubber items, static O3 tests

(50 plus or 3 pphm O3 by vol) were carried out at temperature of 100 F on rubber test specimens wrapped in the following plastic materials: black polyethylene sheet films, 2 and 4 mils thick; transparent saran sheet film, 2 mils thick; commercial transparent plastic shirt bag, 1 mil in film thickness; black polyethylene bag film, 2 mils thick, formed by folding and sewing 2 sides; and transparent polyethylene envelope, heat sealed on 3 sides, film thickness of 6 mils. Rubber specimens were reported in satisfactory condition after 20, 40, 25, 40, 22, and 250 days' exposure, protected respectively, by the above named materials. Doubling the black polyethylene film doubles the time before deterioration takes place; also the better the seal, the longer it takes before ozone deterioration commences.##

03995

HOW TO PROTECT ELASTOMER PARTS FROM OZONE ATTACK. Mater.  
Design Eng. 64, (2) 82-3, Aug. 1966.

Susceptibility of an elastomer to ozone deterioration is related to its proportion of unsaturated carbon-to-carbon bonds. As O3 attacks these bonds, elastomers with a large proportion of them are very vulnerable. Commercial elastomers can be divided into 3 groups according to their O3 resistance: Group A (inherently O3-resistant) includes fluoroelastomers, silicone rubber, fluorinated silicone rubber, polyacrylate, chlorosulfonated polyethylene, ethylene-propylene copolymers and terpolymers, polyurethanes, polysulfide rubber, epichlorohydrin elastomers; Group B (O3-resistant but requiring special formulation for optimum performance) includes butyl and halogenated butyl rubbers; Group C (inherently non-O3-resistant) includes natural rubber, polyisoprene rubber, SBR, NBR, polybutadiene rubber. Hydrocarbon waxes and lacquers have been used in the past for protection but have the disadvantage of rupturing when flexed, leaving the vulnerable elastomer exposed. A new class of chemical derivatives, P-phenylenediamines have been found to be effective against O3 attack. These additives are added to the rubber during mixing, bloom to the surface during vulcanization and form a film which reacts with the atmospheric O3 before it comes into contact with the elastomer. When an elastomer will be exposed to substances which may dissolve the protective films, blending of highly resistant O3 materials is the best approach.##

04320

Jaffe, L. S.

THE EFFECTS OF PHOTOCHEMICAL OXIDANTS ON MATERIALS. J. Air  
Pollution Control Assoc. 17(6):375-378, June 1967.

The deterioration of materials exposed to photochemical smog, in particular to the oxidants and ozone contained therein, are reviewed. One of the earliest indications of photochemical oxidants was the excessive cracking of rubber products. It has been demonstrated that this excessive cracking of rubber is caused by ozone formed in the photochemical smog formation process. Other materials known to deteriorate under atmospheric photochemical smog conditions are textiles and certain dyed

fabrics, particularly under conditions of high humidity. Loss of tensile strength of cotton textiles when wet or moist, and similar fading of these dyed fabrics, particularly under high humidity, can be produced by laboratory exposure of these textiles to pure ozone. Depending on the formulation of the rubber, cracking under stress can be readily detected within 3/4 hr when atmospheric oxidants levels are as low as 0.03 ppm. Natural and certain synthetic rubbers are particularly vulnerable. These rubbers when stressed show cracking when exposed to 0.02 ppm ozone for about 1 hr. Ozone effects on asphaltic materials are reported also. AAM##

05233

P. J. Hearst

VOLATILE PHOTODEGRADATION PRODUCTS OF ORGANIC COATINGS. Naval Civil Engineering Lab., Port Hueneme, Calif. July 1966. 36 pp. (Technical Rept. (No. R 460.)

Various clear and pigmented vehicle films were irradiated in air with a mercury arc and a xenon arc. The volatile photodegradation products were identified by infrared spectroscopy. The coatings included alkyd, oil, vinyl-alkyd, vinyl copolymer, partially hydrolyzed vinyl copolymer, polyvinyl acetate, epoxy-amine, and epoxy-polyamide films. The major product from all films was carbon dioxide. Eleven other products or types of products were obtained, as well as some unidentified products. The addition of pigments decreased the yields of almost all the products. However, the yields of different products were affected in different degrees by pigmentation, and this difference may in part be related to the penetration of the light responsible for the production of each particular product. (Author abstract)

08475

Veber, A.

ATMOSPHERIC POLLUTION AS A FACTOR IN THE AGING OF ELASTOMERS. ((La pollution atmospherique comme facteur de vieillissement d'elastomere.)) Text in French. Rev. Pathol. Comparee (Paris), 67(784):21-24, Jan. 1967. 2 refs.

A technique for the evaluation of aging of natural rubber films is described. Aging is determined either by loss of resistance to breaking, expressed in gm./sq. of section, or by variation in the modulus of elasticity. The mathematical calculation of resistance to rupture correlates with the observed results. A series of rubber films formulated with the following agents were tested: (1) with the bridge catalyst, phenylethylthiocarbamate; (2) with the catalyst and an antioxygenating agent, bis-(2-hydroxy-3-butyl-5-methylphenyl) methane; (3) with the catalyst and titanium dioxide; (4) with the catalyst and isopropyl N-phenyl-D-phenylene diamine; and, (5) with all four agents. Samples of the first three rubber formulations, when exposed to polluted air, exhibited marked decreases in tensile strength with age (25.5-65.2% decrease). Only the samples formulated with the diamine or with all four agents exhibited no significant decrease in tensile strength (1.5% increase, and 0.2% decrease, respectively).##

Pink, Ferdinand

THE COMBUSTION OF DOMESTIC REFUSE CONTAINING A HIGH PROPORTION OF SYNTHETIC MATERIALS. (Verbrennung von Hausmuell mit hoeheren Kunststoffanteilen). Text in German. Brennstoff-Waerme-Kraft, 21(9):472-476, Sept. 1969. 8 refs.

The domestic refuse in the city of Zurich contained 1.1 to 2.7% by weight of synthetic material in the years 1963 and 1964, as compared with other large cities where it contained 4 to 5%. In Germany, half of the synthetics in domestic refuse are composed of polyvinyl chloride (PVC). The relatively low PVC fraction in the waste causes corrosion problems. Polyvinyl chloride begins to melt at 120 C; at 200 C, it begins to separate. It has a heating value of 6000 kcal/kg; the ignition point is 460 C. Domestic refuse is incinerated with a large amount of excess air. The heterogeneous waste composition causes a fluctuating combustion process. Thus, the waste gas composition varies as follows: 7 to 11% by volume CO, 10 to 16% water vapor, 6 to 10% oxygen, and 0.2 to 1.0 g/cu m HCl. Varying gas composition and fluctuating temperatures damage the oxide layer on the steel pipes. There are two types of corrosion: sulfate corrosion and chlorine corrosion. It is generally thought that sulfate corrosion is due to alkali pyrosulfates which, when superheated, yield activated SO<sub>3</sub>. The latter substance is highly corrosive. Chlorine corrosion is due to the presence of HCl. In oxidizing waste gases, HCl attacks only metal; in reducing waste gases, iron oxide and dust incrustations may adsorb HCl, which is liberated again at higher temperatures. The chlorine gas and the HCl which develop in this manner are both highly corrosive after desorption. To prevent chlorine corrosion, large amounts of water vapor must be present in the waste gas. Injection of water into the combustion chamber helps to fulfill this demand. Furthermore, reducing components in the waste gas must be avoided. The temperature at the pipe wall should never exceed 400 C.

## I. EFFECTS - ECONOMIC

3289

L. J. Sterba.

REFINING TO PRODUCE GASOLINES OF REDUCED LEAD CONTENT.  
Universal Oil Products Co., Des Plaines, Ill. (Presented  
at the Symposium on Environmental Lead Contamination, Public  
Health Service, Washington, D.C., Dec. 13-15, 1965.) Mar.  
1966. PP. 113-30.

GPO 0-210-345; HEW 1440

In the variations of the generalized situations considered in this discussion, the estimated incremental manufacturing cost to the refiner for making an unleaded gasoline of current octane number quality ranged from 1.1 to 1.5 cents/Gal. above what it costs to make current gasolines. This incremental cost will vary, both above and below the range indicated, depending on the refinery size, its type, its location, crude characteristics, crude supply situation, products made, price structures, labor costs, accounting methods, and many other factors. The important conclusion to be made is that it is possible to make unleaded gasolines, but at costs that must be passed on to the driving public. In order to market the same amount and quality of clear gasoline as the refiner presently sells of leaded gasoline, he must either market less of distillates or residual fuel, or process more crude oil. Based on estimates made for a 50,000 BSD refinery, the U.S. refining industry would be required to make a capital investment of 1.5 to 2 billion dollars. This is to be compared with annual expenditures of the order of 500 million dollars for normal refinery expansion and modernization.##

07698

Liston, Linda

AIR AND WATER POLLUTION: DOES IT LIMIT INDUSTRIAL EXPANSION?  
Ind. Develop., 136(5):14-21, July-Aug. 1967.

The cost of cleaning the nation's air and water is discussed, with particular emphasis on the role of industry. The Public Health Service estimated that the cost of air pollution in 1960 was \$7 billion. They estimated that it is now costing about \$11.5 billion and it may increase to \$20 billion by 1975 for abatement equipment, extra cost of cleaner fuel, and damage to crops, buildings and other property. The need to deal with the increasing amounts of air and water pollution affects plant operations and

11204

Lawson, S. D., J. F. Moore, and J. B. Rather, Jr.

A LOOK AT LEAD ECONOMICS IN MOTOR GASOLINE. Preprint, Phillips Petroleum Co., Bartlesville, Okla., Bonner and Moore Associates, Inc., Houston, Texas, and Mobil Oil Corp., New York, 35p. 1967. 7 refs. (Presented at 32nd Midyear Meeting of Refining, Fuels and Emissions, Los Angeles, Calif., May 16, 1967, Paper 36-67.)

The potential economic effects on the domestic refining industry that would result from completely eliminating the use of lead additives in motor gasoline were investigated. A complete technical and economic report containing results as well as a compilation of data is presented.##

16174

COSTS AND ECONOMIC IMPACTS OF AIR POLLUTION CONTROL FISCAL YEARS 1970-1974. Ernst and Ernst, Washington, D. C. Contract PH 22-68-29, Task Order 2, 321p., Oct. 1969. 26 refs.

A study was conducted to estimate prospective additional costs to the private sector of the economy of controlling air pollution from both stationary and mobile sources during the years 1970-1974. The pollutants considered are particulate and sulfur oxides from stationary sources and hydrocarbons and carbon monoxide from automobiles. Estimates of control conditions prevailing prior to the passage of the Air Quality Act (1967) were taken as a base. Two types of stationary sources are considered: combustion and process. Costs are estimated for controlling three classes of combustion sources: steam-electric power generation industrial fuel combustion, commercial fuel combustion. Industries for which process emission control costs are developed are sulfate pulping, sulfuric acid manufacture, petroleum refining, asphalt batching, hydraulic cement production, steel production, ferrous casting, and nonferrous metals smelting and refining. Only automobiles are included in the mobile source class. Estimates of additional costs to the private sector are developed for nationwide control of sulfur oxides and particulates from stationary combustion sources; nationwide control of particulate from process sources in eight selected industries and of sulfur oxides from sulfuric acid and petroleum refining process; nationwide control of automobile exhaust emissions; and combined control of sulfur oxides and particulates from combustion and process sources in 85 geographical areas. Estimated costs are presented as ranges within which actual costs can be expected to fall. The economic implications of control costs for the nation are discussed. The additional costs range from \$0.9 to \$1.7 billion dollars for 1970 and rise to \$1.0 to \$1.9 billion in 1974. (Author summary modified)

16417

Francis, A. W. and Judson D. Lowd

HOW TO INCREASE LIQUID RECOVERY FROM YOUR GAS-CONDENSATE OIL WELLS. Gas J., 57(51):68-75, Dec. 14, 1959.

High-efficiency liquid recovery methods, economically justified, are used on wet gas streams. Evaluation of the wellhead or lease-type processes covers: stage separation, liquid processing (stabilization), adsorption recovery from high-pressure separator gas, or combinations of these. Three divergent but typical gas-distillate well streams classified as lean, rich, and very rich are considered. The factors evaluated for each process on each stream are: liquid recovery efficiency, optimum separation conditions, gross operating incomes generated by increased recovery efficiency, differential expenses associated with increased recovery efficiency, the pattern for payback of increased investment, and the rate of return on the increased investment.



## J. AIR QUALITY MEASUREMENTS

00110

R. I. Larsen

DETERMINING SOURCE REDUCTION NEEDED TO MEET AIR QUALITY STANDARDS. Proc. (Part I) Intern. Clean Air Cong., London, 1966. (Paper III/8.)pp. 60-4.

Air pollutant concentrations can be expressed as a function of location, averaging time, and frequency that a certain concentration is exceeded. Concentration data can be used with air quality standards to calculate the overall source reduction needed to meet a standard. The calculations can be refined to consider the effects of future growth, rural background concentrations, secondary pollutants arising from photochemical and other atmospheric interactions, and the contribution from each source or source type in a city. (Author)\*\*

00111

E. Sawicki, H. Johnson and M. Morgan

COMPARISON OF FLUORIMETRIC METHODS OF ASSAY FOR 7H-BENZ(DE)ANTHRACEN-7-ONE IN AIRBORNE PARTICULATES AND AIR POLLUTION SOURCE EFFLUENTS. Mikrochim. Acta (2) 297-306 1968.

Various modifications of a thin-layer chromatography fluorimetric method for the determination of 7H-benz(de)anthracen-7-one (BO) and phenalen-1-one (PO) in complex mixtures have been compared. The best modifications consisted of one-dimensional thin-layer chromatography followed by elution, solution in trifluoroacetic acid, followed by either spectrophotofluorimetric or fluorimetric assay. In some cases a quenching agent was necessary to quench the fluorescence of the interferences. Urban atmospheres and air pollution source effluents can be analyzed by these micromethods. These methods with slight modification could be applied to the determination of the aza heterocyclic and the other ring-carbonyl compounds found in urban atmospheres and air pollution source effluents. (Author)\*\*

00241

R.W. Hurn D.E. Seizinger

AIR POLLUTION INVENTORY - ENTER THE DIESEL. Proc. Am. Petrol. Inst., 45(111):127-132, May 1965. (Presented at the 30th Midyear Meeting, American Petroleum Inst. Div. of Refining, Montreal, Canada, May 10, 1965.)

Exhaust gases from truck-type diesel engines tested on a dynamometer stand were shown to involve hydrocarbons, oxides of nitrogen, and formaldehyde in significant quantities. Without reference to similar modes of operation, each class of pollutant was found to be generated in the diesel combustion in concentrations comparable to concentrations found in automotive (gasoline-powered) equipment. Although some trends in the data were observed, the experimental program was not extensive enough to justify conclusions regarding effects of fuels, engine design, or mode of engine operation. In comparing present findings with previously published information, the authors have noted interpretations of data that do not readily reflect the significant magnitudes of diesel emissions. Both the real contribution of diesels to air pollutant loading and the participation of these pollutants in the photochemical system should be weighed more carefully. (Authors' abstract)##

00251

L. R. Reckner, W. E. Scott and W. F. Biller

THE COMPOSITION AND ODOR OF DIESEL EXHAUST. Proc. Am. Petrol. Inst. 45(111):133-147, May 1965. (Presented at the 30th Midyear Meeting, American Petroleum Inst. Division of Refining, Montreal, Canada, May 10, 1965.)

Sampling and analysis techniques are described for determining light hydrocarbons, oxides of nitrogen, formaldehyde, acrolein, total aldehydes, total particulate, and polycyclic aromatic hydrocarbons in diesel exhaust. Using the techniques described, results are reported on the composition of exhaust from two diesel engines, a two- and a four-cycle, under a variety of operating conditions. Smoke ratings using different techniques are also reported and compared to total particulate results. No correlation was found between smokemeter ratings and particulate loadings at other than black smoke conditions. Human panel observations of exhaust odor are being made as part of a continuing program, but no panel data are reported. (Authors' abstract)##

00447

W. H. Toliver, Sr. and M. L. Morris

CHEMICAL ANALYSIS OF PERMANENT AND ORGANIC GASES IN A 30-DAY MANNED EXPERIMENT. Aerospace Med. 37(3):233-238, Mar. 1966.

Chemical analyses of the permanent gases and the trace volatile organic constituents were performed on a 30-day manned experiment. This experiment was primarily concerned with the feasibility of providing a suitable atmosphere for three men. The major portion of the oxygen required by the subjects was obtained from their exhaled carbon dioxide by means of the Sabatier process. The primary instrumentation used was the gas chromatograph. The adjunct instrumentation was infrared spectrophotometry and mass spectrometry. Consideration is given to the sampling and analytical procedures used. Organic compounds unique to space cabin and evaluator studies are reported. Indications of future gas chromatography methodology are given.##

00534

C. B. Robinson, F. L. Meadows, and J. J. Henderson

AIR POLLUTION PATTERNS IN THE GREATER BIRMINGHAM AREA.  
Preprint. 1965.

In 1962, the Alabama Respiratory Disease and Air Pollution Study was initiated to determine the prevalence of various pulmonary disorders and to relate these findings with air quality data. This paper describes part of the aerometric effort begun in December 1963 in the Greater Birmingham Area. Samples for analysis of suspended particulate, dustfall, sulfation, and 24-hour gases (nitrogen dioxide, sulfur dioxide, and aldehydes) were collected routinely from 21 stations located primarily in residential areas. The sampling network, analytical methods, and statistical procedures used are discussed. Air quality results are presented with emphasis on spatial and temporal variations. (Authors' abstract)##

00321

R. I. Larsen, C. E. Zimmer, D. A. Lynn, K. G. Blemel

ANALYZING AIR POLLUTANT CONCENTRATION AND DOSAGE DATA. J.  
Air Pollution Control Assoc. 17, (2) 85-93, Feb. 1967.  
(Presented at the 59th Annual Meeting of the Air Pollution Control Association, San Francisco, Calif., June 20-24, 1966, Paper No. 66-93.)

Continuous air pollutant concentration data have been analyzed for carbon monoxide, hydrocarbons, nitric oxide, nitrogen dioxide, nitrogen oxides, oxidant, and sulfur San Francisco, and Washington for years 1962 through 1964. Concentrations are approximately lognormally distributed for all pollutants in all cities for all averaging times. Maximum concentration is inversely proportional to averaging time to an exponent. Air pollutant dosage (concentration times time) above various threshold concentrations has been computed for all of the pollutants in all of the cities for year 1964. Equations have been developed from these analyses to predict the frequency of occurrence of air pollutant dosages of various intensities as a function of the geometric mean and standard geometric deviation. An example is shown for predicting the number of occurrences of sulfur dioxide dosages that might cause acute plant damage. (Author)##

00526

Middleton, J. T.

CONTROL OF ENVIRONMENT - ECONOMIC AND TECHNOLOGICAL PROSPECTS.  
Preprint. In: Environ. Improvement: Air, Water, Soil, pp. 53-71, Oct. 1966. (Presented at the Dept. of Agriculture on or about May 24, 1966)

Man's exploitation of land, water, and air has caused serious pollution of his environment, not only affecting man but other

E. Sawicki, J. E. Meeker, and M. J. Morgan

THE QUANTITATIVE COMPOSITION OF AIR POLLUTION SOURCE EFFLUENTS IN TERMS OF AZA HETEROCYCLIC COMPOUNDS AND POLYNUCLEAR AROMATIC HYDROCARBONS. Intern. J. Air Water Pollution 9, 291-8, 1965.

Eleven heterocyclic compounds and twelve polynuclear aromatic hydrocarbons have been determined in the effluents from the stack of a coal-heated residence, in effluents from two industrial sources and in air contaminated with coal-tar-pitch fumes. These compounds were present in extremely large amounts. In addition to the hydrocarbon carcinogens, such as benzo(a)pyrene and benzo(a)anthracene, some aza heterocyclic carcinogens were found, e.g., dibenz(a,h)acridine, dibenz(a,j)acridine, and some possibly carcinogenic alkylbenz(c)acridines. A large number of the other aza heterocyclic compounds were present but were not determined because of the unavailability of standards. (Author abstract)##

00682

W. Ingram, J. R. McCarroll, E. J. Cassell, and D. Wolter

HEALTH AND THE URBAN ENVIRONMENT (AIR POLLUTION AND FAMILY ILLNESS: II. TWO ACUTE AIR POLLUTION EPISODES IN NEW YORK CITY). Arch. Environ. Health Vol. 10(2):364-366, Feb. 1965. (Presented at the Seventh Annual Air Pollution Medical Research Conference, Los Angeles, Calif., Feb. 10-11, 1964.)

Article briefly describes two air pollution episodes in New York City, October 10-27, 1963 and November 8-December 4, 1962. The factors of meteorological conditions (and similarities) are considered in the study; also relative concentrations of SO<sub>2</sub> and hydrocarbon content.##

00689

G. E. Moore, W. B. Drowley, and M. Katz

POLYNUCLEAR AROMATIC HYDROCARBONS IN URBAN ATMOSPHERES IN ONTARIO. J. Air Pollution Control Assoc. Vol. 16(9):492-497, Sept. 1966. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965, Paper No. 65-116.)

In Canada a considerable number of polynuclear aromatic hydrocarbons has been extracted from particulate samples collected from the atmospheres of Windsor, Ottawa, Montreal and Vancouver, and the presence of 3,4-benzpyrene has been confirmed qualitatively, and, in a few cases, quantitatively but the samples have been collected somewhat at random and primarily for the purpose of developing analytical methods. This paper describes the results of a comprehensive sampling programme and the concentrations of a number of polynuclear aromatics found in the atmospheres of over 20 Ontario cities and towns.##

living organisms, quality of the land, water, and air resources. Not only must large sums of money be spent to restore the quality of man's environment, but it must be done quickly. The quality of air is determined by the uses made of air and by the pollutants injected into it by man. While some air contamination results from pesticides and chemical manufacturing the greatest degradation results from the use of air to support combustion. Principal pollutants from combustion for the development of energy and the propulsion of motor vehicles, and the manufacture of goods are liquid and solid particles, oxides of S and N, organic vapors, CO<sub>2</sub> and CO. The pollutant released in largest quantities throughout the nation is SO<sub>2</sub>, amounting to 23,300,000 tons a year. The quality of air within a given air shed depends upon the nature of pollutants, the quality of the air supply and the geographical and meteorological factors affecting the movement and dispersal of contaminants. One result of multiple pollution sources is the combination of N oxides and organic vapors in the presence of sunlight, resulting in photochemical air pollution i.e. ozone, peroxyacetyl nitrate (PAN), aldehydes, and organic acids. The resulting pollution effects are metal corrosion, building and fabric deterioration, cracking of rubber, visibility reduction, forest and agriculture damages, livestock injury health problems, and the spoiling of air environment. The recognized importance of these effects, the recognition of air pollution as a social problem, and the enactment of legislation to control air quality has occurred at both state and national levels.##

00727

L. DeMaio M. Corn

POLYNUCLEAR AROMATIC HYDROCARBONS ASSOCIATED WITH PARTICULATES IN PITTSBURGH AIR. J. Air Pollution Control Assoc., 16(2):67-71, Feb. 1966. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965, Paper No. 65-37.)

A sampling method which separately collected "respirable" and "non-respirable" particulates was used in conjunction with a new method of analysis to study the aromatic polynuclear hydrocarbon content of suspended particulates in the air of Pittsburgh during summer and winter months. Gas chromatography was successfully used for the first time to analyze airborne particulates for polycyclic hydrocarbon content. After benzene extraction of a particulate sample the time required, benz(a)anthracene, chrysene, benzo(k)fluoranthene, benzo(a)pyrene, and benzo(e)pyrene in respirable and non-respirable sample fractions are presented in terms of micrograms/1000 cubic meter of air, micrograms/g suspended particulate, and micrograms/g benzene soluble fraction. More than three-fourths by weight of the hydrocarbons studied were associated with respirable particulates, i.e., material collected on the filter stage of the sampling apparatus. Concentrations of all polycyclics except pyrene and benz(a)anthracene were greater in winter than in summer. The concentration of the highly carcinogenic benzo(a)pyrene was found to vary from 0.8 micrograms to 37.4 micrograms/1000 cubic meter. Approximately 60% of the 94 urban sites samples in 1959 by Sawicki were characterized by values below this average. In general, the profile of concentrations of the polynuclear aromatic hydrocarbons studied, with the exception of benz(a)anthracene, was quantitatively similar to those

reported by Sawicki for other American cities. Benz(a)anthracene was found to be present in Pittsburgh air at a concentration exceeding that of any other compound studies. Concentrations of benz(a)anthracene in other American cities are not reported in the literature and this new result awaits confirmation by analysts elsewhere. Presumably, lack of interest in this compound stems from its lower capacity for carcinogenesis relative to benzo(a)pyrene. (Author's summary)##

00730

E.M. Ilgenfritz, J.F. Shively, M.E. Krienke

SURVEYING AIR QUALITY AT DOW CHEMICAL COMPANY (AIR POLLUTION CONTROL ENGINEERS EXPLAIN). Air Eng., 7(10):20-28, Oct. 1965 (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965.)

An 18-station survey program was established in 1958 for Midland, Michigan, headquarters of The Dow Chemical Company and location of the Midland Division. This site contains a chemical complex with over 500 organic and inorganic chemical processes. Measurements of dustfall sulfation, sulfur dioxide, suspended dust, stain index, chlorides, hydrocarbons and corrosion are recorded and correlated with meteorological data. Air Pollution complaint data are also recorded both within the plant and in the community and form a part of this surveillance program. (Author's abstract)##

00739

C.E. Zimmer R.I. Larsen

CALCULATING AIR QUALITY AND ITS CONTROL. J. Air Pollution Control Assoc., 15(12):565-572, Dec. 1965. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965.)

Air quality is shown as a function of averaging times of five minutes to one year for carbon monoxide, hydrocarbons, nitric oxide, nitrogen dioxide, nitrogen oxides, oxidant, and sulfur dioxide in Chicago, Cincinnati, Los Angeles, New Orleans, Philadelphia, San Francisco, and Washington, D. C. Concentrations are approximately lognormally distributed for all pollutants in all cities for all averaging times. Maximum concentration is inversely proportional to averaging time to an exponent. The exponent is a function of the standard geometric deviation. General air quality and control parameters are derived and shown for one example, nitrogen oxides in Washington, D. C. These values are compared to one air quality standard. (Authors' abstract)##

00802

I.H. Williams

AN ATMOSPHERIC SURVEY OF CHILLIWACK, BRITISH COLUMBIA. Preprint. 1963.

A one-year study of the air pollution level of the City of Chilliwack has been completed. Methods employed and data collected for dustfall, sulfation rates, soiling index, hydrogen sulfide, oxidants and total hydrocarbons are presented. Difficulties experienced in the determination of very low oxidant levels are discussed. The results obtained indicate that the City is particularly free of air pollutants and thus will serve as a suitable base for comparative studies on the relationship between air pollution and other factors in the prevalence of certain chronic respiratory diseases. (Author abstract)##

00847

J.D. Williams N.G. Edmisten

AN AIR RESOURCE MANAGEMENT PLAN FOR THE NASHVILLE METROPOLITAN AREA. Public Health Service, Cincinnati, Ohio, Div. of Air Pollution. Sept. 1965. 160 pp.  
GPO: 822-811-8, HEW: 999 AP - 18

This report is based on the numerous technical and scientific papers resulting from a major study of air pollution and effects made in Nashville, Tennessee, by the Public Health Service, Vanderbilt University, and state and local agencies during 1958-59. These papers have been supplemented by field investigations to complete the background information needed for preparation of an air resource management program plan. The report summarizes a number of the technical and scientific papers and uses all of them to develop new concepts as well as unify new and old approaches to air pollution control in preparation of the air resource management program plan. Air quality goals and the means to reach those goals are suggested. Supporting data are provided and methodology adapted for relating air quality goals to control of emissions. Methods for predicting air pollutant levels by use of mathematical models are presented. Public opinion survey results and their implications for the air resource management program are given. The report has specific use for development of an air resource management program in Nashville and general use for program development and reference in many other places. (Author abstract)##

01010

A REPORT TO THE LEGISLATURE ON AIR POLLUTION IN COLORADO. Colorado State Dept. of Public Health, Denver. Feb. 5, 1964. 66 pp.

A series of studies by the State Department of Public Health, local health departments and other interested agencies and groups led to the present Colorado Air Pollution Law calling for the State Department of Public Health to study the air pollution problem and to recommend ambient air standards and control measures. Colorado is experiencing a rapid growth of population, urbanization and sources of air pollution, and meteorological and topographical features over much of the State are conducive to the development of serious air pollution conditions. With the assistance of the Colorado Air Pollution Advisory Committee, the State Dept. of Public Health has recommended standards for ambient air quality in the State. Air quality monitoring programs in six of Colorado's largest cities

were conducted and much information about the extent and nature of the air pollution problem was obtained. Three monitored areas (Denver Metropolitan Area, Boulder and Pueblo) definitely do not meet the ambient air quality standards established and one (Grand Junction) might not meet the standards. The geographical air pollution basins of the areas that do not meet the standards have been outlined, with the exception of Boulder. The geographical boundaries for Boulder will be determined at an early date. Measures for the abatement of air pollution within the State have been recommended and are listed. (Author summary)##

01089

V. J. Konopinski and L. J. Schafer

ORGANIC LEAD - CINCINNATI 1964. Preprint. 1964.

The U.S. Public Health Service and Kettering Laboratory cooperated in making this study to obtain additional data on the concentration of alkyl lead compounds in the atmosphere by varying the sample air volumes. Two different locations in Cincinnati were used to obtain ambient air samples. Particulate lead was removed from the air by millipore filters while scrubbers filled with iodine crystals served to separate out the organic lead compounds. Analysis for organic lead was by wet-chemistry techniques. Results corroborated the findings of Cholak and associates that organic lead compounds are present in the air in very small concentrations.##

01202

M. Nolan

A SURVEY OF AIR POLLUTION IN COMMUNITIES AROUND THE JOHN F. KENNEDY INTERNATIONAL AIRPORT (Sept. - Oct. 1964).  
Public Health Service, Cincinnati, Ohio, Div. of Air  
Pollution. June 1966. 82 pp.  
GPO,HEW: 826-792-2

A 1-month air-quality study was conducted in the communities adjacent to John F. Kennedy Airport in Queens and Nassau Counties, New York, from September 24 to October 24, 1964. Eight sampling stations were located in the area. Limited measurements of particulate matter and hydrocarbons, and odor observations yielded some evidence to indicate that aircraft operations contributed a small amount to particulate and hydrocarbon concentrations and to odor occurrence. Concentrations of particulates, odors, and hydrocarbons at the sampling stations were substantial and came from many sources in the metropolitan area. Thus, the small variations that occurred in measured air quality were not significantly correlated to aircraft emissions on a statistical basis. The number and percentage of jet aircraft using water injection during takeoff decreased markedly from 1963 to 1964 at the J. F. Kennedy Airport; therefore, smoke emissions caused by water injection have been reduced. This downward trend is expected to continue. Meteorological conditions during the study were near normal for this period of the year. Poor conditions for atmospheric dispersion were experienced for a



5-day period; however, no prolonged severe atmospheric stagnation occurred. Therefore, air contaminant concentrations that would exist under extremely adverse meteorological conditions could not be measured. The limited, modest studies did not show any difference in the characteristics of particulates emitted from jet, diesel, or gasoline engines.##

01270

M. Katz

QUALITY STANDARDS FOR AIR AND WATER. Occupational Health Rev. (Ottawa) 17(1):3-8, 1965. (Presented at the Occupational Health and Safety Conference, Canadian Congress of Labour, North Bay, Ontario, Nov. 16, 1964).

Author reiterates air quality standards and threshold limit values for gases and vapors (ppm) in the USSR and USA: ambient air quality standards and workroom air threshold limit values for some gases (carbon monoxide, chlorine, hydrogen chloride, ethylene, ozone, oxides of nitrogen and sulfur dioxide); air quality standards and threshold limit values for solids or liquids; and comparative ambient air quality standards for particulate matter. Data are given for California, Oregon, USSR, Czechoslovakia and West Germany.##

01471

S. P. McPherson, E. Sawicki, and F. T. Fox

CHARACTERIZATION AND ESTIMATION OF N-ALKANES IN AIRBORNE PARTICULATES. J. Gas Chromatog., Vol. 4:156-159, April 1966.

A system is presented for the characterization and analysis of atmospheric n-alkanes, C15 to C28. Several atmospheric samples obtained from Nashville have been analyzed for these compounds. Their importance is derived from their reported cocarcinogenicity. (Author abstract)##

01736

A. P. Altshuller, T. A. Bellar, C. A. Clemons, and E. Vanderzanden

METHANE COMPOSITION OF URBAN ATMOSPHERES. Intern. J. Air Water Pollution 8, 29-35, 1964.

Methane levels have been determined in Los Angeles, Cincinnati, Chicago, and Washington, D.C., by analysis with flame ionization gas-solid chromatography. Samples were analysed directly from the atmosphere and after collection in a variety of flexible containers. Most of the concentrations of methane measured in urban atmospheres are in the range between 1.5 and 2.5 ppm. However, values ranging from slightly below 1.2 ppm to 6 ppm are observed. The geophysical methane level appears to be in the 1.0 to 1.2 ppm range. (Author abstract)##

R. M. Brice and J. H. Ludwig

THE DISTRIBUTION OF VEHICULAR AIR POLLUTION IN THE UNITED STATES. Preprint. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965, Paper 65-21.)

The contribution of automotive vehicular emissions to air pollution and the magnitude of the effects of these emissions have been well documented in Los Angeles County and to a lesser extent throughout the State of California. Data are presented which show the presence of photochemical "smog" and prevalence of "smog" in eastern communities is not as high as in Los Angeles; however, evidence from most large cities where atmospheric pollutants have been measured shows some photochemical activity with production of oxidants throughout the year and severe "smog" when adverse meteorological conditions occur. Plant damage of the types associated with photochemical pollutants has been observed in many areas throughout the country and further indicates the presence of adverse levels of motor-vehicle-derived pollutants. Source surveys in a number of cities in the United States show that motor vehicles are responsible for very appreciable amounts of the total emissions of hydrocarbons, nitrogen oxides, and carbon monoxide. The facts presented clearly point to potential problems under current conditions and problems of increasing severity as population densities and use of motor vehicles increase. (Author abstract)##

01912

D. A. Lynn and T. B. McMullen.

AIR POLLUTION IN SIX MAJOR U.S. CITIES AS MEASURED BY THE CONTINUOUS AIR MONITORING PROGRAM (CAMP). J. Air Pollution Control Assoc. 16, (4) 186-90, Apr. 1966. (Presented at the 58th Annual Meeting, Air Pollution Control Association, Toronto, Canada, June 20-24, 1965, Paper No. 65-92.)

Data obtained by the Continuous Air Monitoring Program (CAMP) in six cities during 2 years are summarized. Six gaseous pollutants were monitored in Cincinnati, Chicago, New Orleans, Philadelphia, San Francisco, and Washington, D.C. during 1962 and 1963. The data serve as a basis for describing several contrasts and similarities in the nature of air pollution experienced in six cities, which represent a broad geographical and climatological range of urban environments. Specific topics covered are: typical pollutant levels, patterns of daily and seasonal variations, and unusual phenomena such as atmospheric stagnation periods and photochemical smog formation. (Author abstract)##

01949

P. W. Hildebrand and R. L. Stockman

AIR QUALITY IN CLARK COUNTY, WASHINGTON. Washington State Dept. of Health, Olympia, Division of Environmental Health. 74 pp.

This is a report on a community air pollution survey which began Feb. 1, 1961 and which was conducted in cooperation with the Clark County Air Pollution Committee and the Clark-Skamania Health District. The following findings, and conclusions, are given. Clark County air pollution problems are primarily restricted to localized areas in the immediate vicinity of specific sources. Existing nuisance conditions and the potential for an area-wide problem in the near future warrant corrective and preventive action on the part of the community. Air pollution concentrations in Portland, Oregon are demonstrably higher than those measured in Clark County leading to the conclusion that area-wide pollution in the County will increase as community development progresses. Air pollution effects that can be established include fallout of solid materials, odor, soiling, and esthetic considerations. Heating and transportation make significant contributions to the total problem. Gaseous emissions and concentrations have not been studied sufficiently to establish their effects upon the community. Local legislation is presently inadequate to control the problem on either a corrective or preventive basis. This report recommends that an air pollution control district, as provided for by the laws of the State of Washington, be established encompassing Clark County and the cities of Vancouver and Camas.##

01980

A. P. Altshuller and T. A. Bellar

GAS CHROMATOGRAPHIC ANALYSIS OF HYDROCARBONS IN THE LOS ANGELES ATMOSPHERE. J. Air Pollution Control Assoc. 13, (2) 81-7, Feb. 1963. (Presented at the 55th Annual Meeting, Air Pollution Control Association, Chicago, Ill., May 20-24, 1962.)

Almost 900 gas chromatographic analyses for hydrocarbons were made on 3 ml gas samples collected directly from the atmosphere outside the monitoring station at the San Pedro Street Laboratory. Analyses were made on a molecular sieve column for methane; on a silica gel column for ethane, ethylene, acetylene, propane, propylene, n-butane, isobutane, n-pentane, and isopentane; or on a carbowax column for benzene, toluene, ethylbenzene, and m, p-, and o-xylene. A concentration range for 0.005 to 4 ppm was covered for the various hydrocarbons in these analyses. The gas chromatograph was operated as a monitoring instrument with samples manually injected for analysis every 15 to 20 minutes. It was demonstrated that rapid repetitive analyses of small-volume samples taken directly from polluted atmospheres are possible with gas chromatographs equipped with flame ionization detectors. A wide variety of hydrocarbons can be analyzed. It appears that monitoring gas chromatographs should be entirely feasible for atmospheric hydrocarbon analyses. Data now available indicate that only a small part of the hydrocarbons present in the atmosphere are highly reactive in producing smog manifestations. The fraction of hydrocarbons present that are moderately to slight reactive is several times greater than the highly reactive fraction; a majority of the hydrocarbons present in the atmosphere are essentially inert in smog-producing reactions. This wide variation in the reactivity of hydrocarbon species makes it very difficult to interpret results from infrared of flame ionization hydrocarbon analyzers for total atmospheric hydrocarbons or organics. Both instruments, and especially the infrared one, give

the paraffinic hydrocarbons much more weight than is warranted by their reactivities. This intrinsic disadvantage will prevail until more specific monitoring instruments are developed for the various hydrocarbon series.##

01981

A. P. Altshuller and I. Cohen

THE GAS PHASE REACTIONS OF NITROGEN OXIDES WITH OLEFINS.  
Intern. J. Air Water Pollution 4, (1/2) 55-69, 1961.  
(Presented at the 134th Annual Meeting, American Chemical Society, Chicago, Ill., Sept. 1958)

The nature of the condensation products formed in the gas phase reactions of nitrogen dioxide and nitric oxide with pentene-1, 2-methylbutene-2, and 2-methylbutadiene-1,3 was investigated. The reactants were combined at partial pressures in the range of 0.1 to 2.5 mm with the total pressure at one atmosphere. The products were determined by infrared and ultraviolet spectroscopy and colorimetry. The condensates included primary and secondary nitro compounds and alkyl nitrates. Strong hydroxyl and single bond carbon to oxygen stretching vibrations indicate the presence of either nitroalcohols or simple aliphatic alcohols formed through oxidation reactions. Carbonyl stretching frequencies observable in some of the reactions support the conclusion that a portion of the reactants disappear by oxidation rather than by nitration processes. The available results do not indicate the presence of appreciable amounts of tert.-nitrocompounds, conjugated nitro-olefins, or gem-dinitroalkanes. The reactivities of the olefins with the nitrogen oxides are in the decreasing order: 2-methylbutadiene-1,3, 2-methylbutene-2, pentene-1. (Author abstract)##

02061

H. Watanabe and K. Tomita.

CARCINOGENIC HYDROCARBONS IN THE ATMOSPHERE OF OSAKA CITY.  
Proc. (Part I) Intern. Clean Air Cong., London, 1966.  
(Paper VII/5). pp. 226-8.

During the two-year period from September 1963 to August 1965 local and seasonal variation in the concentration of benzo(a)pyrene (BaP) in the atmosphere in the district of Osaka City was determined. Hydrocarbons in the sample were extracted by benzene for about 10 hours. Utilizing column chromatography with active alumina, 22 fractions of the extract were obtained. The nature of the hydrocarbons in each fraction was determined by ultraviolet spectrophotometry. Thin-layer chromatography (silica gel) was used to measure the concentration of hydrocarbons. BaP concentration in the dustfall (micrograms/sq m/month) in respect of various sample districts varied; industrial area 10.8, commercial area 7.3, residential area 5.2, suburban residential area 2.4. Seasonal variations of BaP were found to be 14.8 in the winter, 8.5 in the autumn, 4.7 in the spring and 3.0 in the summer. BaP concentration in the suspended matter microgram/1000 cum air in the commercial district was 14.0 in the winter, 9.4 in the autumn, 5.7 in the spring and 2.7 in the summer. In the

suspended matter collected in the street crossing in the commercial district, with heavy automobile traffic, during the winter period the BaP concentration was 20 to 50 microgram-1000 cum air and higher than the corresponding BaP concentration in the industrial district. The ratio of BaP concentration to that of other polycyclic hydrocarbons was (setting BaP as 100): pyrene 90, fluoranthene 105, 1.2-benzanthracene 20, 1.12-benzperylene 95. (Author abstract)##

02129

A. P. Altshuller

AIR POLLUTION. Anal. Chem. 35, (5) 3R-10R, Apr. 1963.

Author presents a literature review in the field of air pollution, January, 1961 to February 1962. There are two hundred forty (240) references.##

02169

02169

S. S. Epstein, M. Small, J. Koplan, N. Mantel, H. L. Falk, and E. Sawicki.

PHOTODYNAMIC BIOASSAY OF POLYCYCLIC AIR POLLUTANTS. Arch. Environ. Health.

Fifteen fractions of organic atmospheric particulates from several American cities were bioassayed for photodynamic activity, and results obtained were expressed as apparent potencies relative to an arbitrary benzo(a)pyrene standard. All six crude benzene extracts assayed showed photodynamic activity, with a correlation evident between apparent relative potencies as chemical analysis. Five aliphatic fractions were photodynamically inactive. The single aromatic fraction tested had high activity. Three oxygenated fractions showed photodynamic activity, despite the absence from them of benzo(a)pyrene and other polycyclic hydrocarbons of known structure commonly found in atmospheric particulates. Such oxygenated fractions are reportedly carcinogenic. In recovery experiments, the constituents of neither crude benzene extracts nor oxygenated fractions interfered with the activity of added benzo(a)pyrene. Photodynamic bioassay of nine other polycyclic hydrocarbons commonly found in atmospheric particulates showed that their activities and/or atmospheric particulates showed that their activities and/or atmospheric concentrations, generally, were so limited as not to contribute materially to the potencies of the air samples. This pilot study suggests that photodynamic bioassay may provide a rapid, simple, and economical biological index of potential carcinogenic hazard attributable to polycyclic hydrocarbons. The utility of the assay for this purpose should be further evaluated. (Author summary)##

02210

J.P. Lodge, Jr. E.D. Barber

THE IDENTIFICATION OF ALIPHATIC AMINES IN AIR AS THEIR BENZAMIDES BY PAPER CHROMATOGRAPHY. Anal. Chim. Acta 24, 235-40, 1961.

A method is described for the separation of amines as their benzamides by paper chromatography. Data are given on separations in two systems. Homologous benzamides from C1 to C10 are best separated on S & S 2040a paper. When radiocarbon labelled benzamides were chromatographed and placed on x-ray film for eight to ten days with subsequent development of the radioautograph, the lower limit of identification was found to be ca. 2.5 micrograms of each benzamide. The results of analysis for amines in two samples of air particulate matter, and one of atmospheric vapors are presented. (Author summary)##

02225

E. Sawicki, W.C. Elbert, T.R. Hauser, F.T. Fox, T.W. Stanley

BENZO(A)PYRENE CONTENT OF THE AIR OF AMERICAN COMMUNITIES. Am. Ind. Hyg. Assoc. J. 21, (6) 443-51, Dec. 1960. (Presented at the 21st Annual Meeting, American Industrial Hygiene Association, Rochester, N.Y., Apr. 1960.)

Examination of the benzpyrene content in the air of 131 urban and non-urban areas in various parts of the country has disclosed that benzpyrene is universally present. Samples from sites in urban areas yielded higher concentrations of benzpyrene in the air and in air borne particulates than those from nonurban areas. The concentration of benzpyrene at these sites was found to vary from 0.01 to 61 micro grams per 1000 cu m of air. A 12-month study of the atmospheric benzpyrene concentration in nine large, widely separated American cities has shown that, for the majority, the concentration of benzpyrene in airborne particulates and in the air is at the highest level during the winter months and at the lowest level during the summer months. The concentration of benzpyrene in the benzene-soluble fractions of particulates from the air of different urban and nonurban areas varied from 0.00093 to 0.26 %. The concentration of benzpyrene in the airborne particulates of urban and nonurban areas varied from 0.00001 to 0.041%. In cigarette tar, the concentration of benzpyrene is in the range of 0.00002 to 0.00001%. (Author summary modified)##

02239

R.I. Larsen V.J. Konopinski

SUMNER TUNNEL AIR QUALITY. Arch. Environ. Health 5, 597-608, Dec. 1962, (A revision of a paper presented at the session on Constituents of Motor Vehicle Exhaust at the Research Conference on Motor Vehicle Exhaust Emissions and Their Effects, Southern California Univ., Los Angeles, Dec. 5, 1961.)

Aerometric studies of the Boston Sumner tunnel were conducted in July and Sept., 1961. The 35,000 vehicles/day that traveled this 2-way tunnel produced an average carbon monoxide concentration of 70ppm. in the tunnel, with instantaneous peaks as high as 257 ppm. The soiling index values in Cohs/1000ft. of air were approximately 1 for tunnel inlet air, 2 for the toll station, and 4 for tunnel outlet air. The amount of pollutants/vehicle mile of tunnel travel were: carbon monoxide 60 gm, total suspended 0.36, organic suspended 0.16, and particulate lead 0.31. The relative significance of vehicular exhaust on outdoor concentrations was estimated for the suspended particulates measured. Ranked in order from most to least significant, the 1st several pollutants were caronene, benzo(a pyrene; benzo(g,h,i)perylene, lead total organics, iron, titanium, and total suspended particulate.##

02317

W.J. Basbagill J.L. Dallas

AIR QUALITY IN BOSTON, MASSACHUSETTS (NOVEMBER-DECEMBER 1963). Public Health Service, Cincinnati, Ohio, Div. of Air Pollution. Nov. 1964. 55 pp.

A short-term air contamination pilot study was conducted using a mobile air-sampling laboratory. This laboratory, designed and constructed by the Technical Assistance Branch, Division of Air Pollution, Public Health Service, contains continuous automatic equipment for monitoring air quality, manual air-sampling equipment, meteorological instrumentation, and laboratory facilities. This mobile laboratory was used to: (1) obtain comprehensive measurements of gaseous and particulate air contaminants at a single test site, (2) train air-contamination investigators in the application of methodology, (3) evaluate and compare air-contamination measurement techniques, and (4) enhance public awareness of the air-contamination problem to encourage support for local air-contamination control and monitoring programs.##

02340

AIR QUALITY DATA FROM THE NATIONAL AIR SAMPLING NETWORKS AND CONTRIBUTING STATE AND LOCAL NETWORKS 1964-1965. Public Health Service, Cincinnati, Ohio, Division of Air Pollution pp. 128, 1966.

The Air Quality Section of the Public Health Service's Division of Air Pollution, with the assistance and cooperation of state and local agencies, carries on a variety of air sampling activities to obtain information about air quality in the United States. This report summarizes data gathered during 1964 and 1965 at nearly 300 stations that gathered bi-weekly samples of suspended particulate matter, about 30 stations that gathered bi-weekly samples of two gaseous pollutants, and another seven stations that continuously monitored six gaseous pollutants, suspended particulates and soiling index. This volume also continues the policy of including summaries of data contributed by state and local agencies that operate their own air sampling networks. This effort to bring together in one publication as much air quality data as possible is particularly important in

light of the continuing rapid expansion of state and local sampling activities. In addition to the basic data on suspended particulates and gases, data on several fractions of the particulate matter are included herein. (Author abstract)##

02351

G.R. Hilst J.G. Bryan

PRELIMINARY METEOROLOGICAL ANALYSIS OF NATIONAL AIR SAMPLING NETWORK DATA. VOL. II. COMPARISON AND INTERPRETATION OF RESULTS (FINAL REPT.). Travelers Research Center, Inc., Hartford, Conn. (Rept. TRC-19). Jan. 1962. 72 pp.

This report is the second of a two-volume presentation of the analysis of relationships between particulate pollution levels and concomitant meteorological variables, both measured in urban areas. Data from 51 stations for the period 1957 through 1959 have been used for these analyses. The methodology for statistical discernment of the relationships between urban pollution levels and the meteorological variables observed routinely at nearby U.S. Weather Bureau stations for each area has been presented in Volume I. The results of application of these analytical techniques have also been presented there. In the present volume the comparison and interpretation of these results are presented and suggestions for future studies are outlined.##

02587

O. L. Danetskaya and P. P. Dikun

CONTAMINATION OF THE AIR OF A LARGE CITY WITH CARCINOGENIC AGENTS. (Zagryaznenie kantserogennykh veshchestvami vozduzhnogo basseina bol'shogo goroda.) Hyg. Sanit. 29, (7) 121-3, July 1964.

CFSTI: TT65-50023/7

Purpose of study was to determine the main potential industrial carcinogenic foci in a large city and the recommendation of measures for reducing the carcinogenic waste of these industries. These determinations were based on the polynuclear compound, 3,4-benzpyrene. Samples were taken at industrial sites such as concrete/asphalt plant, tar roofing plant and a rubber manufacturing facility. Recommendations for reducing the concentration of carcinogenic agents are: (a) the technical process should be altered in the direction of the greatest possible air-tight enclosure of the machine units; (b) all vapors should be recovered, and (c) old asphalt concrete plants operating in open yards should be replaced with new plants where the technical process is carried out in adapted buildings and the units for drying the ingredients are gasified. Recommendations for plants engaged in rubber manufacturing are: (a) powdery soot should be replaced with the granulated form in the rubber compounds; (b) all carcinogenic ingredients should be excluded from rubber compounds and replaced with noncarcinogenic ingredients and; (c) the units should be enclosed as much as possible.##



02592

A. V. Mnatskanyan

DATA FOR SUBSTANTIATION OF THE PERMISSIBLE CONCENTRATION OF CHLOROPRENE IN THE ATMOSPHERIC AIR. (Materialy k obosnovaniyu predel'no dopustimoi kontsentratsii khloroprena v atmosfernom vozdukh.) Hyg. Sanit. 29, (9) 14-8, Sept. 1964  
CFSTI: TT65-50023/9

Determination was made of the sulfhydryl groups content in the brain and liver homogenates, as well as of the adenosine triphosphatase activity of the liver in rats. One group of the animals had been receiving chloroprene in concentrations of 0.48 plus or minus 0.02. 0.22 plus or minus 0.009 and 0.088 plus or minus 0.004 micrograms/cu mc throughout 60 days and nights, and thereupon was immediately sacrificed. The other group of rats was sacrificed 15 days after the completion of the chloroprene administration. The threshold concentration of chloroprene in the groups was found to be 0.22 micrograms/cu mc. The effect produced by the substance in question on the sulfhydryl groups in the brain homogenates was that of a drop in their content by approximately 10 per cent as compared with control, while the effect on the adenosine triphosphatase activity in the liver manifested itself in the enhanced enzymic activity which increased approximately 30 per cent. The chloroprene concentrations under examination produced no statistically significant shifts in the sulfhydryl groups content in the liver homogenates. The investigations performed substantiate the USSR standard for maximum permissible concentration of chloroprene in the atmospheric air, the standard providing for the daily average value of 0.08 micrograms/cu mc. (Author abstract)##

02762

L. Dubois, R.G. Reynolds, T. Teichman, J.L. Monkman

THE HYDROCARBON CONTENT OF URBAN AIR - A SIX MONTH SURVEY.  
J. Air Pollution Control Assoc. 14, (8) 295-8, Aug. 1964.

Flame ionization detection, with or without prior gas chromatographic separation, is probably the best method of continuously monitoring hydrocarbons in air. It can be used to monitor concentrations in both external air pollution, and also in plant atmospheres. Response to changes is rapid, and in air pollution studies some indication of inversion conditions is possible. It is planned to carry out future work using both approaches simultaneously, the gas chromatographic separation, and the total. It is hoped to operate on a 24 hr. basis to elucidate any daily trends, such as for example, the occurrence of maxima at 12.00 midnight to 2.00 am.##

02822

S. Hochheiser and R. E. Wetzel

AIR POLLUTION MEASUREMENTS IN INDIANAPOLIS (JUNE-JULY 1963).  
Public Health Service, Cincinnati, Ohio, Div. of Air

Pollution and Bureau of Air Pollution Control, Indianapolis,  
Ind. 67 pp., July 1964

The Indianapolis Bureau of Air Pollution Control and the Division of Air Pollution, U.S. Public Health Service conducted a joint air pollution study in June and July 1963. A mobile air sampling laboratory was used in the study. This laboratory contains continuous automatic equipment for monitoring air quality, manual air sampling equipment, meteorological instrumentation, and laboratory facilities. This mobile laboratory is used mainly to (1) obtain comprehensive measurements of gaseous and particulate air pollutants at a single test site in various communities; (2) train air pollution investigators in the application of methodology; (3) evaluate and compare air pollution measurement techniques, and (4) enhance public awareness of the air pollution problem and encourage support for local air pollution control and monitoring programs. Some of the data obtained in this study, such as the range of concentrations of air contaminants, relationships among levels of air pollutants, and the relationship of meteorological factors and air pollution levels are presented here. Detailed tabulations of air pollution and meteorological measurements are given in the Appendix. (Author introduction modified)##

02825

T. E. Kreichelt and E. W. Dahle, Jr.

AIR POLLUTION MEASUREMENTS IN BALTIMORE, MD. (MARCH AND APRIL 1964). Public Health Service, Cincinnati, Ohio, Div. of Air Pollution and Baltimore City Health Dept., Md., Bureau of Industrial Hygiene, Nov. 1964. 58 pp.  
GPO: 817-288-2

Air pollution concentrations measured in this brief study are sufficiently great to justify further planning and development of an air resource management program in the Baltimore area. Conclusions based on the limited data of this study are as follows: Pollution due to particulate matter is higher than desirable. Atmospheric particulate concentrations exceeded 200 micrograms per cubic meter 5 out of 36 days of the study or 14 percent of the time. Soiling index values were rated as "heavy" or greater during 22 percent of the study period. Pollution due to sulfur dioxide is sometimes a problem. The average sulfur dioxide concentration during the study was 0.06 ppm but did reach an hourly concentration of 0.24 ppm. Photochemical-type smog was neither detected nor expected during the spring season. The relatively large concentrations of oxides of nitrogen, hydrocarbons, and aldehydes present suggest, however, that photochemically produced smog may be a problem during the summer months with the occurrence of greatest intensity and longest duration of sunlight. (Author conclusion modified)##

02833

AIR POLLUTION IN ERIE COUNTY (COMPREHENSIVE AREA SURVEY REPORT NUMBER TWO.) New York State Air Pollution Control Board, Albany. 1963. 109 pp.

The objectives of this survey were: To determine, by means of a contaminant emission inventory, the relative contribution of the respective sources of air contamination to the overall loading of the community atmosphere. To determine population, land use, agriculture and industrial development trends and the ability of the air reservoir to dilute and disperse air contaminant emissions. To extrapolate, from applicable meteorological, air sampling and source data, the potential atmospheric concentrations of the more common air contaminants. To assess the effectiveness of presently applied emission controls and the administrative steps that have been and can be taken by government agencies to control both existing and potential air pollution sources.##

02944

E. Sawicki, T. R. Hauser, W. C. Elbert, F. T. Fox, and J. E. Meeker

POLYNUCLEAR AROMATIC HYDROCARBON COMPOSITION OF THE ATMOSPHERE IN SOME LARGE AMERICAN CITIES. And. Hyg. Assoc. J. 23, 137-44, Apr. 1962. (Presented at the Air Pollution Seminar, American Chemical Society, Chicago, Ill., Sept. 1961.)

The air of 14 American cities was examined for the following polycyclic hydrocarbons: pyrene, benzo(a)pyrene, benzo(e)pyrene, benzo(k)fluoranthene, perylene, benzo(g, h, i)perylene, anthanthrene and coronene. Usually, fluoranthene, chrysene, and benz(a)anthracene were also found in ambient air samples. In all urban samples the concentration of the polycyclic aromatic hydrocarbons was generally greater in winter than in summer. The ratios of benzo(a)pyrene to benzo(g, h, i)perylene and to coronene are introduced as possible indicators of air pollution due to automobile exhaust fumes or coal combustion pollution. (Author abstract)##

03024

SUMMARY OF DATA FROM THE CONTINUOUS AIR MONITORING PROGRAM. Public Health Service, Cincinnati, Ohio, Division of Air Pollution. Oct. 1965. 16 pp.

This report contains data gathered during 1962, 1963, and 1964, with the data from 1964 presented more extensively than data from the earlier years. The annual average concentrations, the maximum and minimum monthly average concentration, and the maximum daily concentration of the several pollutants monitored are summarized. The minimum daily average concentration was, in each case, below the minimum concentration detectable by the instruments. The following summaries are contained in tables: 1964 average and maximum pollutant levels in greater detail for the several cities. Relative cumulatively frequency distributions for 1964 3f basic CAMP data recorded at 5-minute intervals, and similar distribution of data for 1962 and 1963. These frequency distributions permit the ready determination of the concentration that was exceeded only 5 percent of the time, the median concentration. Total oxidant data for 1964 in the form of the number and percent of day when the maximum hourly total oxidant concentration equalled or exceeded 0.15, 0.10 and 0.05 ppm, and the average and maximum soiling index levels for 1964.##

J. D. Williams, F. D. Maddox, T. O. Harris, C. M. Copeley, Jr., and W. Vand Dokkenburg, Jr.

INTERSTATE AIR POLLUTION STUDY PHASE II PROJECT REPORT. VI. EFFECTS OF AIR POLLUTION. Public Health Service, Cincinnati, Ohio, National Center for Air Pollution Control 66 pp., Dec. 1966

The Air Quality Goals Subcommittee, appointed under provisions of item 5-A-5 of the Interstate Air Pollution Study Phase II Project Agreement, reviewed literature, met with consultants in the air pollution effects field, and selected air quality goals for consideration by the Project Executive Committee. The Committee limited its consideration to goals because it does not have authority to adopt air quality standards, a function restricted to legally constituted governmental agencies. The Committee does, however, by approving this report, accept the consensus of professional and technical personnel. The explanations of effect levels presented herein were prepared by the staff of the Public Health Service Technical Assistance Branch who utilized the advisory resources available within the Division of Air Pollution. The effects of air pollution as a program element, is only one part of an air resources management program. Air pollution effects, air-quality levels, and pollutant emissions are the major program elements that provide the basis for air quality goals. Actually, if no consideration were given to the length of time needed to reach goals or to the priorities of community needs, air pollution effects would be the only program element to be considered in establishing goals. Suggested goals are listed and are based on the air quality (indicating major types and amounts of pollutants present) as well as actual and anticipated effects of air pollutants in the Interstate Air Pollution Study area. The effects of air pollution have been considered in this report from the viewpoint of a consultant whose task has been the development of a set of goals that will meet the future need of the area. Some of the quantitative relationships between effects and air quality levels have not yet been established, but enough is known that a guide for a constructive air resource management program has been provided for the Interstate Air Pollution Study area. This guide is intended to serve the needs of the study area only, and is not intended to have general application.##

H.C. Wohlers M. Feldstein

INVESTIGATION TO DETERMINE THE POSSIBLE NEED FOR A REGULATION ON ORGANIC COMPOUND EMISSIONS FROM STATIONARY SOURCES IN THE SAN FRANCISCO BAY AREA. J. Air Pollution Control Assoc. 15, (5) 226-9, May 1965.

On the basis of evidence presented, it is concluded that photochemical smog is a major air pollution problem in the San Francisco Bay Area. Attempts should be made to reduce the intensity of photochemical smog effects by controlling the emission of organic compounds to the atmosphere. In order to reduce the intensity of photochemical smog effects in the

Bay Area, it is estimated that an 80 percent total reduction of organic material emitted to the atmosphere is necessary. The nitrogen oxide problem needs clarification. Because of the complexity of the photochemical smog reaction in open atmospheres, technical answers to all phases of the problem are not available.##

03363

M. S. Sokoloskii, Zh. L. Gabinova, B. V. Popov, L. F. Kachor, and B. S. Levine, "Translator"

SANITARY PROTECTION OF MOSCOW ATMOSPHERIC AIR (U.S.S.R. LITERATURE ON AIR POLLUTION AND RELATED OCCUPATIONAL DISEASES, VOLUME 14). Moscow Sanitary-Epidemiological Station. 1965. 68 PP.

CFSTI, TT 67-60046

Moscow is a large industrial center with various types of industries discharging a complex of solid and gaseous, organic and inorganic chemical substances into the air, causing considerable damage to the National economy. This work reviews the Moscow Sanitary Service in its efforts to control air pollution from the many sources described.##

03404

D. S. Mathews J.J. Schueneman

MANAGEMENT OF DADE COUNTY'S AIR RESOURCES. Public Health Service, Cincinnati, Ohio, Division of Air Pollution. (In cooperation with Florida State Board of Health and Dade County Dept. of Public Health, Fla.) Oct. 1962. 43 pp.  
HEW

Metropolitan Dade County has a long history of being a desirable area in which to live, work, and play. A great sub-tropical agricultural industry abounds. Tourism is one of the largest income producing industries in this area. Population and urban development are increasing rapidly. In general, these trends have to reduce agricultural income. Due to the dominance of tourism and agriculture, economic return has been somewhat uncertain and has not been balanced equally throughout the year. To compensate for this situation, a significant effort is being put forth to bring new kinds of income producing activities into Dade County. A specific proposal has been made to construct and operate a petroleum refinery near Homestead as part of an extensive industrial development. The Dade County Manager and the Dade County Department of Public Health requested technical assistance from Florida State Board of Health and the United States Public Health Service in reviewing the refinery proposal, evaluating its possible environmental effects and in planning a long range air resource management program. Air pollution aspects are considered and presented herein. (Author introduction modified)##

G. J. Raschka

AN APPRAISAL OF AIR POLLUTION IN MINNESOTA. Minnesota Dept. of Health, Minneapolis, (In cooperation with the Public Health Service.) Jan. 1961. 78 pp.

This appraisal of the air pollution situation in Minnesota arose from a growing concern about air pollution problems in the state. Increasing requests for information and assistance registered with the State Department of Health Service were obtained concerning methods of conducting a survey which would establish the nature and extent of the air pollution problem in the state and indicate what activity is needed on the part of the state and local governments in meeting the problem. Data used in preparing this report were obtained by interviews, direct observation, questionnaires, limited air sampling, and review of existing information. The appraisal was made from October 1959 to July 1960.##

03410

A STUDY OF AIR POLLUTION IN MONTANA JULY 1961 - JULY 1962. Montana State Board of Health, Helena Division of Disease Control. 1962. 110 pp.

The principal pollutants in the air were determined with the staff and analytical equipment available to the State Board of Health and some idea as to the carcinogenic potential of the materials in the air in the various cities as well as the over-all characteristics in each of the cities were determined as a base-line for future reference. Emission inventories are included.##

03426

E. C. Tabor, J. E. Meeker, and J. M. Leavitt.

AIR POLLUTION IN ST. BERNARD, OHIO. Public Health Service, Cincinnati, Ohio, Div. of Air Pollution, 1958. 17 pp.  
HEW

An area survey was conducted in St. Bernard, Ohio. It was determined that the levels of suspended particulates and crude organics were considerably higher than that in downtown Cincinnati for the same days. The average levels of 270 micrograms of suspended particulate per cubic meter of air and 65.5 micrograms of crude organics per cubic meter of air were somewhat higher than for other communities of size comparable to St. Bernard. Nitrate and sulfate concentrations also were slightly higher. The highest levels of sulfur dioxide, while not high enough to be of great concern, were associated with northerly winds. On several occasions the level of oxides of nitrogen was high enough to be detectable by the odor. The large amount of aliphatic hydrocarbons in the organic matter was very unusual. It was considerably higher than that from any other community in the United States for which similar measurements have been reported. The soiling power of the air was higher when the wind blew from the North.##

03433

F. A. Bell, Jr., G. Bisel, Jr., T. N. Hushower,  
L. B. Perry, F. J. Schuette, and E. Vihman.

FRESNO AIR POLLUTION STUDY. Public Health Service,  
Washington, D. C., Div. of Air Pollution; California  
State Dept. of Public Health, Berkeley; and Fresno County  
Health Dept., Calif. July 1960. 25 pp.

HEW

Haze and other air pollution effects have occurred in the Central Valley of California. In order to answer questions regarding present pollution levels and to estimate the future pollution potential of an area which is just beginning to experience air pollution, Fresno was selected as a representative growing metropolitan area of the Central Valley. Air pollution concentration levels together with visibility reduction measurements and subjective observations indicate that photochemical smog occurs in the Fresno area. The Fresno rural station in Kerney Park had AISI particulate matter results which were in general higher than the results at the Fresno city station. AISI particulate matter results indicate that episodes of air pollution occur widely throughout the Valley. Comparisons of average results from stations at Fresno, at Kearney Park, Sacramento, Stockton and Bakersfield show that the AISI results were two to four times higher for the December 3-9 period than for the September 10-17 period for all stations. An estimate of pollutants being emitted to the atmosphere indicates that motor vehicles are the main and most significant sources of smog-forming raw materials in the Fresno area.##

03441

CLEAN AIR FOR CALIFORNIA (INITIAL REPORT OF THE AIR POLLUTION  
STUDY PROJECT, CALIFORNIA STATE DEPT. OF PUBLIC HEALTH).  
California State Dept. of Public Health, San Francisco.  
Mar. 1955. 60 pp.

This is an early survey report of the air pollution situation in California. The body of knowledge, available at that time, on the growing problems of polluted air is discussed and a plan for action outlined. Attention is focussed on the air pollution problem in the Los Angeles area, where eye irritation, plant damage and other harmful effects, such as discomfort, decreased visibility and nuisance occur most frequently. Recommendations to State and local Governmental authorities, to universities and other research organizations, to the industry and public are made.##

03451

BI-STATE STUDY OF AIR POLLUTION IN THE CHICAGO METROPOLITAN  
AREA. Indiana State Board of Health, Illinois Dept. of  
Public Health, Springfield and Purdue Univ. Lafayette, Ind.  
1959. 151 pp.

The population of the Chicago area, as a whole, has evidently not yet experienced great inconvenience because of air pollution. However, with the increased growth of the area both population-wise and industrially it is important that knowledge of the present conditions be obtained to protect the public well-being and to prevent future conditions that may have an adverse effect

upon the citizens of the area. Some of the conclusions resulting from the Bi-State Study of Air Pollution in the Chicago Metropolitan Area are: (1) The Chicago Area is an extensive heterogeneous area consisting of a complexity of domestic, commercial, and industrial activities which emit a variety of foreign materials to the atmosphere; (2) Air pollution problems may transcend local boundaries and require intercommunity cooperation for their solution; (3) Prior studies show an early awareness of the presence of foreign materials in the atmosphere in concentrations varying with local and meteorological conditions; (4) The probable major contributors of material to the air in the Chicago Metropolitan Area and their probable major emissions are: (a) Poor community housekeeping - wind-generated particulate matter; (b) Burning of refuse in open dumps and backyard incinerators-products from incomplete combustion of organic and inorganic matter; (c) Residential and small commercial and industrial heating plants - products from incomplete combustion of coal; (d) Automobile exhaust - products from combustion of gasoline; (e) Electric utilities - combustion products; (f) Domestic and industrial combustion of fuel oil - combustion products; (g) Primary metals industry - particulate matter; and (h) Petroleum refineries and gasoline handling facilities - hydrocarbons.##

03454

W. C. Cope, Chairman.

SMOKE AND AIR POLLUTION - NEW YORK NEW JERSEY. Interstate Sanitation Commission, New York City. Feb. 1958, 95 pp.

Pollution in the metropolitan area was studied by: aerial reconnaissances and photography; and surveys in the communities. Significant information was collected on: relationships of meteorology, visibility and pollution; interstate movement of pollution as indicated by releasing tracer dust in one state and collecting in the other; amount of vehicle exhaust fumes and other organic materials in the air; sulfur dioxide concentration on Staten Island, and ozone on Staten Island and in Carteret, N.J.; effects of the polluted atmosphere on health, vegetation, materials and transportation; and a study and evaluation was made of existing laws in the State of New York, New Jersey and Connecticut, and other jurisdictions. Air pollution originating in regions of New York and New Jersey within the New York Metropolitan Area is interstate in character, affects public health and comfort adversely, and damages property. While the control and abatement of air pollution at its sources is the primary obligation of the states, counties or municipalities in which it originates, the problems of interstate air pollution cannot be solved wholly by governmental agencies independently of one another. The abatement of existing interstate air pollution and the control of future interstate air pollution is of prime importance to the persons living and industry located in the area affected thereby, and can best be accomplished through the cooperation of the states involved, by and through a common agency or instrumentality. An interstate instrumentality, employing the administrative practices followed by the Interstate Sanitation Commission in the abatement of interstate water pollution, should be created to deal with the problems of interstate air pollution. Drafts of proposed legislation to meet the situation described in this report should reflect fully the opinions and needs of many agencies, local governing bodies,



members of the Legislatures, representatives of industry, and of the public. There has been insufficient time between the completion of the study and the submission of this report to afford opportunity to interested agencies to express their views on the form which legislation to abate interstate air pollution should take.##

03458

D. M. Keagy and J. J. Schueneman

AIR POLLUTION IN THE BIRMINGHAM, ALABAMA, AREA. Public Health Service, Cincinnati, Ohio, Div. of Air Pollution. (Rept. No. A58-8.) May 1958. 80 pp.  
HEW: A58-8

The purposes of this survey were to: (1.) Review the existing and potential air pollution situations. (2.) Review existing air pollution control activities; and (3.) Develop recommendations for organization, staff, facilities, program, and legislation relative to air pollution control activities. The scope of the study was limited to consideration of available information relative to air pollution including: types of activity which cause pollution, evidences of pollution levels, meteorological and topographical influences on the dispersion of pollutants, existing or authorized governmental activity for control of air pollution, and other relevant community characteristics. The study area was the boundary of Jefferson County.##

03462

E. E. Lemke, N. R. Shaffer, and J. A. Verssen

SUMMARY OF AIR POLLUTION DATA FOR LOS ANGELES COUNTY. Los Angeles County Air Pollution Control District, Calif., Engineering Div.

Emission concentrations of pollutants for Los Angeles, California are given. The levels cited are a result of the Board of Supervisors of Los Angeles giving the authority to the Air Pollution Control District - County of Los Angeles. Also included are sixty-two (62) industrial control programs started in the Los Angeles area, along with the dates installed and the cost.##

03504

E. R. Hendrickson, D. M. Keagy, and R. L. Stockman

EVALUATION OF AIR POLLUTION IN THE STATE OF WASHINGTON (A JOINT REPORT WITH THE STATE OF WASHINGTON DEPARTMENT OF HEALTH-JULY 1 THROUGH NOVEMBER 30, 1956). Public Health Service, Cincinnati, Ohio, Div. of Air Pollution. 1957. 165 pp.

The objective of this study was to estimate the current and potential air pollution problems in the State of Washington and to provide a basis for the State to determine the appropriate action it should take. The survey consisted of a study of

population distribution and trends, geography and topography, meteorology and climatology, and existing and potential sources of pollution. The sources of pollution which were considered include transportation, domestic activities, agricultural practices, industrial activities, refuse disposal, out-of-state sources, and natural sources. In addition, a determination was made of available resources in the State for research and investigation in air pollution problems. On the basis of the findings of this state-wide survey, it is recommended that: (1) Air pollution be recognized as a matter of State concern. (2) Ways and means of prevention and control of air pollution, including consideration of local and regional aspects, be investigated. (3) A continuing State program include surveillance, study and cooperation and (4) An agency be designated to represent the State in interstate and Federal air pollution matters.##

03505

M. D. Hornedo and J. H. Tillman

AIR POLLUTION IN THE EL PASO, TEXAS AREA. El Paso City - County Health Unit, Texas. 1959. 104 pp.

The primary purpose of this study was to obtain basic scientific air pollution data concerning the type, extent, source, and effect of the waste from industry and other air pollution in the El Paso area. Another purpose was to determine the need and nature of a permanent air pollution control program. The scope of the program was limited by two factors; the gathering of those samples which were within our means to analyze and the collection of pollutants commonly found in any city.##

03506

P. A. Kenline

AIR POLLUTION IN CHARLESTON, SOUTH CAROLINA. Public Health Service, Cincinnati, Ohio, Div. of Air Pollution. (Rept. A60-6.) 1960. 32 pp.  
HEW: A60-6

At the request of the South Carolina Department of Health and with the cooperation of the Charleston County Health Department, the Public Health Service made an appraisal of factors relating to air pollution in the Charleston area. The purpose of this appraisal was to determine the status of the air pollution situation, and the need for government activity in solving air pollution problems. This report is an analysis of information collected relating to sources of pollutants, dispersion of pollutants, indication of pollution levels, and the status of local activity in the air pollution field. Charleston lies in an area of frequent stagnating high pressure systems - the meteorological model associated with major air pollution episodes - and for this reason bears surveillance. However, because of its proximity to the Atlantic Ocean and its level topography, Charleston usually receives good ventilation in part because of the sea breeze. This advantageous phenomenon decreases inland. The atmospheric pollutants of immediate concern derive from industrial sources. However, domestic, commercial, and municipal sources do contribute to the overall pollution load of the

atmosphere. To date, public complaints relate to nuisances, particularly industrial odors. There have also been a few allegations of vegetation and property damage. Measurements by the Public Health Service's National Air Sampling Network in the City of Charleston indicate that the particulate loading is not excessive, as judged by comparison with cities of comparable size. The sampler is located in the center of the city and is not indicative of pollution levels in other areas. Of greatest interest and concern is the North Charleston "neck" which contains within a limited area a complex of air pollutant sources and residences. No data are available to indicate pollution levels in this area, although analysis of the Network data implies that they are significantly higher than in the city. There is presently no local or State air pollution program, nor is there routinely available to the local area any agency with authority and competence in this field. On the basis of this appraisal and the general available knowledge relating to air pollution, the following recommendations are made to the Charleston County Health Department. (1) Information should be developed relating in detail to air pollution levels and sources in the Charleston area, particularly to the north of the city limits. (2) A modest public education program should be undertaken. (3) A modest air pollution program should be developed within the County Health Department.

03526

P. Stocks, B. T. Commins, K. V. Aubrey

A STUDY OF POLYCYCLIC HYDROCARBONS AND TRACE ELEMENTS IN SMOKE IN MERSEYSIDE AND OTHER NORTHERN LOCALITIES. Intern. J. Air Water Pollution 4, (3/4) 141-53, 1961.

Smoke samples collected continuously for one or more years by filter in Merseyside conurbation and elsewhere in northern England and Wales were analysed for 7 polycyclic hydrocarbons and 13 trace elements. The locations included seaside and riverside, small and large towns, a smokeless zone, the Mersey Tunnel, bus and motor car garages, an office and a steelworks. The amount of coronene in smoke varied little in town or country but the higher levels in tunnel smoke and in the motor garage were such as to suggest its usefulness for measurement of air pollution by motor traffic. In country places amounts of smoke and of the hydrocarbons were 2 1/2 times as great in the autumn-winter half of the year as in the spring-summer half, but in Merseyside, whilst the seasonal ratio for total smoke was similar, for the hydrocarbons it was about 5 to 1. Indoor office air was less polluted than that outside in winter, the hydrocarbons showing a seasonal ratio about 4 to 1. Trace element concentrations in air were all higher in urban than in country places but only for antimony, vanadium and molybdenum was the excess relatively greater than for total ash. Mersey tunnel air contained very much greater amounts of lead than did the entering air, and in a motor garage the air contained more lead and vanadium than the air outside. In the smokeless zone trace elements were present in smaller amount than at the town centre. In the rolling-mill shed and melting-shop of the steelworks, concentrations of all the elements, particularly of copper, were largely, increased. (Author abstract)##

J. M. Campbell and L. Kreyberg

THE DEGREE OF AIR POLLUTION IN NORWEGIAN TOWNS. Brit. J. Cancer (London) 10, 481-4, 1956.

3:4 Benzpyrene has been estimated in samples of atmospheric smoke (suspended matter) in Oslo and a number of smaller towns in Norway, and these results are compared with similar values previously obtained for towns in England and Wales. (Author summary modified)##

03918

R. 'Ubaidullaev

EFFECT OF LOW CONCENTRATIONS OF METHANOL VAPOR ON MAN AND ANIMALS. Hyg. Sanit. 31, (4-6), 8-12, Apr.-June 1966. Russ. (Tr.)

CFSTI TT 66-51160/4-6

The maximum one-time and daily average permissible concentration of methanol in the atmosphere was determined. The threshold value of smell of the substance, its effect on the light sensitivity of eyes and that on the electric activity of the cerebral cortex of man was ascertained. Chronic 24-hour poisoning of albino rats was carried out for a period of 90 days. This experiment included a study of the chronaxy of muscle antagonists, the cholinesterase activity of the whole blood, the coproporphyrin excretion with the urine and the determination of the total amount of proteins and protein fractions in the blood serum. On the basis of the results obtained it is recommended that the maximum one-time and daily average permissible concentration of methanol in the atmosphere be set at a level of 1 and 0.5 mg/cu m respectively. (Author summary)##

03925

M. N. Bolotova

THE DETERMINATION OF 3,4-BENZPYRENE IN THE AIR IN TASHKENT. Hyg. Sanit. 31, (4-6) 116-20, Apr.-June 1966. Russ. (1.)

CFSTI, TT 6651160/4-6

Air samples from the city of Tashkent were taken by an aspirator, this method having been used for 3,4-benzpyrene studies in the USSR and abroad. The results show that the contents of 3,4-benzpyrene in different districts of Tashkent varied from 0.55 to 11.2 micrograms per 100 cubic meters air. In the residential zone without industrial enterprises its content was 0.58 to 2.3 micrograms per 100 cubic meters. The highest concentration of this carcinogenic substance, 9.7 to 11.2 micrograms per 100 cubic meters, was found in the northern industrial zone. The concentration of 3,4-benzpyrene was comparatively low (0.8 micrograms per 100 cubic meters) in the zone of the toolmaking and abrasives-making factories which burned gas, and this low concentration is probably due to the

complete combustion of the fuel. Samples were taken at 15 different points using the best method of aspiration. The results provide a fairly complete picture of the degree of contamination with 3,4-benzpyrene of the air basin of the large industrial city of Tashkent.##

03930

S. A. Pigalev

POLLUTION OF AIR BY A SYNTHETIC RUBBER PLANT. Hyg. Sanit. 31, (4-6) 253-4, Apr.-June 1966. Russ. (Tr.) CFSTI, TT 66-51160/4-6

The principal and general professional hazard in the manufacture of any tupe of synthetic rubber are the liberated gases. The pollution of air by vapors of toxic compounds is possible at all stages of the technological processes, including the initial stages (synthesis, isolation and fractionation of the monomer) as well as in the final operation of the processing of the manufactured rubber. The plant investigated manufactures two kinds of rubber, the isoprene and the divinyl-alpha-methylstyrene rubbers. This plant discharges up to 162.2 kg of alpha-methylstyrene, up to 48 kg of unsaturated hydrocarbons, and up to 5 kg of ammonia into the atmosphere per hr. The atmospheric air was sampled by aspiration when the plant was working at full capacity, at a distance of 0.5 to 1.5 km from the source. Studies revealed a zonal nature of distribution of these substances in the atmosphere, their concentration diminishing at greater distances from the pollution source. The concentrations in the zone of 500 to 1500 m from the pollution source exceed the one-time maximum permissible concentrations for atmospheric air. It was determined that the discharge of harmful products of synthetic rubber manufacture into the atmosphere can be reduced by further improvements in the technological process and in equipment, in the construction of ceilings and in operation of the equipment.##

03931

V. A. Kononova

ATMOSPHERIC POLLUTION IN THE AREA OF PESTICIDE STOREHOUSES. Hyg. Sanit. 31, (4-6) 255-6, Apr.-June 1966. Russ. (Tr.) CFSTI, TT 66-51160/4-6

Operation of new rural industries and the use of poisonous chemicals in the fields and orchards involve the danger of atmospheric and soil pollution in rural areas, which may have a detrimental effect on the health of the population. The presence of atmospheric pollution in the area of pesticide storehouses and its effect on the feeling of well being, living conditions and health of the population residing in the area was investigated. The presence of pesticides near the storehouses was investigated by taking and testing 156 samples of air, including 30 samples for organomercuric compounds, 48 organophosphorus compounds and 28 samples for organochlorine admixtures. Organomercuric compounds were determined and scaled to thiophos or metaphos according to

Trotsenko's method based on the decomposition of thiophos and metaphos with sulfuric acid with the formation of b-nitrophenolate. The contents of organophosphorus and organomercuric compounds in the air are listed in the table. No organochlorine mixtures were detected. It was concluded that operation of new pesticide storehouses can be permitted only after internal repairs in the buildings, and adequate equipment of servicing premises and packaging room, and the installation of ventilation. In order to avoid poisoning cases among the local population, the pesticide storehouses must be surrounded with a fence, adequately locked and guarded.##

04091

Zh. L. Gabinova, A. A. Vasil'eva, N. Kh. Sklyarskaya, and M. D. Manita

EXPERIMENTAL STUDY OF ATMOSPHERIC AIR POLLUTION WITH 3,4-BENZPYRENE IN INDUSTRIAL SECTIONS. *Gigiena i Sanit.* 28, (6) 65-9, June 1963. Russ. (Tr.) (Translated by B. S. Levine in U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 12.)

The purpose was to obtain more complete and up-to-date information on the state of Moscow atmospheric air pollution with 3,4-benzpyrene, on the basis of which rational sanitation means could be developed for the protection of atmospheric air against pollution with 3,4-benzpyrene. The first investigation was centered around industrial enterprises which had been only slightly surveyed with regard to the presence of 3,4-benzpyrene in the air and which, by the nature of their processing and production, lent themselves to the introduction of appropriate sanitization measures. The 3,4-benzpyrene determinations were made by fluorescent spectral method in the following order: in the primary raw material, in the intermediate and final products, in dust settled from the atmospheric air, and in dust collected by aspiration. Analyses were conducted in the physico-chemical laboratory of the Moscow Sanitary Epidemiological Station. The authors conclusions are as follows: It has been established that some raw materials, intermediate and final products used or manufactured by the investigated industrial plant contained detectable quantities of 3,4-benzpyrene; samples of settled dust collected in the proximity of the investigated plants also contained detectable quantities of 3,4-benzpyrene. Samples of aspirated atmospheric air collected on the electrode plant grounds during August-November of 1961, contained 3,4-benzpyrene in 0.4-2.33 gamma per 100 cu m of air. On the basis of this orientation investigation and sanitary-hygienic examinations, certain sanitization and air pollution protection means have been recommended and instituted in the investigated plants. The present report presents results of the first stage of a general investigation to be conducted in the future on a broader and profounder scale.##

04616

J. E. Dickinson

AIR QUALITY OF LOS ANGELES COUNTY (TECHNICAL PROGRESS REPORT - VOLUME II). Los Angeles County Air Pollution Control District, Calif. Feb. 1961. 306 pp.

Volume II of the Technical Progress Report is concerned with chronicling the air monitoring program of the Los Angeles County Air Pollution Control District between 1951 and 1959. Topics covered include: Chemistry of the Atmosphere; Air Monitoring; Evaluation of Smog Effects Data; Estimation of Total Air Pollution in Los Angeles County; Utilization and Analyses of Total Air Pollution Data. Without the data accumulated as the result of the sampling programs of 1951-57 it would not have been possible to discover the unique problems involved with Los Angeles smog and to determine what kind of control measures would be needed to abate them. Thus, it was possible (1) to identify in the atmosphere the contaminants considered to be the most important with regard to photochemical smog formation theory; (2) to establish their approximate concentration ranges; (3) to confirm theories of photochemical smog formation and transport; and (4) to define the areas of the Basin most severely affected by smog and the areas in which most of the contaminant sources were concentrated. Correlation between meteorological trends and smog occurrence, without radical change in emission concentrations, indicate the importance of weather conditions to smog occurrence.##

04651

B. T. Commins R. E. Waller

OBSERVATIONS FROM A TEN-YEAR-STUDY OF POLLUTION AT A SITE IN THE CITY OF LONDON. Atmos. Environ. 1, (1) 49-68, Jan. 1967.

As part of an extensive study of the effects of air pollution on health, measurements of pollution have been made at a site in London for more than ten years. The results of daily measurements of the concentration of smoke and sulfur dioxide made throughout that period and of more frequent measurements made during episodes of high pollution are reported. These show a reduction in the annual mean and peak concentrations of smoke during the ten year period, but there have not been any significant changes in the concentrations of sulfur dioxide. Occasional measurements of a wide range of other pollutants are also reported and results from a series of measurements of polycyclic aromatic hydrocarbons indicate a decline in the concentration of this potentially carcinogenic component of pollution in London. (Author abstract modified)##

04770

J. E. Yocom, J. A. Farrow, R. M. Gagosz and J. C. Magyar

AIR POLLUTION STUDY OF THE CAPITOL REGION (INTERIM REPORT). TRC Service Corp., Hartford, Conn. 1968. 65 pp.

The objectives were: (1) Evaluate the air pollution problem in the Capitol Region, both existing and potential with emphasis on the latter. (2) Procure data for determining the need for a regional air pollution control program and delineate rational boundaries for such a program. The purpose of this Interim Report is to present and summarize the completed Source Inventory and to report on the status of the other phases of the study. The pattern of air pollution emissions is strongly related

to land use and road systems and is regional in nature. Although the towns making up the Capitol Region differ widely in character, the pattern of emissions are not related to town boundaries. Carbon monoxide emissions are related almost entirely to automobile use. Automobiles are also the principal contribution to hydrocarbon emissions, but home and municipal refuse burning and industrial processes make significant contributions. Nitrogen oxides are contributed in almost equal amounts by automobiles and heating systems. This accounts for the relatively even distribution of this pollutant. Sulfur oxides are produced mainly in industrial heating and power generation plants burning high sulfur fuel. Therefore the emission of this pollutant type is clearly related to industrial land use. Particulate matter is produced largely by industrial heating and manufacturing processes with significant contributions from domestic and municipal refuse burning. The distribution of particulate emissions is dependent to some degree on land used for heavy industry such as metallurgical and mineral processing. Levels of pollutants measured were, in general, low. Except for a few days, weather conditions readily dispersed pollutants before they could accumulate. High concentrations of pollutants occurred during a prolonged stable atmospheric condition during late November as recorded by the State Department of Health. The differences in pollutant levels from station to station, could, in general, not be accounted for based on surrounding land use and estimated emissions (Source Inventory) without specific knowledge of the prevailing weather patterns. Inversions occur frequently during the night and early morning hours in both the Connecticut and Farmington Valleys. Only two of the towns in the Capitol Region have specific regulations governing emissions of air pollutants. Most of the towns have some measure of control over potential air pollution emissions by means of zoning ordinances.##

04833

H. H. Hovey, Jr.

AIR POLLUTION IN WESTCHESTER. Westchester Cooperative Air Pollution Control Study, Westchester County, New York. (In cooperation with Mount Vernon City Health Dept., New Rochelle City Health Dept., Westchester County Health Dept., and Yonkers City Health Dept.) 1965. 86 pp.

Within the framework of the New York State Air Pollution Control Act a series of air pollution surveys was initiated to provide data for carrying out the directive in the law. Among these was a comprehensive study of the air pollution potential in Westchester County, undertaken from July, 1962, until September, 1964, as a cooperative effort by the Mt. Vernon, New Rochelle, and Yonkers City Health Departments and the Westchester County Health Department. The objective of this study was to define the nature and extent, and causes and effects of the air pollution potential in Westchester County. Both the industrial and nonindustrial air pollution potential were studied by conducting an inventory of possible air contaminant sources to determine contaminant emissions within the county. The inventory was supplemented by an atmospheric sampling network consisting of 23 stations located throughout the county. Recommendations were based on the findings from combined inventory and atmospheric sampling data. Many problems are created by the 182,000 tons of air contaminants (exclusive of CO,



estimated to be more than 830,000 tons per year) emitted annually to the outer air in Westchester County, although there are no major county-wide air pollution problems. Traffic concentrations in the southern portions of the county tend to increase the potential problem from CO. Westchester County has a meteorological regime relatively favorable to good dispersion and diffusion of contaminants in the atmosphere. Only 23% or 42,000 tons of Westchester County's air contamination comes from industrial sources while 78% or 140,000 tons of the total contamination comes from nonindustrial sources. Of this amount over 100,000 tons comes from motor vehicle and other transportation sources. Southern Westchester County is densely populated and has most of the county's industry with the exception of the villages of Dobbs Ferry, Elmsford, Larchmont, North Pelham, Pelham and Scarsdale, and the City of Rye.##

04834

New York State Air Pollution Control Board, Albany. 1965.  
15 pp.

AIR POLLUTION/CHEMUNG COUNTY SUPPLEMENT TO COMPREHENSIVE  
AREA SURVEY REPORT NUMBER ONE (GREATER ELMIRA).

Since the degree of air pollution is low in this rural portion of Chemung County, proper steps would be taken to insure continuing low levels of air contaminants. All new sources of air pollution can be controlled by adherence to rules and regulations promulgated by the New York State Air Pollution Control Board in 1962. Local officials, in cooperation with the Board, can insure new sources or modifications to existing sources and meet minimum requirements as established by the Board. Rules and regulations for this area should be made at the same time as those for Greater Elmira, using ambient air quality objectives as promulgated by the Board. When applying the ambient air quality objectives, both the present survey area and Greater Elmira should be classified as one region. In this manner, all of Chemung County may have a uniform set of rules and regulations at the same time. Refuse disposal practices should be reviewed in each community. Open burning of refuse by private individuals should be prohibited and central collection instigated. Disposal should be properly-operated, sanitary landfills or any other acceptable method. (Author summary)##

04864

New York State Air Pollution Control Board Albany. 1964.  
96 pp.

AIR POLLUTION - NIAGARA COUNTY (COMPREHENSIVE AREA SURVEY  
Report number three).

The objectives of this study are to define the nature and extent of the air pollution potential in Niagara County so as: (1) To provide information by which rules and regulations can be established for the control of existing air pollution; (2) To provide technical data needed for implementation of a practical and reasonable air pollution abatement program; (3) To assess the effectiveness of existing controls and determine what steps must be taken by governmental agencies to control both existing and

potential air pollution; and (4) To provide background data needed to check the effectiveness of any future control program.##

04938

J. M. Colucci and C. R. Begeman

THE AUTOMOTIVE CONTRIBUTION TO AIR-BORNE POLYNUCLEAR AROMATIC HYDROCARBONS IN DETROIT. J. Air Pollution Control Assoc. 15, (3) 113-22, Mar. 1965.

The aim was to determine the contribution by automotive vehicles to the polynuclear aromatic hydrocarbons in city air. Sampling of particulate matter at the rate of 140 cu m/min 5000 cfm) was carried out at two heavily-trafficked sites in Detroit and one suburban site in Warren, Michigan. Carbon monoxide was determined continuously, and particulate matter was analyzed for "tar," polynuclear aromatic hydrocarbons, lead, vanadium, and sulfates. Polynuclear aromatic hydrocarbons in automobile exhaust gas are assumed to be dispersed in air along with carbon monoxide or lead from automobiles. It is further assumed that automobiles are the sole source of carbon monoxide and lead in the atmosphere. Concentrations of carbon monoxide and lead in exhaust gas and in the air are utilized to estimate the percentage of polynuclear aromatic hydrocarbons in the air attributable to automobiles. The mean automobile contributions to benzo(a)pyrene in the air, based on lead concentrations, were 18% at a Freeway Interchange, 5% in a downtown commercial area, and 42% in suburban Warren. The average concentrations of benzo(a)pyrene at the sites were 6 micrograms/1,000 cu m, 7 micrograms/1,000 cu m and 1 microgram/1,000 cu m, respectively. Mean contributions based on carbon monoxide concentrations were approximately twice the levels based on lead concentrations. Benzo(a)pyrene and benz(a)anthracene in air were not statistically related to carbon monoxide or lead in air, but were higher in winter than in summer, probably because of the higher levels of these materials emitted in space heating combustion in winter. (Author abstract modified)##

05008

New York State Air Pollution Control Board, Albany. (Feb. 1966.) 132 pp.

AIR POLLUTION/THE MID-HUDSON: GREENE, ULSTER, ROCKLAND, COLUMBIA, DUTCHESS (COMPREHENSIVE AREA SURVEY REPORT NUMBER SIX).

A comprehensive study of the air pollution potential in the Mid-Hudson area was undertaken as a cooperative effort by the Columbia, Dutchess, Rockland, and Ulster County Health Departments, and the State Health Department's Oneonta District Office (for Greene County) and Middletown District Office (for Beacon City). The objective of the study was to define the nature and extent, and causes and effects, of the air pollution potential in the Mid-Hudson area. Both industrial and nonindustrial air pollution were studied by conducting an inventory of possible air contaminant sources and determining contaminant emissions within each county. The inventory was supplemented by an atmospheric sampling network consisting of 41 stations located throughout the five counties.##

05009

New York State Air Pollution Control Board, Albany. June 1966. 35 pp.

AIR POLLUTION NASSAU COUNTY (COMPREHENSIVE AREA SURVEY REPORT NUMBER FOUR).

A comprehensive survey of local sources of atmospheric contamination was conducted by the Nassau County Department of Health in order to appraise the present status of and the potential for air pollution in the County. In defining the nature and extent of existing and potential air pollution, the objectives of this study were: (1) To provide information from which rules and regulations may be established for the control and abatement of existing air pollution in Nassau County; (2) To provide technical data needed to implement a practical and reasonable air pollution abatement program; (3) To assess the effectiveness of existing controls and determine what steps must be taken by governmental agencies to control both existing and potential air pollution; (4) To provide background data needed to check the effectiveness of any future control program; and (5) To obtain information for presentation to the State Air Pollution Control Board for use by the Board in establishing rules and regulations for control of air pollution as mandated by law. An inventory of air contaminant sources, an aerometric sampling network, and an investigation of complaints and air pollution effects were undertaken to obtain the data needed.##

05057

M. E. Umstead, W. D. Smith, and J. E. Johnson

SUBMARINE ATMOSPHERE STUDIES ABOARD USS SCULPIN. Naval Research Lab., Washington, D. C., Chemistry Div. (NRL Rept. No. 6074.) Feb. 27, 1964. 27 pp.

Studies of the organic contaminants in the atmosphere of USS SCULPIN were made during a submerged cruise. Detailed analyses were made of the concentrations of methane, Freon-12, and "total hydrocarbons" by means of a backflush gas chromatograph of new design. The effectiveness of the CO/H<sub>2</sub> burners and main carbon bed as removal agents for organic contaminants was included in the studies. The CO/H<sub>2</sub> burners satisfactorily burned organic contaminants at temperatures as low as 500 degrees F. The active carbon in the main filter bed removed the higher hydrocarbons, but was not very effective for the removal of lower hydrocarbons and Freon-12. Based on experimental data obtained on shipboard, it was calculated that the rate of generation of organic vapor contaminants was about 1.5 pounds per day throughout the cruise. (Author abstract)##

05110

W. J. Hamming, R. D. MacPhee, and J. R. Taylor

CONTAMINANT CONCENTRATIONS IN THE ATMOSPHERE OF LOS ANGELES COUNTY. J. Air Pollution Control Assoc. 10, (1) 7-16, 93, Feb. 1960.

The primary purpose of this study was to analyze long-term pollution trends as measured by the Los Angeles air monitoring network. Except for work in England on a distinctly different type of air pollution problem, there are few data available which span any appreciable number of years. The District's monitoring was accomplished with 24-hr recording devices. Its usefulness is justified primarily as a protection and warning measure. A by-product of this operation is the generation of data from which pollution can be studied. The findings may be summarized as follows: (1) During the three-year period, 1956-59, the general level of CO rose. The rise in CO of one ppm per year was not reconciled with weather or other pollution factors. The rise in NO<sub>2</sub> was small and trends are available only from 1957. SO<sub>2</sub> varied slightly without changing its general level. Particulates declined during 1956 and 1957 which could have been due in part to the District's incinerator ban. A preliminary study on the basis of comparable weather factors appeared to justify this conclusion. The oxidant, eye irritant, and plant toxicant declined in 1956 and 1957 from a high in 1955, but exhibited a slight upturn in 1958. Winds and inversions appear to the determining factors for trends in eye irritant, oxidant and plant toxicant. (2) In examining the monthly average data used as the basis for the trend lines, it was observed that certain contaminant and weather factors could be grouped together. Monthly averages for primary, or Type I factors exhibited annual peaks in midwinter. These were CO, hydrocarbons, NO<sub>2</sub>, particulates, SO<sub>2</sub> (not perfect fit), frequency of morning surface inversions, and the inverse of 1600-1900 PST windspeeds. In addition, the Type I contaminants are known to yield bimodal diurnal variations. Secondary, or Type II, entities showed annual peaks in the autumn, and single daily peaks. These included aldehydes, eye irritant, oxidant, plant toxicants, ozone alerts, restricted visibility, the frequency of Rule 57 Days, and the inverse of 24-hr average windspeeds. Both the yearly and the diurnal cycles confirm the distinction between Type I and Type II contaminants. (Author conclusions modified)##

05336

C. E. Schumann and C. W. Gruber

AIR QUALITY DATA-1966. Cincinnati Dept. of Safety, Ohio, Div. of Air Pollution Control and Heating Inspection. (May 1967). 3j pp.

The purpose of this report, published for the first time as a separate document by the Cincinnati Division of Air Pollution Control, is to summarize air quality levels of pollutants currently being measured in the City of Cincinnati, including: (1) measurements made wholly by this Division; (2) results of cooperative projects with the U.S. Public Health Service; and (3) summaries of Cincinnati air quality compared to other cities for certain pollutants. Tabular data are given for: dust fall (setteable particulates); soiling index; suspended particulates; wind-blown particulates; gaseous pollutants; and Southwestern Ohio-Northern Kentucky air pollution survey.##

05573

L. B. Hitchcock, W. L. Faith, M. Neiburger, N. A. Renzetti, and L. H. Rogers

This paper summarizes the methods, the results, and some preliminary indications and conclusions employed in the survey. A major purpose of the survey was to monitor presumably important variables so as to provide a more adequate basis for diagnosis of the general problem. Pinto beans were used to measure the plant damaging effects of smog. Also measured were oxidants, nitrogen dioxide, hydrocarbons, carbon monoxide, aldehydes, sulfur dioxide, particulates, and meteorological factors. Some of the recommendations derived from the survey are that more complete meteorological measurements be obtained, that plant damage as a measure of smog be given more extensive study, and that a minimum of 14 monitoring stations be established in the Los Angeles Basin.##

05627

W. E. Scott, E. R. Stephens, P. L. Hanst, and R. C. Doerr

FURTHER DEVELOPMENTS IN THE CHEMISTRY OF THE ATMOSPHERE.  
Preprint. (Presented at the Session on Air Pollution,  
22nd Midyear Meeting, American Petroleum Inst., Division of  
Refining, Philadelphia, Pa., Mat 14, 1957.)

The technique of long-path IR spectroscopy is currently being used at the Franklin Institute both for direct studies of atmospheric pollution and for laboratory experiments. With the field instrument, concentrations of most of the important pollutants in the Los Angeles atmosphere were measured as a function of time and meteorological conditions. These studies supported the general picture of atmospheric pollutants and their reactions which was developed from laboratory studies both at The Franklin Institute and in other laboratories. Laboratory studies indicated the concentrations of NO and NO<sub>2</sub> would be quite low in smog. The organic nitrogen compound, identified as peroxyacyl nitrite, was a prominent product in the laboratory studies, and it was predicted that this compound would be found in the smog. Both of these conclusions were confirmed by atmospheric analysis. The presence of ozone, long used as the primary smog indicator, was also confirmed. Air analyses for several major pollutants, made after sundown, showed a close similarity to an analysis of diluted automobile exhaust and to an analysis of air taken near a heavy traffic center. Several compounds whose presence in polluted air has been suspected were found to be below the limit of detectability. Among these were H<sub>2</sub>CO, HNO<sub>3</sub> and CH<sub>3</sub>OH. Reaction products of O<sub>3</sub> with olefins at low concentration (30 ppm to 60 ppm) were identified as aldehydes, CO, CO<sub>2</sub>, water, and, from propylene and 2-pentene, ketene. Other products of the reaction between O<sub>3</sub> and the higher olefins were indicated. Yield of CO and CO<sub>2</sub> indicated a definite connection between chain length and the decomposition of products. Several pure ozonides were prepared at low temperature, and their infrared spectra recorded. In some cases the decomposition products were determined.##

Anderson, D. O., Williams, I. H., and Ferris, B. G., Jr.

THE CHILLIWACK RESPIRATORY SURVEY, 1963: PART II. AEROMETRIC STUDY. Can. Med. Assoc. J. 92, 954-61, May 1, 1965.

A study of the quality of the ambient air at Chilliwack, British Columbia, was conducted from May 1963 to April 1964. Measurements of dustfall, sulfation, hydrogen sulfide, oxidants and total hydrocarbons were made by a network of five sampling stations. The results of this survey indicated that Chilliwack was relatively free from any air pollution and would therefore be a suitable control for a study of the relationship between community air pollution and respiratory disease.

05675

G. J. Cleary and J. L. Sullivan

POLLUTION BY POLYCYCLIC AROMATIC HYDROCARBONS IN THE CITY OF SYDNEY. Med. J. Australia 52, 758-63, May 22, 1965.

General characteristics of atmospheric pollution and sources of polycyclic hydrocarbons in Sydney are briefly discussed. Air particulate samples were collected with high-volume samplers each month. These were extracted with acetone or cyclohexane, then developed on long alumina columns. The ultra-violet spectrum of each fraction provided the main criterion for qualitative identification, although fluorescence spectroscopy and paper chromatography were used to a minor extent. Quantitative analysis was made on the ultra-violet spectrum by means of the local base-line technique. Monthly concentrations of the hydrocarbons pyrene, fluoranthene, 1,2 benzanthrane, chrysene, 1,2 benzopyrene, 3,4 benzopyrene, 1,12 benzoperylene and coronene were reported. These showed a rise and fall cycle which paralleled the seasonal particulate density fluctuations. First-order correlation coefficients showed that the concentrations of each of the hydrocarbons measured were associated significantly with particulate density at the conventional probability level. The future contribution by petrol and Diesel engine exhaust products to the pollution by polycyclic aromatic hydrocarbons in Sydney should become more important. Conversely, the contribution from coal combustion sources should decline progressively. (Authors' summary)##

05839

H. Bravo and A. P. Baez

APPROACH TO THE CHARACTERIZATION OF THE AIRBORNE ORGANIC MATTER (BENZENE SOLUBLE) IN THE ATMOSPHERE OF MEXICO CITY. Preprint. (Presented at the 54th Annual Meeting, Air Pollution Control Association, New York City June 11-15, 1961.)

As 52% of the neutral benzene organic fraction in Mexico City's airborne particles consists of aromatic compounds, a characterization of this material was made. High volume samplers

were used. Three different sampling sites were chosen in the area of Mexico City with variation in activities considered when these sampling points were selected, i.e. Tacuba station was located in a semi-industrial area; a downtown station in an area with great traffic density; and a station at the University City, near a residential zone. Over a year period Tacuba station was operated only 2 weeks a month, while the other 2 were operated simultaneously one day each month, in order to obtain comparative data between the three sampling sites. The exposed filters were afterwards treated with benzene in a Soxhlet apparatus for a period of eight hours; collected (benzene soluble) material was dried in a water bath and weighed. An idea of the amount of organic benzene soluble material found in the samples taken at the stations in 0.1 g/cu m was 232. 184, 81 for the Downtown, Tacuba, and University City stations respectively. This table shows the average of simultaneous sampling carried out at the 3 stations. That the downtown area is the richest in its content of organic benzene soluble material in airborne particles is believed due to two factors: (1) traffic conditions; (2) buildings that screen or filter most of contaminants carried by prevailing winds coming from NE and NW. The highest concentration of organic benzene soluble material was found during the winter months. Comparison of the uv spectrum of the benzopyrene fraction (Mexico City) and benzopyrene spectrum reported by Sawicki indicate the presence of BaP in the analyses. Other polynuclear hydrocarbons found in the benzene soluble fraction in Mexico City's airborne particles were: fluoranthene, pyrene benzo(a)-anthracene, benzo(e)pyrene, benzo(g,h,i)perylene, and coronene. The benzo(a)pyrene value found in the organic benzene airborne particles in Mexico City lies within the range expected for nonurban areas. The only large communities where similar hydrocarbon concentrations are found are cities where auto-exhaust fumes are the principal pollutants (Los Angeles, San Francisco). A clear correlation between direct solar radiation and the organic matter content (benzene soluble) in airborne particles in Mexico City was not evident.##

05895

L. J. Proulx, Jr.

THE RISING TIDE OF AIR POLLUTION. Connecticut State Dept. Health, Hartford 81 (3), (Mar. 1967). 10 pp.

The air quality measurements of cities in Connecticut are presented. A correlation between population and the average suspended particulates (micrograms per cubic meter), benzene soluble organics, and dustfall is given. It is demonstrated that the contamination of the atmosphere is directly proportional to the size of the community. An enabling act (HB4D36) is presently under consideration in the 1967 General Assembly which would empower the Connecticut State Department of Health to develop air pollution regulations for inclusion in the Public Health Code of the State of Connecticut.##

Goetz, A.

THE CONSTITUTION OF AEROCOLLOIDAL PARTICULATES ABOVE THE OCEAN SURFACE. Proc. Intern. Conf. Cloud Phys., Tokyo Sapporo, Japan, p. 42-46, 1965.

The composition of particulates in the submicron range over the ocean was investigated. An aerosol spectrometer and a special polished chrome slide impactor were used to sample the particles. The deposits were analyzed microphotometrically and with regard to thermal stability, by exposure to 70 C for 15 hours. Deposits on formvar screens were taken with both instruments for electron microscope studies. Samples were taken as far as 70 miles off the coast of Southern California. The samples are typically thermally unstable. The poresence of organic compounds might explain this. Kelp leaves in sea water samples showed distinct foam formation. Air sampled above the agitated surface showed a prolific quantity of thermally volatilizable organics. Nebulized surface sea water samples showed a majority of liquid droplets and the absence of crystal formation; in 10 feet deep water samples, crystalline particles predominate. When the organics in the deposits were extracted with a clean solvent, the deposits' light scattering was substantially reduced to about the same level as by thermal exposure. The condensation pattern was also altered substantially. Electron photomicrographs indicated crystal formation only for particles larger than .7 microns, whereas the small sizes appear predominately amorphous.

06290

Public Health Service, Cincinnati, Ohio, National Center for Air Pollution Control

WASHINGTON, D. C., METROPOLITAN AREA AIR POLLUTION ABATEMENT ACTIVITY. ((212)) p., Nov. 1967. 18 refs.

From February 1967 to August 1967 the Public Health Service conducted a technical investigation in the Washington, D.C., metropolitan area to provide information that could form a basis for recommendations for abatement in accordance with the tenets of the Clean Air Act. The results are presented of the 1967 investigation and the methods, techniques, and procedures are described. In concert with cooperative regional and local agencies, an air quality network was established, an emissions inventory was conducted, extensive meteorological data were acquired, air pollution effects on vegetation and various materials were investigated, and special data processing and summarization techniques were developed. The boundaries for the activity conformed to the Metropolitan Washington Council of Governments' area which includes the District of Columbia; the Maryland counties of Montgomery and Prince Georges; the Virginia counties of Arlington, Fairfax, Loudoun, and Prince William; and the independent cities of Alexandria, Falls Church, and Fairfax.##



S. S. Epstein

EFFECTS OF PHOTOSENSITIZING POLYCYCLIC ATMOSPHERIC POLLUTANTS ON SINGLE CELLS. Preprint. (Presented at the 60th Annual Meeting, Air Pollution Control Association, Cleveland, Ohio, June 11-16, 1967, Paper No. 67-60.)

Polycyclic aromatic hydrocarbons, some of which are carcinogenic, are an important class of atmospheric pollutants produced by pyrolysis of organic matter. In a large series of polycyclic compounds, a strong positive association has been demonstrated between carcinogenicity and photodynamic toxicity, measured by lethal sensitization of a ciliated protozoan, *Paramecium caudatum*, to the otherwise non-toxic effects of long-wave ultraviolet light. A simple photodynamic bioassay has been developed to provide a rapid but indirect measure of the carcinogenicity of organic extracts of particulate atmospheric pollutants attributable to polycyclic compounds. NASN samples of atmospheric particulates were collected from approximately 100 different sources in the USA, exemplifying a wide spectrum of urban and rural pollutant characteristics, and composited by site, extracted and fractionated by standard procedures. Photodynamic potency bears no relationship to atmospheric concentration of particulates, organics or derived fractions. For the aromatic fraction, which contains all the BaP present in the parent organic extract, photodynamic potencies are strongly and positively correlated with BaP concentrations. The high potency of basic fractions probably reflects their content of carcinogenic di-alkylated benz(c)acridines. Sub-fractionation of a large composite oxy-neutral fraction has suggested that its photodynamic activity is due to the carcinogenic (7H-benz(de)anthracene-7-one. In a limited study on the carcinogenicity of organic extracts of atmospheric pollutants from 6 urban sites, using the mouse neonatal assay, a positive association was found between carcinogenicity and photodynamic toxicity. These and related studies are being further pursued.##

06430

J. F. Shively and E. M. Ilgenfritz

A SURVEY OF HYDROCARBON AMBIENT AIR CONCENTRATIONS IN MIDLAND, MICHIGAN. Preprint. (Presented at the 60th Annual Meeting, Air Pollution Control Association, Cleveland, Ohio, June 11-16, 1967, Paper No. 67-184.)

Ambient air hydrocarbon concentrations (reported as ppm of methane) were determined at the Midland location of the Dow Chemical Company at five sites during the years 1963 through 1966. Hydrocarbon concentrations as determined with a Beckman Hydrocarbon analyzer (Model 108) were correlated with wind direction and wind speed. Wind speed concentration data are presented in two groupings (0-7) and 8-24+) M.P.H. In addition to hourly average concentration data the paper demonstrates the benefit of also recording the hourly maximum instantaneous peak concentration as an aid in highlighting shot losses or poor dispersive characteristics of vents. Interpretation and integration of individual site data clearly indicated the plant

areas contributing the major hydrocarbon losses. Hydrocarbon background level (non-plant) was established and found to be closely representative of urban air. Dow contribution to the city area was determined to be at a low but measurable level and to be relatively constant irrespective of wind speed. Comparison with survey data from other areas was made. (Authors' abstract)##

06535

T. O. Carver, B. Bucove, V. G. Mackenzie, and A. N. Heller

AN APPROACH TO A SOLUTION OF AN INTERSTATE AIR POLLUTION PROBLEM. Preprint. (Presented at the 57th Annual Meeting, Air Pollution Control Association, Houston, Tex., June 1964.)

A six-months study (1961-1962) of an air pollution problem in Lewiston, Idaho and Clarkston, Washington was made jointly by the Departments of Health of Idaho and Washington and the Division of Air Pollution, Public Health Service. Aerometric studies, meteorological conditions, materials damage, and emission inventories were evaluated and preliminary considerations of health effects were made. Socio-economic aspects via a public awareness study of air pollution in Clarkston, Washington are reviewed in terms of survey methodology and analysis. Complementary studies of an odor survey in both Lewiston and Clarkston are interpreted. The development of a number of joint recommendations to solve the immediate air resource management problem and allow for future economic growth in the valley is explored. (Authors' abstract)##

06701

NATIONAL AIR SURVEILLANCE NETWORKS CONTINUOUS AIR MONITORING PROGRAM (1966 DATA TABULATIONS AND SUMMARIES FOR CHICAGO, CINCINNATI, DENVER, PHILADELPHIA, ST. LOUIS, AND WASHINGTON, D.C.). Public Health Service, Cincinnati, Ohio, National Center for Air Pollution Control. (1966). 551 pp.

The Continuous Air Monitoring Program is the National Air Surveillance Network which operates six continuous monitoring stations in major cities throughout the country. The data tabulations in this booklet are summaries of hourly concentrations of gaseous pollutants and 2-hourly summaries of soiling index levels during 1966. Also enclosed is a brief summary of monthly means and maxima, and annual frequency distributions of data from all stations.##

06707

SUMMARY OF 1964-1965 AIR QUALITY MEASUREMENTS. 90th Congress ("Air Pollution--1967, Part 3 (Air Quality Act") Senate Committee on Public Works, Washington, D.C., Subcommittee on Air and Water Pollution, April 19, May 2-4, 2-10, 1967.) p. 129801306.

Air pollution surveillance activities conducted by the National Center for Air Pollution Control include a nationwide network of stations equipped for periodic measurement of suspended particulate matter and, in some instances, such gaseous pollutants as sulfur dioxide and nitrogen dioxide; a six-city network of

stations equipped for continuous measurement of several gaseous pollutants; and a relatively new network of stations designed to provide a general indication of effects of air pollution on various types of materials in interstate regions. Data from both the periodic and continuous air sampling stations are discussed.##

06760

N. Saruta

AIR POLLUTION IN NORTHERN KYUSHU. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo) 4, (2) 35-45, July8 1966. Jap.

A preliminary investigation of air pollution in northern Kyushu was started in 1952 and studies on existing conditions have been carried out since 1959. The yearly and monthly amounts of dust fall and SO<sub>2</sub> in the five wards of northern Kyushu are tabulated for 1959 through 1965. The results show decrease in dust fall (from 26.49 to 20.73 tons/sq. cm./month) and in increase in SO<sub>2</sub> (from 0.25 to 0.64 mg/100 cc/day). Tabulations of dust fall and SO<sub>2</sub> are given for the industrial, business, and residential sections. The Fe<sub>2</sub>O<sub>3</sub> present in red smoke has also been measured and averages between 2.0 and 2.8g/sq. m/month. Measurements of 3,4-benzopyrene and components of automobile exhaust such as CO, SO<sub>2</sub>, Pb, NO, and NO<sub>2</sub> are also tabulated for the five wards.##

06788

(STUDIES OF AIR POLLUTION IN THE DEPARTMENT OF THE SEINE IN 1965. PART 3. CONDITIONS AT ORLY AIRPORT.) Etudes de Pollution Atmospherique dans le Departement de la Seine en 1965. Troisieme Partie. Operation "Aerodrome d'Orly." Laboratoire Municipal de la Prefecture de Police, Paris, France. (Apr. 1966.) pp. 1-2, 9, 11, 13-7. Fr.

The results of an air pollution study made at Orly Airport at the request of the medical services at the airport are given. The survey covered the exposure to ground personnel and an investigation of the components of the fuel and emissions from jets. The investigation was conducted by a mobile air pollution laboratory located at the field during the study. In general, the pollution was negligible, the emissions from the jets were not a matter of concern, but there was a nuisance hazard to workers on piston planes. The carbon monoxide was determined by infra-red absorption with an average reading recorded every 15 min. The averages ranged from 0.5 to 18 ppm. The other contaminants that were determined included carbon dioxide, nitric oxide, nitrogen dioxide, sulfur dioxide, aldehydes, lead, 3,4-benzopyrene, toluene, xylene, and benzene, and in all cases the results were much lower than those obtained in various stations in Paris. Both on the basis of analyses made on ambient air and on emissions from jets there is little evidence of air pollution at Orly Airport in Paris.##

(STUDIES OF AIR POLLUTION IN THE DEPARTMENT OF THE SEINE IN 1965. PART 4. CONDITIONS IN THE LOOP OF THE SEINE.) Etudes de Pollution Atmospherique dans le Department de la Seine en 1965. Quatrieme Partie. Operation Boucle de la Seine. Laboratoire Municipal de la Prefecture de Police, Paris, France. Apr. 1966. pp. 1-2, 5-7, 9-10, 13, 15-7, 21, 23. Fr.

The 1965 results are reported of a continuing study of the air pollution in the industrial region northwest of Paris which originated with complaints of the residents. Because of the low carbon monoxide content of the air no tests for that gas have been made since 1960. This work is based on an examination of the dust collected from 16 Owens gages located in the loop and, for comparison, 5 in Paris and 1 in Bievres. The amount of insoluble dust and the content of ash and 3,4-benzopyrene was determined. In the soluble dust, the sulfate, chloride, and calcium ions were measured. The results were reported as the dust fall on a surface of 100 sq m per month. The elimination of coal from two central power stations in 1965 compared to 1961-1963, which indicated some other important pollution source was responsible. Tables and charts show the values for the various components of the settled dust since 1959 and compare the results with samples taken in other areas.##

06886

Borisyyuk, Yu.P., and B. S. Ruchkovskii

CONTAMINATION OF AIR BY 3,4-BENZOPYRENE AROUND CERTAIN INDUSTRIAL ENTERPRISES. ((Zagryaznenie 3,4-benzpirenom atmosfernogo vozdukha v raionakh nekotorykh proizvodstvennykh predpriyatii.)). Hyg. Sanit. (Gigiena i Sanit.), 30(1):107-108, Jan. 1965. Translated from Russian.

CFSTI: TT 66-51033

Atmospheric pollution by 3,4-benzpyrene in the vicinity of certain industrial enterprises is reported. Samples were taken by the aspiration method, using the FFP-15 grade filter. In taking a single sample, about 2000 cu m air were passed through the aspirator. The deposit on the filter was extracted with petroleum ether. The samples were tested for 3,4-benzpyrene by fluorimetric spectrography and spectrophotometry. Considerable quantities of 3,4-benzpyrene were discharges of metallurgical and asphalt-concrete enterprises. Only traces of 3,4-benzpyrene were detected in the vicinity of agglomeration factories of ore-dressing plants, and this is probably explained by the technological conditions of agglomeration.##

06946

New York State Air Pollution Control Board, Albany.

AIR POLLUTION IN WESTCHESTER. 87pp. (Dec. 1965).

The industrial and nonindustrial air pollution potential of Westchester County, N.Y. were studied by conducting an inventory of possible air contaminant sources to determine

contaminant emissions. The inventory was supplemented by an atmosphere sampling network consisting of 23 stations located throughout the county. Recommendations were based on the findings from combined inventory and atmospheric sampling data. Unlike the heavily industrialized portions of the state, only 23% or 42,000 tons of Westchester County's air contamination comes from industrial sources while 77% or 140,000 tons of the total contamination comes from nonindustrial sources. Of this amount over 100,000 tons come from motor vehicle and other transportation sources. Thus in aggregate, more than 55% of the total air pollution comes from these transportation sources while 64,000 tons of approximately 35% comes from fuel used for heat and power. Approximately half of the fuel emissions, 18% of the total contaminants, are from industrial sources. This, along with the 6% contributed by industrial processes, accounts for industry's 23% of the total emissions.##

06948

CRITERIA FOR AIR QUALITY AND METHODS OF MEASUREMENT. World Health Organization, Geneva, Switzerland. (Rept. No. WHO/AP/23.) (Presented at the Inter-Regional Symposium, Geneva, Switzerland, Aug. 1963.) (Sept. 10, 1963). 20 pp.

An Inter-Regional Symposium on Criteria for Air Quality and Methods of Measurement was convened in Geneva from 6-12 August 1963. Twenty experts in the field of air pollution from 15 countries in the American and European Regions of WHO presented technical papers and participated in the discussions. The Symposium discussed the rationale for selecting air quality criteria in Member countries, the role of epidemiological surveys in establishing guides to air quality, and studies on effects indirectly related to human well-being, such as damage to vegetation, soiling of surfaces, and reduction in visibility. The Symposium also defined the areas in which further research is needed to produce data that will serve as a sound basis for establishing guides to air quality; the participants emphasized the need for agreement on methods of measurement that, even if not identical, yield comparable data. Topics discussed (1) General considerations; (2) Rationale for selecting air quality criteria; (3) Role of epidemiological and aerometric surveys; (4) Damage to vegetation, soiling of surfaces and visibility reduction; (5) medical studies needed for the improvement of data relating to guides to air quality; (6) needs for the standardization of methods of sampling and analysis of ambient air pollutants; (7) need for international collaboration and agreement on air quality criteria and methods of measurement.##

06966

J. E. Yocom, J. A. Farrow, J. C. Magyar, and R. M. Gagosz

AIR POLLUTION STUDY OF NEW BRITAIN, CONNECTICUT (SUMMARY REPORT). ((TRC Service Corp., Hartford, Conn.)) (Sept. 1966). 38 pp.

The City of New Britain Health Department conducted a survey of air pollution in the city. It was the purpose of the survey to develop information on the major sources of air pollution in the city and determine their geographical distribution, to collect data

on the general level of air quality in terms of several pollutants, and to measure meteorological conditions associated with the air quality measurements. The survey was started in October 1965 and was completed in July 1966. Air sampling and meteorological measurements were made concurrently over approximately a one month period in each of the 4 seasons. Between the winter and spring sampling periods several samples for suspended particulate matter were collected in the vicinity of suspected major sources of particulate matter. The source inventory was conducted throughout the entire survey period. The survey was designed to enable the Health Department to assess the need for an air pollution control program and to serve as the basis for developing such a program.##

06977

AIR RESOURCES IN THE MID-WILLAMETTE VALLEY. Mid-Willamette Valley Air Pollution Authority, Salem, Oreg. (Dec. 1966). 80 pp.

In October of 1965, a survey and sampling program was initiated to determine the quality of air within the five counties of Benton, Linn, Marion, Polk and Yamhill. Phase I of this survey was accomplished by location of major sources of air pollution, identification of amounts and kinds of pollutants and, with meteorological data, establishment of dispersal and disposition patterns of pollution. Sources of pollution in the Mid-Willamette Valley consist mainly of combustion of fuels for heat and power, process emissions, and industrial and community solid waste disposal practice. Other sources of lesser significance at this time include auto exhaust emissions and agriculture and forest management practices. Intermittent build up of suspended particulates occurs during inversion periods throughout the year. Any month of the year in Salem will see inversions two of every three mornings. In conclusion, the early findings in the study do not indicate the need for a crash program of air pollution control. There is a strong indication that unless a preventive program is initiated to cope with the expansion and growth of communities and industries, the quality of the air supply will rapidly deteriorate.##

07198

Y. Kawanami

AIR POLLUTION IN TOKYO. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo) 4(2):11-22 (July 1966). Jap.

A definition of smog is given as the restriction of visibility to less than 2 km in the city and vicinity, excluding the restriction by rain. Out of 154 days when smog occurred in Tokyo in 1965, 64 were caused by heavy fumes and 90 by mist or haze. The differences in times of occurrence of heavy fume-type smog and mist or haze-type smog is discussed. The yearly variation of the number of "smog days" is graphed indicating seasonal influences. Smog decreases in winter but increases in summer and fall. The current status of air pollution in Tokyo is also covered with respect to dust and soot fall, floating dust, sulfuric acid, nitrogen oxides, hydrocarbons, and lead compounds. Measurement of dust and soot fall in Tokyo began in 1955 and yearly variations are graphed through 1965. Dust fall reaches a peak between

February and May and then again in August and September. These peaks are related to the meteorological influence of strong winds in spring and large amounts of rain in spring and late summer. Therefore, July and December are considered the best times to investigate air pollution without meteorological influence. Lengthy discussion is given to daily and hourly variations of pollution peaks in urban, industrial, and suburban areas.##

07292

Grushko, Y. M., P. P. Dikun, I. M. Shabad, T. I. Rukavishnikova, L. M. Zak, and O. M. Vlasenko

A COMPARATIVE STUDY OF ATMOSPHERIC AIR POLLUTION WITH CARCINOGENIC SUBSTANCE (3,4-BENZOPYRENE) IN IRKUTSK AND ANGARSK. Text in Russian. *Gigiena i Sanit.*, 23(4):7-10, 1958. 6 refs. Engl. transl. by B. S. Levine, U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol. 2, p. 81-86, March 1960.

CFSTI TT60-21188

Most of the fuel consumed in Irkutsk is burned by boiler operated manufacturing and production plants and by residential heating installations at comparatively low temperatures, which results in an extensive emission of soot into the atmospheric air. In addition, the Irkutsk smokestacks are of insufficient height for proper dispersion. At the Angarsk electric heat station the coal is burned at 1100 deg., which results in the production of the minimum amount of soot. The boilers are equipped with electrostatic precipitators which remove 95% of the ash from the discharge gases, and the smokestack of the station is 120 m high. All the above aid is sharply reducing the atmospheric air pollution. It was thought that the content of 3,4-benzopyrene in the atmospheric air of Irkutsk and Angarsk may differ sharply. To determine the correctness of such an assumption snow samples were collected in 1956 at certain points in Irkutsk and in Angarsk which contained sedimented industrial smoke fall-out; these were studied for their content of 3,4-benzopyrene. The results indicated that the control measures instituted in the city of Angarsk proved adequate for the protection of the atmospheric air of the residential part of the city, especially as related to the prevention of dissemination throughout the city of carcinogenic hydrocarbons.##

07304

Los', L. I., A. G. Sadiwnikova, R. M. Soboleva, and D. Ya. Turets

THE QUALITY OF ATMOSPHERIC AIR IN THE VICINITY OF PETROLEUM REFINERY PLANTS. *Gigiena i Sanit.*, No. 8:8-13, 1950. Translated from Russian by B. S. Levine, U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol. 2, p. 175-180, March 1960.

CFSTI TT60-21188

The present study extended over 1947 - 1949. Air samples for the determination of hydrocarbons were collected in special 100 - 200 ml pipettes. Hydrocarbons were determined by the combustion

method and carbonic acid by the Reberg method. The sensitivity of the method was 0.01 - 0.02 mg of carbon per 1 liter of air. Qualitative hydrogen sulfide tests were made with lead acetate paper and quantitative by Khrustaleva's silver nitrate method. A maximum of 1 liter of air was aspirated through a microdrexell absorber. The sensitivity of Khrustaleva's method was 0.0005 - 0.001 mg/l. Air samples were collected at production assemblies 3 - 4, 7 - 8, 45 and others throughout the plant. A subjective study was made by questioning 174 residents of the different community areas. Residents of the south and east settlements noticed the odor of petroleum becoming stronger when the wind blew toward the settlement. Residents of the upper residential area noticed the unpleasant odor only when the wind blew from the plant in the area. In the summer all had noticed a stronger odor of petroleum in the air; they complained that it was not possible to open the windows or ventilators for house airing. Residents of the south settlements complained of metallic objects tarnishing. It is recommended that working conditions in the plant be improved and pollution of the atmospheric air of the populated areas be decreased by instituting the following sanitary measures: install equipment for the removal of sulfur compounds from the petroleum; enforce prevention of gas leakage in manufacturing process; and sanitize surroundings by planting trees, shrubs and other greenery.

07366

Grafe, K. and K. H. Peters

RECORDING OF CO AND ITS DEPENDENCE ON TRAFFIC AND WIND. ((Co-Registrierungen in ihrer Abhängigkeit vom Strassenverkehr und vom Wind.)) Text in German. Städtehygiene (Uelzen/Hamburg), 15(6):129-134, June 1964. 8 refs.

At two locations in down-town Hamburg, CO measurements were made with the aim of establishing relationships between CO concentrations, traffic density, and wind velocity and direction. Three maps illustrate the general and detailed location of the sample points. The equipment used was the continuously recording URAS-1-CO instrument of Hartmann & Braun. In six diagrams, daily and weekly variations of the CO concentration, their distribution function, and their dependence on wind direction and velocity are presented. While some influence of the buildings lining the street is noticed, the CO concentration is mainly a function of the traffic density. No relationship was found between the concentrations of CO and 3,4-benzopyrene. Increased CO concentration is accompanied by increased dust concentrations, probably stemming also from the exhausts.##

07393

K. Nakayama

PRESENT STATUS OF AIR POLLUTION IN CITIES AND TOWNS. Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc.) (Tokyo/). 3(3):4-10, 1965. 12 refs.

A review of well-known air pollution episodes is given citing environmental conditions, damages, and causes for episodes in Meuse (Belgium) in 1930, Donora, Pa. in 1948, London in 1952, Mexico in 1950, Yokohama (Japan) in 1946,



and Los Angeles at present. The present problems of air pollution in Tokyo are dealt with including dust fall, SO<sub>2</sub> concentration, floating soot, dust, and hydrocarbons. The average value of dust fall was 23.46 tons/sq km/30 days for 1959 to 1963; the soluble elements of soot fall were measured at 6.47 tons/sq km/30 days. The maximum was recorded in 1961; seasonal measurements indicate a maximum in February and a minimum in December. Yearly variations of the quantities of coal and petroleum used between 1955 and 1964 indicate a relation between dust fall and the amount of coal used, but no relation between the latter and petroleum consumption. The distribution of SO<sub>2</sub> gas concentrations in 1964 as measured by the lead peroxide method is shown on a map of Tokyo. Hydrocarbon concentration of C<sub>2</sub> to C<sub>8</sub> compounds ranges from 15 ppb to 1.5 ppm. In heavily trafficked areas the concentration of 3,4-benzopyrene is between 1.3 and 6.6 microgram/100 cu m. The effects of automobile exhaust from the gasoline engine are detected as high as 500 m. Also, water pollution from the Samida river causes ammonia and hydrogen sulfide to be discharged into the air.##

07408

Violet, P. and G. Dumarchey

STUDY OF THE AIR POLLUTION IN LYON DURING 1965. ((Etude de la Pollution de l'Atmosphere de Lyon (Annee 1965).)) Text in French. Pollut. Atmos. (Paris), 9(34):77-83, Apr.-June 1967.

The results obtained at various stations located in the Lyon area are detailed in charts, tables, and graphs to show the air pollution by month for SO<sub>2</sub>, dust, CO, CO<sub>2</sub>, unburned hydrocarbons as well as an analysis of the dust samples caught on a Teflon filter over the period of a month. The maximum SO<sub>2</sub> for the year was found on Jan. 12 at Bossuet St. and showed 222 ppm compared to 510 in 1963. The average concentration during the winter for SO<sub>2</sub> and dusts was 129 and 108 micrograms/cu. m., respectively, while the summer values were 34 and 36 micrograms/cu. m., respectively. On the 27th of July, no SO<sub>2</sub> was found at 10 stations. Analytical methods are given for the various pollutants. The average SO<sub>2</sub> concentration for Lyon was below that of Rotterdam and Paris. Paris from October to March has a much higher concentration than Rotterdam but is lower from April through October. Rotterdam is lower than Lyon in Smoke concentration and Paris is about the same as Lyon with regard to smoke.##

07448

C. B. Robison, J. C. Chambers, J. W. Bates

DEFINING THE PROBLEM OF AIR POLLUTION IN METROPOLITAN BIRMINGHAM, ALABAMA. Preprint, Jefferson County Dept. of Health, Ala., ((32)) p., June 1967. 15 refs.

The air pollution problem in Metropolitan Birmingham, Alabama is presented. The results and recommendations of previous and current studies of air pollution in Jefferson County are compiled. Possible methods of air pollution control are also discussed. The topography of the Birmingham

area is irregular, consisting of ridges with intervening valleys. The city proper is in a valley. The main climatic effect of the topography is that during winter months it produces extreme temperature inversions and rather low minimum temperatures. The range of annual averages of suspended particulate matter in the 10 station sampling network varied from 72 to 281 microgram/cu. m. Results show that 20% of the time suspended particulate matter in Jefferson County exceeds 265 microgram/cu. m. The annual averages for dustfall range from 9.5 tons/sq. mi./mo to 87.8 tons/sq mi./mo. Sulfation levels are generally rather low in Jefferson County. Sulfur dioxide levels are generally low year round with the winter season having the highest concentrations. Nitrogen dioxide was the only gaseous pollutant found in any significant quantities with the range of daily levels being 0.7 to 62.7 parts per hundred million. Daily aldehyde levels ranged from 0 to 4.0 parts per hundred million. Air pollution comes from four main sources: (1) Domestic, (2) Transportation, (3) Commercial and (4) Industrial. Stationary sources include the domestic, commercial and industrial. Industrial sources account for approximately 98% of the particulate emissions, 88% of the gaseous emissions and 53% of the hydrocarbon emissions from stationary sources. In comparison with stationary sources transportation contributes only slightly to the particulate matter. The results of the public opinion survey showed that 54% of the people within the City of Birmingham and an average of 42% of the people outside the city limits were annoyed or affected adversely in some way by air pollution.##

08163

Y. I. Shvarts, L. A. Zil'berg

ZONAL STUDY OF ATMOSPHERIC AIR POLLUTION IN AREAS SURROUNDING A ROOFING TAR PAPER PLANT. In: Survey of U.S.S.R. Literature on Air Pollution and Related Occupational Diseases. Translated from Russian by B. S. Levine. National Bureau of Standards, Washington, D. C., Inst. for Applied Tech., Vol., 3, p. 186-188, May 1960.

CFSTI: TT 60-21475

Determinations were made of the content of dust, hydrocarbons, and sulfur dioxide in the vicinity of a roofing tar paper plant. Air samples were collected on the windy side, and 2.5 m above the ground on all sides of and at different distances from the plant. Hydrocarbons were determined by the combustion method; sulfur dioxide was determined nephelometrically; and dust was determined gravimetrically. Carbon dioxide determinations were made in 13 air samples collected at 50 m from the plant. The concentration of carbon dioxide varied between 0.048 - 0.9302 mg/l of air. Hydrocarbon concentrations varied between a trace to 0.35 mg/cu m; SO<sub>2</sub> varied between 1.25 and 5.59 mg/cu m. To obtain more accurate results with reference to the basic source of air pollution, 8 additional laboratory analyses were made of air samples collected 1.3 km from the plant at a point far away from industrial establishments. Sulfur dioxide concentrations varied between 0.0012 - 0.0015 mg/l; and dust concentrations varied between 1.05 and 1.12 mg/cu m. This was taken as evidence of the fact that air pollution in the vicinity of the plant was caused by the emission of gases and by the dust coming from the plant.##

08196

Kononova, V. A.

SANITARY CLEARANCE ZONES BETWEEN RESIDENTIAL SECTIONS AND PLACES OF FUEL STORAGE IN SOVKHOZES OF SARATOVSK (OBLAST) TERRITORY.

Gigiena i Sanit., 23(6):11-14, 1958. 3 refs. Translated from Russian by B. S. Levine, U. S. S. R. Literature on Air Pollution and Related Occupational Diseases, Vol. 4, p. 188-192, Aug. 1960.

CFSTI: TT 60-21913

The mechanization of agriculture in the Soviet Union is accompanied by the proliferation of centers where automotive agricultural machinery is housed and fuel for the machinery is stored. The prescribed 75 m wide sanitary clearance zone between residential sections and fuel storage centers was evaluated for effectiveness in protecting residents from gasoline fumes and automotive emissions. Tetraethyl lead and hydrocarbons were measured in air and soil at varying distances from the gasoline storage tanks. It was concluded that a sanitary clearance zone of 75 m was inadequate.##

08198

Stankevich, B. E. and M. I. Isaeva

SELECTION OF AIR INTAKE POINTS FOR VENTILATION OF PREMISES IN PETROLEUM PROCESSING PLANTS. Gigiena i Sanit., No. 8:27-34, 1954. Translated from Russian by B. S. Levine, U. S. S. R. Literature on Air Pollution and Related Occupational Diseases, Vol. 4, p. 202-208, Aug. 1960.

CFSTI: TT 60-21913

Previous investigators had concluded that even under most unfavorable conditions of refinery building location with regard to hydrogen sulfide accumulation, the air intakes located 18 - 20 m above the ground could supply air sufficiently pure for practical ventilation. In an effort to disprove this conclusion, studies were made at two petroleum refineries. Air samples taken simultaneously at 5, 10 and 15 m above the ground were analyzed for the content of hydrogen sulfide, hydrocarbons, carbon monoxide and sulfur dioxide. It was found that the installation of air intakes at 15 - 20 m fails to improve the quality of ventilation air, and in many cases might worsen it. In view of the complexity and specific conditions which may exist in some modern oil refineries, the choice of necessary sanitary measures can be made only on an individual basis by taking into consideration actually existing conditions.##

08300

Maga, John A. and Asce, M.

VEHICULAR POLLUTION EFFECTS IN URBAN DEVELOPMENT. Proc. Am. Soc. Civil Engrs., J. Urban Planning Develop. Div., 93(UP4): 231-241, Dec. 1967. (Presented at the American Society of Civil Engineers Transportation Engineering Conference, Philadelphia, Pa., Oct. 17-21, 1966.)

Toxic emissions from motor vehicles such as carbon monoxide, hydrocarbons, and nitrogen oxides in urban areas were measured. The tabulated results indicate that operation of large numbers of motor vehicles cause high concentrations of these contaminants in the urban atmosphere. The direct relationship between emissions and atmospheric concentrations is found in localized situations as well as communitywide air pollution. The quantity of exhaust contamination emitted can be related to traffic patterns and vehicle operating modes. Stop and go driving results in more pollutants than unimpeded flow. The present approach to a reduction of motor vehicle emissions, which is based mainly on engine modification and the use of control devices, is not sufficient. Additional benefits can be obtained through highway design, mass transit, and urban planning.

08315

Bosco, G. and Grella, A.

DETERMINATION OF AROMATIC POLYCYCLIC HYDROCARBONS IN THE HAZY ATMOSPHERE OF SIENA, ITALY. (Determinazione di idrocarburi policiclici aromatici nel pulviscolo atmosferico della città di Siena.) Text in Italian. Nuovi Ann. Igiene Microbiol. (Rome), 17(4):297-300, 1966. 10 refs.

Data concerning occurrence and quantitative determination of polynuclear aromatic hydrocarbons in the air of Siena, Italy, from February through June, 1965 are reported. The data are tabulated for fluorene, phenanthrene, ant-racene, pyrene, fluoranthene, 1,2-benzanthracene, chrysene, perylene, 3,4-benzopyrene, 1,12-benzanthracene, anthracene, and coronene. Amounts up to 5 micrograms/100 cu.m. of air were determined using hi-volume air-samplers which were placed 2 to 10 meters above the ground in five locations.

08322

Hantzsch, Siegfried and Erdwin Lahmann

CONCENTRATIONS OF HYDROCARBONS IN THE AIR OVER URBAN STREETS AND THEIR RELATION TO THE OCCURRENCE OF CARBON MONOXIDE. ((Kohlenwasserstoff-Konzentrationen in Strassenluft und ihre Relation zum Auftreten von Kohlenmonoxyd.)) Text in German. Erdöl Hölle (Hamburg), 20(9):642-643, Sept. 1967.

Continuous measurements of hydrocarbon and carbon monoxide levels of the ambient air were conducted alongside a Berlin street with high traffic density for several months. Hydrocarbons were measured with a flame ionization detector and carbon monoxide with an infrared analyzer. About 2,000 half-hourly average values and the daily average value were determined. The mean hydrocarbon concentration was dependent on the density of the traffic, reaching 7 ppm during the afternoon peak. Maximum value of total hydrocarbons was 14.2 ppm. Seventy percent of the values were in the 3 - 6 ppm range and 1% exceeded 10 ppm. The carbon monoxide and hydrocarbon concentrations were directly correlated showing a linear relationship, the average daily coefficient of correlation being 0.88. The mean absolute concentration of carbon monoxide was three times higher than that of the hydrocarbons.##

Masek, Vaclav

THE EFFECT OF SOLAR RADIATION ON THE PRESENCE OF 3,4-BENZOPYRENE IN INDUSTRIAL EXHAUSTS. ((Vliv slunečního záření na přítomnost 3,4-benzopyrenu v exhalacích.)) Text in Czech. Chem. Průmysl (Prague), 17(2):99-103, 1967. 30 refs.

The determination of polycyclic hydrocarbons in industrial exhausts and in the atmosphere has become increasingly important in recent years. The main interest is focused on carcinogenic substances, particularly on 3,4-benzopyrene. In the present study, 3,4-benzopyrene was determined from samples obtained by passing air through filter paper in the vicinity of a coking plant in which coal tar products formed during carbonization leak into the atmosphere. At the same time the intensity of solar radiation was recorded with a Robitzsch pyranograph. The results showed that the intensity and duration of solar radiation had no effect on the content of 3,4-benzopyrene in the atmosphere and in the dust in the vicinity of the source. The discharge of tar products into the atmosphere must be controlled by changing the technology, e.g. by improving equipment seals and using steam injection to reduce the vapor pressure inside the equipment. Tables and graphs.##

09117

Alvisatos, G. P., B. N. Bazas, J. Alexopoulos, and E. Verykokakis

AIR POLLUTION IN THE CITY OF ATHENS AND SURROUNDING TERRITORY. L'Igiene Modern, 60(1-2):3-25, Jan.-Feb. 1967. 42 refs.

Air pollution in Athens is discussed with emphasis on emission sources, population density, and city planning. An air sampling survey, conducted from mid-1962 to the early part of 1966, is described. The survey concentrated mainly on determining the amounts of smoke, SO<sub>2</sub>, CO, dust particles, dustfall, and polycyclic aromatic hydrocarbons. The results are tabulated. It is concluded that no immediate health hazard exists from air pollution in Athens because it is a windy and dry area. Recommendations are made to avoid hazardous air pollution in the future.##

09209

Schuenemann, J. J.

ASSIGNMENT REPORT. AIR POLLUTION TEHERAN. AN INTRODUCTORY SURVEY OF THE PROBLEMS AND SOME SUGGESTED ACTIVITIES. World Health Organization, Geneva (Switzerland), 49p., Sept. 13-Oct. 1, 1965. 3 refs.

A project was begun in the city of Teheran which consisted of these two parts: 1. A short term study of the main recognized sources of air pollution in the city with the aim of identifying their causes and recommending appropriate technical and administrative measures for their abatement. 2. A long-term

small scale study of air pollutants and their effects on the community with the aim of training staff and developing techniques for more intensive future studies. Information corresponding to these two parts is presented.##

09766

Moberg, J. L.

ANALYSIS OF TRACE CONTAMINANTS IN CLOSED ECOLOGIC ATMOSPHERES.  
Aerojet-General Corp., Azusa, Calif., Proj. 7930, Task  
793002, SAM-TR-66-99, 17 p., Dec. 1966.  
CFSTI, DDC: AD 647618

A 27-day experiment designed to determine man's contribution to trace contaminants in a sealed environment was conducted. The use of cryogenic fractionation and concentration provided samples with sufficient levels of contaminants for analysis by means of gas chromatography and mass spectroscopy. Large numbers of aromatic and aliphatic hydrocarbon compounds were detected in the samples. Alcohols, aldehydes, organic acids, esters, ethers and ketones were detected in smaller quantities.

09936

Bosco, G., G. Barsini, A. Grella

NEW STUDIES ON THE PRESENCE OF AROMATIC POLYCYCLIC HYDROCARBONS IN THE ATMOSPHERIC DUSTS OF THE HISTORIC CENTER OF THE CITY OF SIENA. ((Nuove indagini sulla presenza di idrocarburi policiclici aromatici nel pulviscolo atmosferico del centro storico della città di Siena.)) Text in Italian. Nuovi Ann. Igiene Microbiol. (Rome), 18(4):285-292, July-Aug. 1967. 14 refs.

Air at three locations in the center of town was sampled daily from Sept. 1965 to June 1966 using a high volume sampler. Particulate residues deposited on the filter paper were then analyzed for the presence of aromatic hydrocarbons. Data are tabulated and are considered of interest due to the closing of this part of town to all private traffic. Pheanthrene, anthracene, pyrene, methylpyrene, fluoranthene, 1,2-benzanthracene, chrysene, perylene, benzopyrenes, benzofluoranthenes, anthanthene, 1,12-benzoperylene, 1,2,5,6-dibenzanthracene and coronene are found in amounts ranging from traces to 10.45 microgram/100 cu m. Highest values are generally observed during December and January. Domestic heating is mentioned as a source of the hydrocarbons.

11015

Tanimura, Hisashige

BENZO(A)PYRENE IN AN IRON AND STEEL WORKS. Arch. Environ. Health, 17(2):172-177, Aug. 1968.

To investigate benzo(a)pyrene in an iron and steel works, separating and measurement methods were studied, and amounts of benzo(a)pyrene contained in suspended and falling particulates were collected in the plant and measured for summer and winter sessions.

The samples were separated chromatographically and the amounts were determined spectrophotometrically. A great amount of benzo(a)pyrene was found near the three high mills in the rolling mill plant, the coke oven, the blast furnace, and the electric furnace. High correlations were found between benzo(a)pyrene in suspended and falling particulates. (Author's abstract)##

11224

Venezia, R. and G. Ozolins

INTERSTATE AIR POLLUTION STUDY PHASE II PROJECT REPORT. II. AIR POLLUTANT EMISSION INVENTORY. Public Health Service, Cincinnati, Ohio, National Center for Air Pollution Control, 50p., Dec. 1966. ((50)) refs.

An emission inventory was conducted during 1963-1964 as part of the St. Louis - East St. Louis Interstate Air Pollution Study. The Study covered an area of 3,567 square miles and included the City of St. Louis and the six surrounding counties - St. Louis, St. Charles, and Jefferson Counties in Missouri and Madison, St. Clair, and Monroe Counties in Illinois. More than 95 percent of the population and almost all of the industrial activity are located in the 400 square miles of the centrally located urbanized part of the Study area. The pollutant emission data presented can be almost entirely attributed to this urbanized portion of the area. Population density and land-use maps, which provide an excellent index to the areal distribution of most pollutant emissions, are presented. The pollutants considered in this survey are those emitted in large quantities from a variety and multitude of sources dispersed throughout the area. Included are aldehydes, carbon monoxide, hydrocarbons, nitrogen oxides (calculated as nitrogen dioxide), sulfur oxides (calculated as sulfur dioxide), particulates, and benzo(a)pyrene. The emissions of other pollutants are generally associated with a specific process or operation and in general, are not distributed throughout the community. (Authors' abstract, modified)##

11267

Public Health Service, Cincinnati, Ohio, Div. of Air Pollution.

FOUR-YEAR SUMMARY OF DATA FROM THE CONTINUOUS AIR MONITORING PROGRAM. Preprint, ((23))p., Aug. 1966.

Continuous air monitoring data gathered during 1962 - 1965 is summarized. Ambient atmospheric concentrations of six gaseous air pollutants from several major American cities are given. These include sulfur dioxide, nitric oxide, nitrogen dioxide, total oxidants, total hydrocarbons, and carbon monoxide, and sailing index values. Summaries by city and year are given of the annual average concentrations, the maximum and minimum monthly average concentrations, and the maximum daily average concentration of the several pollutants monitored.##

Kutscher, W. and R. Tomingas

STUDY OF THE HAZARDS PRESENTED BY SOOT AND AIR DUST WITH PARTICULAR EMPHASIS ON THEIR CARCINOGENIC ACTION. - PART 10 - DUST MEASUREMENTS BY MEANS OF THE TM-II APPARATUS AT A BUSY SECTION OF HEIDELBERG. ((Untersuchungen über die Schädlichkeit von Russen und Luftstäuben unter besonderer Berücksichtigung ihrer kanzerogenen Wirkung.)) Text in German. Arch. Hyg. Bakteriol., 152(3):260-264, June 1968. 3 refs.

In July 1967 (a very hot month, free of precipitation), 10 measurements were made at a busy intersection of Heidelberg, Germany. The findings revealed that the amount of dust in the air was more than 1 mg per cubic meter which, by any standards, is extremely high. Evaluation of various factors suggested that automobile exhaust was largely responsible for this high degree of air pollution. The interesting feature of the present study is that the size of dust particles collected during measurements is compatible with their deep penetration in the respiratory tract. Particles as large as 50 microns were seldom encountered, most of the dust grains being slightly larger than 10 microns. Chemical analysis revealed that the amount of benzo(a)pyrene varied between 37 and 97 micrograms per cubic meter of air.##

Univ. Liege, Belgium, Lab. Toxicology and Hygiene

SURVEYS PERFORMED IN BELGIUM. POLLUTION BY EFFLUENTS OF COMBUSTION IN AN URBAN ZONE WITH HEAVY POPULATION DENSITY. ((Enquetes realisees en Belgique. Pollution par effluents de combustion en zone urbaine a forte densite de population.)) Text in French. Organization for Economic Co-operation and Development, Paris, France, 4p., (1967) 3 refs.

As part of a continuing study of the effects of air pollution in the vicinity of Liege, a qualitative and quantitative evaluation of the pollutants from a charcoal compressing factory on the northeast outskirts of the city are reported. The neighborhood is mixed residential and contains a school, a sport field, an exhibition hall, and a railroad line. The factory produces 60 tons of processed coal per hour, is sealed, and equipped with electrostatic filters. The indicators were settling particles and suspended particulates. The factory began operating in April 1960 and the monitoring began in December 1959 and continued through April 1961. The sites are described for each pollutant and the methods of determination listed. The results are not given in detail (they may be in graphs which are not included with the document). The emissions were exclusively carbon and tars. Some methods of determination were found to be more reproducible than others. Fluorescence was a specific indicator for the presence of polycyclic hydrocarbons in the settling particles.##



SURVEYS PERFORMED IN BELGIUM. POLLUTION BY EFFLUENTS OF COMBUSTION IN AN URBAN ZONE WITH HEAVY POPULATION DENSITY. ((Enquetes Realisees en Belgique. Pollution par Effluents de Combustion en Zone Urbaine a Forte Densite de Population.)) Text in French. Organization for Economic Co-operation and Development, Paris, France, 4p., (1967) No refs.

Air pollution measurements by continuous monitoring were carried out between 1962 and 1965 in Liege, a city of 150,000 inhabitants/25 sq. km. situated in the center of an industrial area of 500,000 inhabitants/90 sq. km. in the Meuse Valley. The weight of respirable suspended particles (permanent pollution) in the air was estimated by spectrophotometry while polycyclic hydrocarbons were obtained by column chromatography and spectrophotometry, or by chemical extraction. Particulate residues induced by fumes (industrial and vehicular) amounted to 0.1 mg/cu m in the center of the agglomeration and 0.07 mg/cu m in the suburbs and high grounds. In wooded sites and in industrial areas permanent pollution amounted to 0.05 mg/cu m and 0.13 mg/cu m, respectively. The general increase (40%) of pollution observed during the winter months was caused by the continual use of combustibles for domestic heating and was higher in the suburbs. Wind velocities of more than 15 km/hr reduced permanent pollution to 0.5 mg/cu m at all sites, while temperature inversion increased pollution 2-3 times the seasonal average. The concentration of polycyclic hydrocarbons increased 5-10 times during the winter and was directly related to temperature. The concentration of polycyclic hydrocarbons per weight unit of permanent pollution changed according to site and season, indicating the varied nature of the samples collected.##

11914

L. N. Samoilovich, and Yu. R. Redkin

AIR POLLUTION WITH 3,4-BENZOPYRENE FROM PETROLEUM AND CHEMICAL INDUSTRIES. ((Zagryaznenie atmosfernogo vozduha 3,4-benzpirenom predpriyatiiyanii neftehimirkeskoi promishlennosti.)) Text in Russian. Gigiena i Sanitariya, 33(9):10-14, Sept. 1968. 7 refs.

The 3,4-benzpyrene concentrations of 193 air samples from 2 petroleum refineries, one chemical plant, and the city of Grozny, collected for 3 years by an ERV-49 aspirator and adsorbed on the organic FPA-15 tissue, were determined after extraction with benzene and dilution with n-octane. The refineries had 0.1-40 mKg microgram/100 cu m (with values of 0.8-40 mKg/100 cu m in coke shops), the chemical plant (pyrolysis shop) 0.9-9.1 mKg/100 cu m, and the city sections (distance 50-2000 m from a contact coke plant) 0.08-0.40 mKg/100 cu m maximal 3,4-benzpyrene concentrations. The emission was the highest during full-capacity production, with 2-4-fold increase in a contact coke plant of refinery No 2. By order of the city sanitary physician refinery No2 was closed down temporarily. The furnaces were supplied with gas-forming fuel and hermetization was carried out. It was concluded that within a 2-km radius from a petroleum refinery, there is considerable 3,4-benzpyrene pollution. The most significant sources were the coke and pyrolysis shops.##

Cavanagh, Leonard A., Conrad F. Schadt, and Elmer Robinson

ATMOSPHERIC HYDROCARBON AND CARBON MONOXIDE MEASUREMENTS AT POINT BARROW, ALASKA. Environ. Sci. Technol., 3(3):251-257, March 1969. 12 refs.

The concentrations of low molecular weight hydrocarbons and carbon monoxide in uncontaminated Arctic air masses were analyzed at Point Barrow, Alaska. Using gas chromatographic techniques, a variety of organic compounds were regularly observed in these air masses, and the following average concentrations were obtained: methane, 1.6 ppm; butane, 0.06 ppb; acetone, 1.0 ppb; and n-butanol, 190 ppb. Carbon monoxide concentrations averaged about 90 ppb. Special investigations confirmed the unexpected presence of n-butanol in these samples. Sources of these organics are postulated. (Author abstract)

13788

Ingiulla, M., C. Grasso, and E. Mariottini

USE OF HYDROCARBONS LEVEL DETERMINATIONS IN THE STUDY OF AIR POLLUTION. (Ulteriori determinazioni dell'ossido di carbonio quale indice di inquinamento atmosferico). Text in Italian. Igiene Mod. (Parma), 61(9-10):582-591, Sept.-Oct. 1968. 3 refs.

Air pollution in Florence was studied by determining concentration levels of carbon monoxide in 1296 air samples and hydrocarbons in 1188 samples. Samples were taken in busy streets and adjacent shops or apartments. The CO concentrations reached levels as high as 150 ppm outdoors and 50 ppm in a shop, indicating notable air pollution. Hydrocarbon levels were too small to be determined. (Author summary modified)

14180

Gordon, Robert J., Henry Mayrsohn, and Raymond M. Ingels

C2-C5 HYDROCARBONS IN THE LOS ANGELES ATMOSPHERE. Environ. Sci. Technol., 2(12):1117-1120, Dec. 1968. 12 refs.

A joint study was carried out in Los Angeles in the fall of 1967 to define more closely the actual concentration of oxides of nitrogen and various hydrocarbons in the atmosphere on days of differing smog intensity. Part of the study involved gas chromatographic analysis for light hydrocarbons, ethane to isopentane, at two sites. Almost 700 samples were run during 46 days. Averages were presented for the hourly samples subdivided into groups of high or low oxidant development. Light paraffins, especially propane, were found in concentrations too high to be ascribed to auto exhaust, but their source was not pinpointed. The average morning concentration of oxidant at various locations was closely similar, hour by hour, in spite of large differences in the levels of primary pollutants. The ratios of acetylene and high olefins to nitrogen oxides were found to be higher than the average in exhaust generated in a test cycle on a dynamometer.

COMMISSION ON EARTH, WATER AND AIR, ROTTERDAM. Annual Report 1968. (Verslag over het jaar 1968). Text in Dutch. 72p.

This report deals with the soil, water, and air pollution problems in the vicinity of Rotterdam. Thirty-three cases of soil pollution reported in 1968 were mainly due to leakage in underground tanks and pipes. The average chlorine content at low tides at the measuring station of the Horingerdijk reservoir was 139 mg/l, 7 mg/l lower than in 1967. The level of air pollution during 1968 was more or less constant in comparison with 1967. A study of the 1218 bronchitis complaints of male civil servants indicated that bronchitis occurs with increasing frequency in the age group above 40 and especially above 60. A study of chronic bronchitis and asthma in elementary school children in two sections of Rotterdam indicated that in Crosswijk, 5.5% of 455 children had chronic bronchitis and 2.2% had asthma. In Hillegersberg, 1.0% of 480 children had chronic bronchitis and 1.7% had asthma. Measurements of precipitation, smoke, polycyclic hydrocarbons, CO, ozone, NO<sub>2</sub>, and sulfur oxides are presented. The smoke meter results show a usual smoke content of 100 micrograms/cu m or more during long periods of mist which occur during the winter months. In the first and fourth quarters, the polycyclic hydrocarbon values were much smaller than those of 1964. Of 174 samples of carbon monoxide, 18 were more than 30 ppm; in 1967, only one sample was higher than 30 ppm. The highest lead content was 1.5 micrograms/cu m. Ozone content of the air was less than 20 micrograms/cu m on cloudy days. Nitrogen oxide concentration ranged from 100-150 micrograms/cu m. Ninety-one days were recorded with SO<sub>2</sub> content equal to or greater than 350 micrograms/cu m, and 89 days were recorded with smoke content equal to or greater than 250 micrograms/cu m. The declining tendency for smoke pollution was attributed to the increasing use of natural gas.

14616

Commission on Earth, Water, and Air, Rotterdam

REPORT ON THE YEAR 1967. (Verslag over het jaar 1967). Text in Dutch. 128p.

The Commission on Earth, Water and Air Pollution, Rotterdam, is composed of engineers and scientists from various municipal commissions and public service departments. It works closely with other municipal groups and industrial associations to regulate pollution in the area around the mouth of the Rhine, collaborating on guidelines for municipal ordinances and emission standards. The commission operates an extensive measurement network and maintains laboratory facilities for the chemical analysis of pollutants. One of its purposes is to compile a report of all public and private activities relating to combating the pollution of earth, water, and air. This report for 1967 surveys the reduction in pollution effected by measures undertaken by municipal power operations, municipal plants, and private industry in the Rotterdam area; control methods still under study; sources of water pollution; complaints about the dispersion of unpleasant odors, smoke, soot, and fog; the possible relation between air pollution and bronchitis in municipal employees and school children; results of atmospheric measurements; and the preparations for a national environmental hygiene literature pool. In 1967,

pollution caused by smoke, sulfur dioxide, and polycyclic hydrocarbons continued to decrease, indicating that conditions imposed by authorities and efforts made by industries were largely successful. Measurement data and meter readings are tabulated. Maps of the measurement network are included.

14776

Lahmann, Erdwin

#### STUDIES OF AIR POLLUTION CAUSED BY MOTOR VEHICLES.

(Untersuchungen ueber Luftverunreinigungen durch den Kraftverkehr). Text in German. Schriftenreihe Ver. Wasser Boden Lufthyg. (Berlin), no. 28, 80p., 1969. 123 refs.

A measuring station for determining the extent of air pollution caused by motor vehicles was erected in front of the city hall in West Berlin, considered to be the busiest point in the city. The Uras infrared analyzer was used for continuous measurement of CO and CO<sub>2</sub> concentrations 75 cm above the ground; ozone was continuously measured at 2 and 20 m with a unit developed by Damaschke und Luebke based on liberation of bromine from a potassium bromide solution by ozone. For continuous measurement of hydrocarbons at 75 cm, a Beckman 109A analyzer was used. Discontinuous sampling was employed for measurement of NO, SO<sub>2</sub>, formaldehyde, and phenols. A high volume sampler was used for determination of the total dust concentration. Traffic counts were conducted throughout the measurement period, and the driving cycles were determined. The results are listed in detail in numerous tables and diagrams. The influence of meteorological factors such as wind direction and speed, humidity, temperature, and pressure is discussed. The maximum half-hourly average CO concentration was 60 ppm with concentration peaks in the morning and afternoon rush hours. Maximum CO<sub>2</sub> concentration was somewhat less than 500 ppm and thus only 50% higher than the natural CO<sub>2</sub> concentration of the atmosphere. No dangerous ozone concentrations were measured. All NO<sub>2</sub> concentrations were below 0.2 mg/cu m. Peak SO<sub>2</sub> concentrations occurred in between rush hours, which indicates that they are due to domestic heaters. A linear relationship between the various pollutants was found. The results of these measurements are compared with results in the literature.

14679

Tanimura, Hisashige

STUDY ON THE RELATION BETWEEN BENZO(A)PYRENE OF THE SUSPENDED MATTERS AND THAT OF THE FALLING MATTERS IN THE ATMOSPHERE. (Taikichu no fuyujin to rakkajin chu no Benzo (a) pyrene ryo no kankai ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), vol. 21:269-278, 1966. 31 refs.

Suspended and settling particulates were collected in industrial and residential urban districts in the city of Kita-Kyushu in the summer and winter from 1964-1965 and analyzed for benzopyrene. Suspended and settling particulates were collected at similar times and places and the relationship between benzopyrene in suspended particulates and settling particulates was determined. The results showed a high correlation between

benzopyrene in suspended and settling particulates in both seasons and in similar places. In suspended and settling particulates, benzopyrene in industrial urban areas was greater in the winter and was always greater than in residential areas. (Author abstract modified)

14785

Franco, P. and C. De Pompeis

INQUIRY INTO ATMOSPHERIC POLLUTION IN THE CITY OF PESCARA. (Indagine sull'inquinamento atmosferico nella città di Pescara). Text in Italian. Igiene Sanita Publica (Rome), 24(11-12):550-567, Nov.-Dec. 1968. 29 refs.

This Italian city of 120,000 inhabitants and 20,703 motor vehicles has light to medium industry, relies heavily on tourist trade from surrounding resorts, is the fastest-growing city outside Rome, and is intersected (rather than by-passed) by the Adriatic national highway. Homes are heated, mostly with heavy naphtha, from early November to late March. Fifty percent of approximately 1000 home heating plants lack official approval. No central facility for burning trash is provided. In May 1967 and April-June 1968, the air was tested at 15 critical points with Draeger 19/31 gas detectors, located 1-1.70 m above street level, for the presence of CO, CO<sub>2</sub>, SO<sub>2</sub>, hydrocarbons, and the nitrogen oxides, from 8:30 to 12 a.m. and 7-8 p.m. Carbon monoxide was detected at six points; at one point, where crosstown and Adriatic highway traffic meet, the concentration was 100 ppm. Sulfur dioxide was detected at two points. Practical proposals were made: better placement of bus stops, timed traffic lights, installation of air purifiers, possibility of more electrically driven public transport, education of motorists in 'anti-pollution' driving habits, and use of larger zones of vegetation in congested areas. The authors feel that confinement of Pescara's expansion to the seacoast has been salutary and they oppose future expansion into the hilly inland region, because such expansion would promote more severe air pollution problems.

14997

Hilst, Glenn R., John E. Yocom, and Norman E. Bowne

THE DEVELOPMENT OF A SIMULATION MODEL FOR AIR POLLUTION OVER CONNECTICUT. VOLUME 1. (SUMMARY REPORT.). Travelers Research Center, Inc., Hartford, Conn., Grant RSA-67-4, 66p., Oct. 1967. 3 refs.

CFSTI, DDC: PB 182 608

A working, computer-oriented simulation model of the state-wide Connecticut air pollution system was developed. This simulation model is designed to estimate the cumulative air pollution loading of Connecticut's atmosphere with a spatial resolution of one mile and a time resolution of one hour. Any arbitrary distribution of the air pollution sources can be evaluated with regard to resultant air quality over the region. As a management tool for evaluation of alternative air pollution control practices, this model provides an unprecedented information and evaluation system. In addition to the construction of this very versatile

simulation model, an inventory of the location and hour-by-hour emission rates of the varied sources of five pollutants was completed, the major variabilities of the atmospheric dispersion processes over Connecticut were assessed. These products serve as the input variables to the simulation model. The source inventories show that, in 1967, man-made sources of air pollution in Connecticut will emit some 300,000 tons of oxides of sulfur, 129,000 tons of the oxides of nitrogen, 1,290,000 tons of carbon monoxide, 328,600 tons of hydrocarbons, and 63,900 tons of suspended particulates. Exemplary calculations of the expected air pollution levels in Connecticut under various meteorological conditions, as predicted by the simulation model, are presented. These examples show clearly the regional variability of air quality; they illustrate the power of the model to evaluate of complex planning and control problems inherent in effective air resource management. Connecticut will have the advantage of a system that can evaluate the air quality implications of control plans before they are implemented and also define, in unprecedented detail, the causes of present and future air pollution problems. (Author summary modified)

15154

Lahmann, Erdwin and Siegfried Haentzsch

AIR POLLUTION BY HYDROCARBONS. (Luftverunreinigung durch Kohlenwasserstoffe). Text in German. Staedtehygiene (Uelzen/Hamburg), 20(10):243-246, 1969. 15 refs.

At the side of a busy road in Berlin, automatic air quality measurements (mainly of hydrocarbons) were taken for a total of six months between 1967 and 1968 using the Beckman hydrocarbon analyzer 109 A. The air samples were taken at 75 cm above the pavement. The measurements were made mostly from 6 a.m. to 10 p.m. and a total of 3500 half-hourly values were obtained. It was found that 75% of the individual values belonged to the concentration range of 3 to 7 ppm hydrocarbons (methane equivalents) and 1.6% of the values exceeded 10 ppm. The arithmetic mean of all values was 5.04 ppm, the 50% value of the cumulative frequency was 4.5 ppm, the 95% value of the cumulative frequency was 8.4 ppm, and the 98% value of the cumulative frequency was 9.8 ppm. The three highest concentrations measured were 17.2, 15.9, and 15.3 ppm. The highest hydrocarbon concentrations were measured during traffic rush hours in the morning and afternoon. The measured concentrations are not considered to be dangerous. In 1955, the maximum allowable concentration for gasoline was set at 500 ppm. The maximum allowable atmospheric concentration is 20 ppm (long-term) and 60 ppm (short-term). A table of hydrocarbon concentrations found in several American cities between 1962 and 1966 is included.

15248

Pailer, M., H. Begutter, R. Baumann, and J. A. Schedling

BENZO(A)PYRENE CONTENT OF DUST SAMPLES FROM THE METROPOLITAN AREA OF VIENNA. (Benzo(a)pyrenegehalt von Staubproben aus dem Wiener Stadtgebiet). Text in German. Oesterr. Chemiker-Zeit., 67(6):222-5, July 1966. 15 refs.

To determine the benzo(a)pyrene content of 31 random dust samples collected on glass fiber filters in Vienna, the filters were extracted with benzene, the benzo(a)pyrene was separated with thin-layer chromatography, and the concentration was determined by spectrophotometry. The samples were obtained from January 1965 to October 1965. In warm weather, concentrations between 16 and 70 micrograms/1000 cu m were measured. In winter months, the concentrations were much higher (123 to 165 micrograms/1000 cu m). Concentration measurements outside the city in the summer yielded values between 0.5 and 0.8 micrograms/1000 cu m. No relationship could be found between the dust concentration and the benzo(a)pyrene concentration. Comparison of the results with those of other cities shows good agreement. Inhaling 20 cu m of city air (100 micrograms benzo(a)pyrene/1000 cu m daily is shown to be equivalent to inhaling smoke from 50 to 60 cigarettes (0.03 micrograms benzo(a)pyrene).

15287

Zur Muehlen, Thorkill

MEASUREMENTS OF STYRENE EMISSIONS AND IMMISSIONS WITH THE AID OF GAS CHROMATOGRAPHY. (Messungen von Styrol-Emissionen und -Immissionen mit Hilfe der Gaschromatographie). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, vol. 18:41-43, Feb. 1968. 15 refs.

Air samples for determining the concentration of styrene fumes in the vicinity of a processing plant for polyester resin were obtained with a gas collecting tube. A membrane pump was used to draw in 30 l air within a period of 5 minutes. In the gas chromatographic analysis of the samples; helium (99.99%) was used as a carrier gas and the operating temperature was 150 C. Calibration was performed according to the method described by J. May. At the outlet of the vapors, 340 ppm were measured; at a distance of 1 m, 130 ppm, at a distance of 10 m, 8 to 9 ppm; and at a distance of about 35 m, about 1 ppm. The odor threshold for styrene was found to be 1 ppm.

15575

Lehmann, E. and J. Westphal

RELATIONSHIP BETWEEN MOTOR TRAFFIC DENSITY AND AIR POLLUTION IN A METROPOLITAN STREET. (Beziehungen zwischen Kraftverkehrsdichte und Luftverunreinigungen in einer Grossstadtstrasse). Text in German. Strassenbau (Duesseldorf-Oberkassel), no. 6: 4p., 1968. 4 refs.

In the years 1966 and 1967, extensive air quality measurements were made on a busy street in Berlin. The relationships between the traffic density and the carbon monoxide, hydrocarbons and lead concentrations in the air above the street were determined. The CO was continuously measured with an infrared analyzer over a period of 12 months. The air samples were taken 75 cm above the pavement. Half-hourly averages were obtained from the continuously recorded CO concentrations. The hydrocarbon (CH) concentration was continuously measured with a flame

ionization detector. The lead content was determined intermittently at a height of 3 m. Analysis of the precipitated dust for lead was performed by the dithizon method. Simultaneously with the lead concentration measurements, traffic counts were conducted between 6 a.m. and 8 p.m. The correlation coefficients were determined for the relationship between traffic density and the CO, CH and lead concentrations. These were 0.90, 0.85, and 0.78, respectively. A correlation between the CO, CH, and lead content of the air and the traffic density was found when long-term averages were used for the comparison. Comparison of the measured results of just one day showed no correlation. The meteorological influence was stronger in this case than that of the traffic density. Concentrations of the various exhaust components were generally interdependent. In this way, measurement of just one substance is sufficient to obtain general information on air composition.

15600

Braja, M., G. Trompeo and G. C. Vanini.

FIRST INVESTIGATIONS ON THE POLLUTION OF THE AIR OF TURIN BY POLYCYCLIC AROMATIC HYDROCARBONS. (Prime ricerche sull'inquinamento de idrocarburi policiclici aromatici nell'atmosfera urbana di Torino). Text in Italian. L'Igiene Moderna, 62(1-2):27-45, Sept. 1969. 9 refs.

Polycyclic aromatic hydrocarbons (PAH), among the substances most frequently accused of cancerogenic powers, are the products of incomplete combustion. Due to the high boiling point of PAH (above 150 C), they easily condense into soot particles and are conveyed in this form, leading to a certain correlation with the dust content of the atmosphere. Results of PAH determinations were evaluated by gas chromatography, recently shown as superior to technical chromatography or spectrophotometry. Two types of sampling were used: protracted sampling when the air had a high dust content; and instantaneous sampling, at times of low dust content. Dust samples were collected every 14 days during the winter and spring, and once a month during the summer. A total of 110 samples were collected from 15 collecting points strategically located throughout the city. About 0.2 grams of dust from a sample was preserved in a plastic food bag in darkness, then placed in the flask, previously treated with acetone, of a Soxhlet apparatus, and extracted with 200 ml of cyclohexane for 16 hours. The cyclohexane was vacuum-evaporated at 35-40 C; the residue was dissolved in 10 ml cyclohexane and divided into two equal samples, one of which was added 0.1 ml of a standard solution of fluoranthene, chrysene, and bensopyrene. These were treated according to the technique of Hoffman and Wynder. a residue of 0.1 ml nitromethane solution was obtained, 1 microliter of which was used for gas chromatography with the Parkin-Elmer model 801, using nitrogen as the transport gas. The present article is limited to an evaluation of the first 55 tests made. The following PAH were identified: anthracene, fluorene, chrysene, 1,2-benzanthracene, and 3,4-benzopyrene. An unknown group of peaks also appeared on the chromatogram which has been noted with chromatograms of auto exhaust gases, suggesting a possible relationship.



Odaira, Toshio

AIR POLLUTION FROM MOTOR VEHICLE GASES IN TOKYO AND OSAKA. (Dai toshi ni okeru jidosha haiki gas ni yoru taiki osen no jittai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(5):337-353, 1969. 17 refs.

Various pollutant concentrations were determined near highways and surrounding areas in Tokyo and Osaka. A large amount of carbon monoxide was found near the highways, and gradually decreased in the surrounding areas. The difference in the height of the pollutant between the highway and surrounding areas could not be measured to 100 m if the wind was slow and natural convections occurred. The carbon monoxide concentration was found to be related to traffic density. The four pollutant patterns differed from each other in the dust content, sulfur dioxide and nitrogen dioxide content, carbon monoxide and nitric oxide content, and ozone content. The average CO was 3 to 8 ppm/yr; however, 40 to 50 ppm/hr was not rare. In the middle of the city, over 10 ppm/hr was measured 27% of the time. In the districts that were 100 to 200 yards from the highway, the monthly average was 5 to 6 ppm, but 30 to 50 ppm/hr sometimes occurred. In winter, this became serious. Nitric oxide concentrations were 0.05 to 0.25 ppm along the highway; NO<sub>2</sub> was estimated to be less than 0.05 ppm. For the surrounding districts, NO was 0.05 to 0.15 ppm in winter and 0.01 to 0.05 ppm in summer. Hydrocarbons averaged 2 ppm/mo along the highway. Carbon monoxide, NO, and the hydrocarbon concentration curve changed during the day. Oxidants averaged 0.02 to 0.06 ppm/mo and sometimes 0.14 to 0.25 ppm/hr. These measurements reveal that photochemical smog is important in Tokyo. Lead was 3 to 9 mg/cu m along the highway and 0.7 to 5 mg/cu m in the surrounding districts.

16266

Hudson, Gerald

AIR QUALITY SURVEY. EL PASO METROPOLITAN AREA. Texas State Dept. of Health, Austin, Div. of Occupational Health and Radiation Control, PHS Grants 69B-4701-SI and 69B-4707-RD, 160p., 1969. 12 refs.

An air sampling program was conducted from Oct. 17, 1968 to Nov. 17, 1968 to determine ambient air quality for the El Paso Metropolitan Area. The concentration and location of air pollutants present in the lower atmosphere were determined. The pollutants monitored were particulate matter, sulfur dioxide, hydrogen sulfide, carbon monoxide, total hydrocarbons, aldehydes, nitrogen dioxide, and ozone. Twenty five fixed sampling sites were chosen in representative locations throughout the area. There were numerous occurrences during the survey of periods of atmospheric stagnation which caused a buildup of pollutants. The period for the survey was deliberately chosen to coincide with the period of the year having the greatest frequency of atmospheric stagnation. A desire to obtain measurements of maximum air pollutant concentrations was a major factor in making this choice. Concentrations of suspended particulates were greater than the ambient air standard of 200 micrograms/cu m 28% of the time.

The sulfur dioxide ambient air standard was 0.2 ppm for 24 hr and 0.4 ppm for any 30 min period. Sulfur dioxide readings monitored during the survey were less than or equal to 0.15 ppm 97% of the time. Concentrations were greater than 1.0 ppm for 30-minute averages on two occasions. Concentrations of greater than 0.5 ppm for one hour were found less than 0.2% of the time. Carbon monoxide values ranged from 0 to 18 ppm, depending on traffic volume. The ambient air standard was not set. Standards for total hydrocarbons were not set either, but hourly averages ranged from 0-10 ppm. It was concluded that the El Paso area has an air pollution problem and the major pollutants are particulate matter, sulfur dioxide, carbon monoxide, and total hydrocarbons. Promotion of air pollution control and control methods were recommended, as well as legislation restricting emissions. Tables are given for industrial and metropolitan emission inventories, soiling index, steel plate corrosion, and particle size distribution. Climatology, topography, and meteorological parameters are discussed.

16336

Schaad, R. and A. Gilgen

BENZO(3-4)PYRENE IN THE DUST SEDIMENT OF ZURICH, BADEN AND KLOTENER RIED. (3,4-Benzpyren im Staubsediment von Zuerich, Baden, und Klotener Ried). Text in German. Z. Praeventivmed., 14(5):299-300, Sept.-Oct. 1969. 9 refs.

To determine the benzo(3-4)pyrene content of the dust and the amount of benzo(3-4)pyrene in the human environment dust was sampled with Bergerhoff units. The samplers were established at 15 stations in Zurich, at 5 in Baden, and at one in Kloten. Each station contained three units. The water insoluble fraction of the monthly dust sediment was separated; the benzo(3-4)pyrene was extracted with cyclohexan and analyzed with a spectrometer. The benzo(3-4)pyrene content of the dust in the city of Zurich was more than twice as high as the dust sedimented in rural areas. The concentration was much lower in Baden than in Zurich, but higher than in the rural area. The sedimented benzo(3-4)pyrene quantity in Zurich in summer was two and one half times larger than in the rural area; in winter, five times larger. It was twice as high in Baden than in the rural area. The benzo(3-4)pyrene maxima can be clearly traced to the motor vehicles in summer and to domestic heating in winter.

16440

Kelenffy, Szilveszter and Jozsef Morik

SOME RESULTS OF THE INVESTIGATION OF AIR POLLUTION CAUSED BY ROAD TRAFFIC. (A kozlekedes okozta legszennyezodes vizsgalatanak nehany eredmenye). Text in Hungarian. Idojaras (Budapest), no. 4:227-231, 1967. 7 refs.

The dust producing effect of road traffic in Hungary was investigated. In addition the concentrations of carbon monoxide, 3,4-benzopyrene, and hydrocarbons were also measured near filling stations. In dry weather, an airborne dust content of 7.0-8.8 mg/cu m on macadamized roads and 3.5-5.2 mg/cu m on concrete roads was found. In rainy weather, the amount of dust was

reduced to 2.1-3.4 mg/cu m. On roads with a dust free covering, under average traffic conditions, the dust content was 15,000-20,000 particles/l of air. In urban regions, the average number of particles was 100,000/l of air. Thus, the dust pollution caused by road traffic was of the order of 1 mg/cu m of air. Vehicles followed by a plume of smoke were frequently seen. In the wake of a strongly smoking tractor, 1-1.5 million particles/l were found. In the busiest parts of Budapest, the average concentration of CO amounted to 20 mg/cu m. The concentration of carbon dioxide ranged from 0.03-4.00% of the total value, with an average of 2% of the volume. The tar content of the street dust, collected at busy points, was 3%, and the content of 3.4-benzopyrene equalled 9 micrograms per 1 gram of dust. (Author abstract modified)

## K. LEGAL AND ADMINISTRATIVE

00152

AUTOMOTIVE AIR POLLUTION IV. (A REPORT OF THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE TO THE U.S. CONGRESS PURSUANT TO PUBLIC LAW 88-206 - THE CLEAN AIR ACT.) 89th Congress (2nd Session.) (Document No. 101.) July 28, 1966. 15 pp.

Emission standards in accordance with section 202 of the amended Clean Air Act have been established to limit the crankcase emissions and the exhaust hydrocarbons and carbon monoxide emissions of all passenger cars and light commercial vehicles with engines larger than 50 cubic inches total displacement, effective with the 1968 models. Procedures are in the final stage of development to enable manufacturers who so request to make application for certification that their vehicles or engines do conform with the Federal regulations as provided for in section 206 of the Clean Air Act. A Federal motor vehicle compliance laboratory is being established in Metropolitan Detroit for confirmation and surveillance testing and to provide assistance and guidance to the vehicle manufacturers. Emission tests of 1966-model cars equipped with California-type exhaust emission controls are being conducted to determine the effectiveness of the systems, and, to some extent, their maintenance history is being reviewed. It is anticipated that when the 1967 models are introduced in California the program will be expanded to include a number of these cars as well. Extensive reports of industry progress in dealing with the automotive air pollution problem are appearing in technical presentations before the Society of Automotive Engineers; 18 such presentations were made in January 1966, and 7 more are scheduled for June 1966. The Public Health Service is placing increased emphasis upon studies which will lead to improved test procedures and which will form the basis for possible revisions in emission standards for future application. (Author)##

00169

A. J. Benline

1965 ANNUAL REPORT - DEPARTMENT OF AIR POLLUTION CONTROL - CITY OF NEW YORK. Dept. of Air Pollution Control News 8, (5) Apr. 1966. 40 pp.

City of New York, Department of Air Pollution Control, Annual Report for 1965, describes New York City air pollution progress as it relates to administration and personnel; engineering; public opinion; types of pollution; means and methods to curtail air pollution.##

00206

CONTROL OF AIR POLLUTION ORIGINATING FROM FEDERAL INSTALLATIONS AND STANDARDS BY THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE

IMPLEMENTING THE OBJECTIVES PRESCRIBED BY THE ORDER. EXECUTIVE ORDER 11282. Dept. of Health, Education, and Welfare, Washington, D.C. May 26, 1966. 6 pp-

The article specifies the overall policy, procedures for new federal facilities and buildings, and objectives for federal facilities and buildings insofar as air pollution control is concerned. In addition, standards to be used in this new order are delineated by Secretary Gardner. The categories to which the article alludes are: combustion of fuels, Stacks, Storage and handling of fuels and ash, and disposal of trash. In each instance are specified limits and means to measure the amount of pollutant covered by the above categories.##

00336

G. Ozolins and R. Smith

A RAPID SURVEY TECHNIQUE FOR ESTIMATING COMMUNITY AIR POLLUTION EMISSIONS. Public Health Service, Cincinnati, Ohio, Division of Air Pollution. Oct. 1966. 83 pp. (Presented at the 59th Annual Meeting of the Air Pollution Control Assoc., San Francisco, Calif., June 20-24, 1966, Paper No. 66-11.)

A technique has been developed for surveying pollutant emissions within a community or metropolitan area in 3 to 6 man-weeks. The methods for conducting such a survey are described in this paper. An important feature of this technique is the concept of reporting zones. The quantities of pollutants released can be assessed not only for the total community but also for different subdivisions of the area. The results are emission maps of a community depicting emission of pollutants in quantities per unit area. Seasonal variations in pollutant concentrations are considered, and emission rates of pollutants can be calculated for specified times of the year. The four major source categories considered are combustion of fuels in stationary and in mobile sources, combustion of refuse material, and industrial process losses. Each category is considered in detail relative to sources of information, seasonal variation in emissions, methods for estimating pollutant emissions by areas, and use of emission factors. Results obtained by application of this technique in two metropolitan areas are summarized. (Author)##

00350

CONTROL OF AIR POLLUTION FROM MOTOR VEHICLES AND NEW MOTOR VEHICLE ENGINES - PROPOSED RULES. Federal Register 30, (252) 17192-9, Dec. 31, 1965.

The standards adopted by the regulations represent the application of current technology to the control of emissions from new motor vehicles and new motor vehicle engines which in the judgment of the Secretary cause or contribute to, or are likely to cause or contribute to air pollution which endangers the health or welfare of any persons. Taking into consideration the technological feasibility and economic costs of meeting these standards, and the lead-time necessary

under current manufacturing processes to conform to these requirements, the regulations will become effective on republication and will be applicable to new motor vehicles and new motor vehicle engines beginning with the 1968 model year. These regulations are subject to revision and additional standards may be prescribed applicable to subsequent model years as may be necessary to prevent or control emissions which in the judgment of the secretary cause or contribute to, or are likely to cause or contribute to, air pollution which endangers the health or welfare of any persons. (Author)##

00359

McKee, J. E.

AIR POLLUTION CONTROL - ECONOMIC IMPACT OF GROWING PROBLEM. Trusts and Estates. Feb. 1964. 5 pp.

Author discusses the general parameters of air pollution and how it has changed over the years. Categories treated are : Magnitude of the Air Pollution Problem; Establishment of Local Agencies; Standards and Criteria; Motor Vehicle Control; Power Plants; Federal Government's Role in Pollution; and the General Extent and Nature of the Air Pollution Problem.##

01604

R.A. Venezia

THE INTERSTATE AIR POLLUTION STUDY: ST. LOUIS - EAST ST. LOUIS METROPOLITAN AREA. Public Health Service, Cincinnati, Ohio, Div. of Air Pollution. (Presented at Missouri Public Health Association Convention, Kansas City, May 11, 1965.) 1965. 22 pp.

The Interstate Air Pollution Study of the St. Louis - East St. Louis metropolitan area is described. The study was in keeping with the air resource management concept. Dustfall, suspended particulates, soiling index, sulfur dioxide, oxidants, odors, carbon monoxide, hydrocarbons, nitrogen oxide, nitrogen dioxide, sulfur dioxide, ozone, and visibility were measured. The effects indicated by steel corrosion, nylon and cotton deterioration, asthma, opinion surveys, and complaints were examined. An emission inventory, meteorology, fluorescent tracer diffusion, diffusion models, economic losses, legal aspects, and public relations were studied during the study.##

02055

E. P. Grant and W. E. Nissen.

CALIFORNIA'S PROGRAM FOR MOTOR VEHICLE EMISSION CONTROL. Proc. (Part I) Intern. Clean Air Cong., London, 1966. (Paper VI/19). pp. 210-2.

The paper gives a general account of the extent of air pollution in the State of California and the measures taken so

far to control it. It proceeds to deal in greater detail with the investigations undertaken by the motor industry, especially by the Motor Vehicle Pollution Control Board and the various devices that have proved to be effective in keeping the objectionable emissions under control. (Author abstract)##

02376

AIR RESOURCE MANAGEMENT PROGRAM SOUTHWESTERN OHIO-NORTHERN KENTUCKY. Preprint. Published as report: Air Resource Management Program for Southwestern Ohio-Northern Kentucky, Mar. 1967, 51 pp. SWO - NK (Southwestern Ohio - Northern Kentucky) Air Pollution Survey, Cincinnati, Ohio, SWO NK Technical Committee. 1966.

The primary purpose of this report is to assist the citizens and governments of southwestern Ohio and northern Kentucky in understanding the nature of their air pollution problem and in developing a course of action - an air resource management program - to assure desirable air quality both now and in the future. This report is the culmination of over a year of study and effort under the title, Southwestern Ohio - Northern Kentucky (SWO-NK) Air Pollution Survey. The survey, established by formal agreement on March 31, 1965, brought together governmental officials, interested citizens, and industrial leaders from both sides of the Ohio River to consider a problem common to them all and to propose a solution, of necessity, common to them all. This report also presents a general discussion of the air pollution problem and applies to it the ideal methodology for solving the problem, the air resource management concept. Various aspects of the air pollution problem in the project area are summarized from Technical Committee reports to provide background for the program proposal. The current status of control is also covered.†

03353

DIGEST OF MUNICIPAL AIR POLLUTION ORDINANCES. Pittsburgh Univ., Pa., Law Center. (PHS Publication No. 982.) 1962. 520 pp.

Regulations, ordinances and their administration regarding allowable concentration for air pollutants are presented. Enforcement procedures, inspection procedures, and penalties for violation of specific regulations are presented for urban areas. Air pollution control starts with the premise that no one has the right to use the atmosphere as a receptor of wastes in a manner which will adversely affect the health, comfort or property of others.##

03554

REGULATION 3. Bay Area Air Pollution Control District, San Francisco, Calif. Jan. 4, 1967. 44 pp.

This Regulation applies to emission of reactive organic gases from source operations defined and to the registration of each person responsible for organic gas emissions, for which limits are established by this Regulation. Analytical procedures prescribed are intended to facilitate the determination of

concentrations or quantities of the various kinds of air contaminants defined in this Regulation. Any procedure which provides for such determination with accuracy equal to or greater than the prescribed procedure shall be acceptable, provided that the burden of demonstrating such accuracy shall rest upon the person proposing the procedure.##

03614L

J. T. Middleton D. Clarkson

MOTOR VEHICLE POLLUTION CONTROL. Traffic Quart. 15(2):306-317, April 1961.

This paper reviews briefly the work of control agencies in California, the legislation of the state's motor vehicle pollution control program of 1960, and its impact on the evolution of control programs in other states, the automobile industry and the motoring public.##

03944

MOTOR VEHICLE POLLUTION IN CALIFORNIA (A STATUS REPORT). California State Dept. of Public Health, Berkeley, Bureau of Air Sanitation. Jan. 1967. 11 pp.

A review of all the factors involved indicates that there is no simple and inexpensive solution to the complex problem of motor vehicle created air pollution. The problem has many aspects. It is legal, political, social, economical and technological. The final solution must incorporate considerations for all these aspects. The motor vehicle control program in California has reduced emissions of hydrocarbons and carbon monoxide into the atmosphere. In spite of the increasing number of vehicles, there has been a reversal in emission trends for the first time. If the goal of prewar air quality is to be achieved, there must be a high degree of emission control. Consequently, the program requires that effective systems be available, and that virtually no cars be exempt. Lack of efficient control of some emissions, large numbers of cars uncontrolled, and deterioration in efficiency of control system will lead to air quality poorer than that desired. Under the present program, which is oriented towards the installation of control systems on new cars, the reduction of contaminants emanating from motor vehicles will be gradual. In order to accomplish a rapid improvement, within a few years, exhaust emissions from all cars (new and used) must be controlled. Even if events follow the predictions growth of motor vehicle usage beyond 1980 leads again to a rising trend. Curtailment time. Motor vehicle registration is increasing at a rapid pace; control programs are usually less effective than planned; there is a long time delay between the establishment of standards and the development of exhaust and evaporative control devices. For these reasons, and because of the poor prospect of exhaust control for used cars, it is important to consider far more stringent motor vehicle emission standards than those already adopted. (Author conclusion)##



F. N. Frenkiel

AIR POLLUTION IN THE GROWING COMMUNITY. Proc. Symp. Cleaner Air Urban Areas, Philadelphia, Pa. pp. 1-15 (1956).

Like any living being, a living community breathes. Its automobiles, railroads, home heaters, rubbish disposals, industry, power plants....all inhale air and exhale polluted air into the atmosphere. Here, Dr. Frenkiel discusses methods for studying the relative contributions of various pollution sources to a community's pollution problem, the increase of pollution in a growing community, and the effectiveness of certain methods for reducing pollution. He explains how a mathematical treatment can clarify the interplay among the many features of a community that contribute to its general air pollution problem - the location and density of pollution sources, meteorological conditions, community geography, and control measures. The main object of these mathematical studies, he points out, is to determine the probable patterns that pollution will take, and the contribution of each source to the pollutant concentration at any given location. He cites a study of this sort made using as an example of Los Angeles County. This mathematical treatment, or "model", then helps determine what measures must be taken when atmospheric pollution threatens to reach emergency levels, how effective various pollution control plans might be, what effect a new source might have on the pattern of concentration, forecasts of patterns that would result from contemplated urban expansion, and the effect of urban planning on predicated pollution levels.##

05598

AIR AND WATER POLLUTION. Ohio Legislative Service Commission, Columbus, Ohio. (Staff Research Rept. 84.) (Feb. 1967). 87 pp.

This study deals separately with air and water pollution problems. Chapters five, six, seven, and eight are concerned with air pollution. They consider the nature and effects of air pollution, the extent to which it is a problem in Ohio, the programs and efforts being made to reduce the problem in Ohio, some problems in existing programs, and finally some suggested approaches for improving control of Ohio air pollution. The chapters dealing with water pollution are treated in essentially the same way. The sources of air pollution are pointed out as motor vehicle exhausts, industrial emission, and power generation as major sources and refuse disposal and space heating as minor sources. The effects that are caused by pollutants are varied but generally they affect human health, comfort, and welfare. In Ohio, a highly industrialized and urbanized state, the potential for serious air pollution problems is great, but an absence of uniform and complete data on all known air pollutants in the state precludes an accurate state-wide assessment. It, of course, reflects the national trend in terms of pollutants. However, air pollution in a particular area has not yet been evaluated. It is known that the levels of some pollutants are declining, but data on some major gases are not available. Ohio is currently using five basic functions in their air pollution control program: abatement,

prevention, monitoring, research and planning. Federal, state, local and intergovernmental levels are all being used to attack the problem. The Report of the Committee to Study Air and Water Pollution is included, and it stresses the need for more stringent regulations to enforce present and future statutes, especially at the local level.##

06188

Larsen, Ralph I.

DETERMINING REDUCED-EMISSION GOALS NEEDED TO ACHIEVE AIR QUALITY GOALS--A HYPOTHETICAL CASE. J. Air Pollution Control Assoc., 17(12):823-829, Dec. 1967. 37 refs. Presented at the Annual Meeting, Air Pollution Control Assoc., Cleveland, Ohio, June 11-16, 1967.)

Air management steps involved in determining reduced-emission goals: include determining the effects of various pollutant concentrations on man, animals, plants, and property; deciding which effects to prevent; selecting ambient air quality goals that will prevent these effects; measuring and evaluating pollutant concentrations from sources and in the ambient atmosphere; calculating overall source reductions needed to achieve selected ambient air quality goals; and finally, determining reduced-emission goals for the various source types. Examples are cited of the various decisions and actions involved in determining a set of reduced-emission goals for stationary and mobile combustion sources.

07235

R. Langmann

CLEAN AIR MAINTENANCE--A TASK FOR THE OFFICE OF PUBLIC HEALTH. Die Reinhaltung der Luft als Aufgabe des Gesundheitsamtes. Oeffentl. Gesundheitswesen (Stuttgart) 29 (3), 126-34 (Mar. 1967). Ger.

Government regulations request that the office of public health pays attention to the maintenance of clean air. More specifically, it must screen projected industrial enterprises as to the degree of their expected air polluting emissions and the eventual impact on the health of the employees and the neighboring inhabitants. In cases where the office of public health through its investigations finds evidence of health hazards, it must recommend various ways of avoiding or eliminating the pollution of air. A large number of pollutants are discussed, such as dust, toxic gases, and obnoxious vapors and odors. Their sources and methods for their elimination are discussed in detail and represented by examples. Particular emphasis is placed on proper city planning, zoning, and a more stringent application of regulations concerning the construction of new plants, especially their chimneys. Further investigations into possibilities of remote heating and of substituting gas and electricity for coal are recommended. Finally, the importance of educating the public on the consequences of air pollution is stressed.##

Maher, G. R.

AIR POLLUTION REGULATION OF NONVEHICULAR, ORGANIC-SOLVENT EMISSIONS BY LOS ANGELES RULE 66. J. Am. Oil Chemists Soc. 44(8):340A, Aug. 1967. (Presented at the AOCS Short Course, East Lansing, Mich., Aug. 29-Sept. 1, 1966.)

In an effort to control sources emitting organic solvents into the atmosphere, the Air Pollution Control District of Los Angeles County, Calif., successfully secured passage of Rule 66 into law. Rule 66 specifically relates to the control of organic solvent emissions from stationary sources. The major contributor to the 550-ton daily emission of organic solvents was industrial, commercial, and residential painting. Organic solvent-containing products are to be controlled as follows. 1. A maximum of 5% by volume of olefinic or cycloolefinic organic solvents may be present. 2. A maximum of 8% by volume of aromatic organic solvents having eight or more carbon atoms may be used. 3. Ketone organic solvents having a branched chain structure, such as methyl iso-butyl ketone, are limited to a maximum of 20% by volume. 4. A maximum of 20% by volume of toluene may be used. 5. Ethylbenzene, an aromatic organic solvent with eight carbon atoms, was given a special status and allowed a maximum of 20% by volume. 6. Trichloroethylene is restricted to a maximum of 20% by volume.##

07550

Philadelphia Dept. of Public Health, Pa.

AIR POLLUTION FROM FUEL COMBUSTION PROCESSES IN PHILADELPHIA. Preprint, 8p., Sept. 1966.

The combustion of fuels is the greatest single source of air pollutant emissions within a metropolitan area. As much as 80% of the total weight of pollutants discharged to the atmosphere result from the burning of fuels for electrical power generation, for industrial and commercial heat and power, for domestic heating, and for vehicular power. The purpose of this report is to summarize the present status of the problem in Philadelphia and to recommend necessary regulations and other action required to deal with the problem.##

07805

AUTOMOTIVE AIR POLLUTION - SIXTH REPORT OF THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE TO THE CONGRESS OF THE UNITED STATES IN COMPLIANCE WITH PUBLIC LAW 88-206 AS AMENDED BY PUBLIC LAW 89-272. Dept. of Health, Education, and Welfare, Washington, D. C., Document No. 47, 13p., June 1967. (90th Congress, 1st Session, Senate.)

GPO: 82-697-0

Satisfactory progress is being made in the testing and certification of 1968 model vehicles or engines to determine conformance with the Federal regulations as provided for in section

206 of the Clean Air Act. With few exceptions, virtually all major manufacturers, known to import or sell cars in the United States, are working diligently to fulfill requirements to limit crankcase emissions and exhaust hydrocarbon and carbon monoxide emission. This certification program is being conducted at the Motor Vehicle Compliance Laboratory of the National Center for Air Pollution Control. A proposed standard for fuel evaporative emissions from motor vehicles was issued by the Secretary of Health, Education, and Welfare on February 4, 1967. Modification of this proposed standard is currently underway based on the comments received. Several State and regional air pollution control agencies have established crankcase and exhaust emission standards in recent months which are either consistent with Federal standards or involve nonfederally regulated pollutants. Both industry and government have markedly increased study and evaluative activities toward development of pollution-free vehicles. The future trend of air pollution levels associated with gasoline-powered vehicles, which incorporate emission controls currently envisioned practicable, has done much to stimulate these development efforts. Progress toward pollution-free cars should not wait for nor depend upon the development of the ideal lowest-cost emission controlled gasoline-powered system. (Author's summary)

08408

Eaton, F. J.

NATURAL GAS AND CLEAN AIR. Smokeless Air, 37 (142):233-241, 1967. 9 refs.

The present position and possible future development of natural gas is based on the effect which this new indigenous smokeless and sulphur-free fuel can have on clean air in Great Britain. The finding of North Sea gas in sufficient quantities has led the Gas Council to base its future development on a change over from town to natural gas. The liquid natural gas imported primarily to enrich the gas made by some of the newer processes is not being used to supply the first conversion areas. Since the passing of the Clean Act in 1956 there has been a significant change in the pattern of domestic fuel usage. Solid smokeless fuels have increased in types and in sales. Town gas has gained in popularity with the public, particularly for domestic space heating, both with room heaters and central heating. Further, it is being used much more widely in Smoke Control Areas. This has been attributed to public demand for a convenient fuel and higher standards of heating, as well as to the improved competitive price position.##

08554

Dorn, Warren M.

RULE 66 - A PART OF TOTAL AIR POLLUTION CONTROL. S.A.E. (Soc. Automotive Engrs.), Preprint 670807, 2p., 1967. (Presented at the Aeronautic & Space Engineering and Manufacturing Meeting, Los Angeles, Calif., Oct. 2-6, 1967.)

The part Rule 66 plays in total air pollution control in Los Angeles County is explained. Background material on the control of

visible emissions, sulfur, hydrocarbons, and motor vehicle emissions is presented. Finally, the background and acceptance of Rule 66 is described. (Author's abstract)

08556

Lunche, Robert G.

COMPLYING WITH SOLVENT CONTROL LEGISLATION. S.A.E. (Soc. Automotive Engrs.), Preprint 670810, 3p., 1967. (Presented at the Aeronautic & Space Engineering and Manufacturing Meeting, Los Angeles, Calif., Oct. 2-6, 1967.)

Compliance with Los Angeles County solvent control legislation be achieved by treatment of the organic emissions resulting from solvent usage, converting to less photochemically reactive solvents, or changing the process. An engineering permit system and an enforcement inspection program ensure that control equipment to treat the effluent is designed for the required efficiency and operated in compliance with the law. (Author's abstract)

08463

Ross, Laurence W.

SIZING UP ANTI-POLLUTION LEGISLATION. Chem. Eng., 74(15):191-196, July 17, 1967. 18 refs.

At instigation of Federal Government, states are working rapidly toward effective standards for regulating quality of water and air. Standards for water will depend primarily on authoritative technical opinion and will vary according to local conditions. Standards for air quality will come increasingly under direction of Federal Government and will tend to be more uniform from locality to locality. Air control, state laws and regulations, municipal laws and regulations and the pattern for the future are air pollution topics discussed. Other topics dealing with water pollution are discussed.##

08826

THE AMERICAN PAINT CONVENTION: AIR POLLUTION AND RULE 66 DISCUSSED. Paint, Oil Colour J. (London), 152(3605):908-912, Nov. 17, 1967. 35 ref-.

The discussion of the panel on air pollution at the annual meeting of the Federation of Societies for Paint Technology is reported. The panel consisted of four speakers and a chairman, or moderator, drawn from various parts of industry, and including raw material and equipment manufacturers. The history of the recent legislative proceedings, a review of other local rules and by-laws, problems of reformation and elimination of air-polluting products were discussed by the panel. Rule 66, which was implemented on July 1, 1967, was the final result of prolonged work and followed the drafting of 65 intermediate regulations, some of which threatened the very existence of many industries in Los Angeles.

The complicated nature of Rule 66 was made apparent from the numerous printed commentaries in the form of questions and answers. Reverting to methods of control and disposal of excessive air pollution emission as discussed by the panel, three major sources of air-pollution in the manufacture of paint and ancillary products and their use were considered, namely: (1) Resin manufacture; (2) Paint application and drying; and (3) Paint baking. The panel did not concern itself with details of reformulation, otherwise than to indicate the basic problems facing formulations.##

08989

NEW PROCEDURE CHECKS VEHICLE EXHAUST EMISSIONS. ENVIRON SCI. Technol., 2(1):13-16, Jan. 1968.

The N.J. Department of Health awarded a two-year contract to Scott Research Laboratories to develop a rapid low-cost diagnostic test for exhaust emissions from automobiles. It was this project that led to a new test sequence and equipment that takes one minute to complete at a cost of 30 to 40 cents per test. The test procedure gives information on the composition of automobile exhaust emissions. These data, in turn, provide a basis for determining the proper maintenance program needed to reduce vehicle emissions. The test procedure takes only a minute for a complete analysis and gives data equivalent to those obtained from the lengthier (17 minutes) existing federal procedure that was used to set federal emission standards for 1968 automobiles. The Scott system employs a set of inertial rolls with a fixed load that serves as external loading to absorb the power output of the automobile. This fixed loading system is inexpensive and requires minimal skill to operate. Yet, data so obtained correlate well with those from the federal procedure.

09053

Copeland, John O.

AIR POLLUTION. Preprint, Public Health Service, Cincinnati, Ohio, National Center for Air Pollution Control, 9p., 1967. (Remarks made at a meeting of the Illinois Society of Professional Engineers, Edwardsville, Ill., Oct. 20, 1967.)

In a talk based on information from other U. S. Public Health Service publications, the air pollution problem is described as one of emissions, effects, regulation, and control touching the technical, social, political and economic aspects of our society. U. S. Public Health Service 1966 estimates of 142 million tons of pollutant emissions per annum are reported by type and source with predictions for rapid increases unless air pollution is controlled in the near future. Air quality criteria are stressed as necessary guidelines for control. Authority for control is described as lying with many jurisdictions with the trend being toward centralization to cover every locality within the United States. The Federal role in air pollution is discussed. The need for the skill and knowledge of the professional engineer in the air pollution field is described as unlimited.##

## California Motor Vehicle Pollution Control Board, Los Angeles

SMOG: THE SILENT ENEMY. (FOURTH BIENNIAL REPORT FOR CALENDAR YEARS 1965-66.) 32p., Jan. 1967.

California has led the world in the fight for cleaner air. Nowhere are found such dynamic and aggressive programs, both on local and Statewide levels. Nowhere are there more dedicated men and women engaged in the effort. Admittedly, the automobile is a major factor in befouling our atmosphere. The ultimate solution to the motor vehicle pollution problem may lie in a completely redesigned automobile engine or in a new motive power source. The Board has thoroughly examined these possibilities, such as the turbine and battery-powered car, and is encouraged for the future, perhaps a decade hence. But, until that time, the State must proceed with its present plans to reduce auto-created pollution with workable control systems or engine modifications. Through sustained, persistent efforts by a determined Administration, State Legislature, and Board, the automobile industry has acknowledge and complied with California's leadership. Today, emission control is a fundamental factor in automobile engineering. For the first time all the world's engine designers are hard at work on the problem. Today, emission control is (built-in,) not (added on,) to every Detroit product. This represents a phenomenal advance in the space of six and a half years. It will continue to result in a better product for the California car purchaser. All new California automobiles now come equipped with both crankcase and exhaust emission control systems. The Highway Patrol is making random roadside checks to make sure that motorists are complying with the law, and the Department of Motor Vehicles has co-operated in carrying out the necessary registration procedures for controlled vehicles. Stricter emission standards must be applied in 1970. Oxides of nitrogen control systems will be incorporated into existing controls, if they are in harmony with hydrocarbon and carbon monoxide controls. Evaporative losses must also be reduced, with a consequent economic saving to the motorist. The Board is actively seeking and hopes to find a simple portable measurement device for all emissions. This would simplify annual emission inspection for all vehicles. There is no doubt that as time passes emission reduction systems will improve rapidly. The art and science of emission control are still in their infancy, but moving ahead.

09324

S. S. Griswold

SOLVENT CONTROL - A NATIONAL PROBLEM. Preprint, Society of Automotive Engineers, 15p., 1967. (Presented at the Aeronautic and Space Engineering and Manufacturing Meeting, Los Angeles, Calif., Oct. 2-6, 1967. Paper 670806.)

Comments on Los Angeles' Rule 66 for the control of organic solvents with respect to the Federal Government and to other parts of the country are presented. Compliance by the Department of Defense and Government Services Administration installations is emphasized.##

Stockton, Edward L. and Winthrop C. Shook

AUTOMATIC AIR MONITORING AND TELEMETERING TO CENTRAL POINTS IN ALLEGHENY COUNTY. J. Air Pollution Control Assoc., 18(3):162-164, March 1968.

In 1968 an automatic monitoring system will supplement existing air sampling stations in Allegheny County (Pittsburgh). This system will measure pollutant levels and weather conditions at several remote sites. "On-site" recorders are equipped to telemeter the data in analog form to a central station. At the central station a multipoint recorder is supplied for each pollutant measured. This basic system, purchased for a modest initial investment, has complete capabilities for future expansion. An estimated fifteen sites will provide representative pollution data for Allegheny County. However, the basic system can be expanded to include industry installed monitoring stations--a possibility now being considered. Further expansion to a complete data management system including a computer based data logger to calculate emission inventory, peak averages, and other control data is also provided for. (Authors' Abstract Modified) ##

10083

Fiero, George W.

AIR POLLUTION AND PROTECTIVE COATINGS: HOUSTON, DALLAS, AND WASHINGTON. J. Paint Technol., 40(520):222-228, May 1968. 18 refs.

In general, man-made air pollutants are largely products of combustion, and solvents from protective coatings are not major air pollutants. Photochemical smog prevalent in Los Angeles results from inter-reaction between oxides of nitrogen, reactive hydrocarbons, an oxygen. Hydrocarbons vary greatly in their reactivity; hydrocarbon found in solvents are less reactive than auto exhaust. Data are provided on common air pollutants in Houston, Dallas, Ft. Worth, and Washington. Rule 66 and its definition of photochemically reactive solvents are examined with respect to the use of protective coatings in the San Francisco Bay Area. Where federal specifications apply, the Bay Area Air Pollution Control District has agreed to draw up a variance to January 24, 1969. So far, Rule 66-type regulations have not been adopted anywhere other than California. The New York, New Jersey and Pennsylvania regulations and proposed rules are discussed. Industry must cooperate with local authorities to reduce general air pollution. The National Paint, Varnish and Lacquer Association smog chamber at Batelle Memorial Institute should provide data relative to the extent solvents add to photochemical smog.

10205

PROGRESS IN THE PREVENTION AND CONTROL OF AIR POLLUTION. FIRST REPORT OF THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE TO THE UNITED STATES CONGRESS. PURSUANT TO PUBLIC LAW 90-148, THE AIR QUALITY ACT OF 1967. 2nd Session, 90th Congress, Senate Document No. 92, 85p., June 28, 1968. GPO



Recent activities initiated under the Air Quality Act of 1967, which was signed into law on November 21 are described, and the air pollution problem as a whole is placed in historical perspective, summarizing the continuing efforts being made to cope with it. Included are: (1) the progress and problems associated with control of automotive exhaust emissions and the research efforts related thereto; (2) the development of air quality criteria and recommended emission control requirements; (3) the status of enforcement actions taken pursuant to this Act; (4) the status of State ambient air standards setting, including such plans for implementation and enforcement as have been developed; (5) the extent of development and expansion of air pollution monitoring systems; (6) progress and problems related to development of new and improved control techniques; (7) the development of quantitative and qualitative instrumentation to monitor emissions and air quality; (8) standards set or under consideration pursuant to title II of this Act; (9) the status of State, interstate, and local pollution control programs established pursuant to and assisted by this Act; and (10) the status of the President's Air

10320

Jan Just, and Kazimierz Nowak

ATMOSPHERIC AIR POLLUTION IN POLAND. ((Zanieczyszczenie powietrza atmosferycznego w Polsce.)) Text in Polish. Gaz Woda Tech. Sanit. (Warsaw), 40(2):53-57, 1967. 18 refs.

Although some attempts at air pollution control date to 1923, the first directives against offending local industrial establishments were issued in 1950 and extended in 1964 to the entire country. Comprehensive air protection legislation was initiated in Poland by Resolution 91 of the Council of Ministers of March 1, 1961. The Ministry of Health and Public Welfare has prepared a projected regulation introducing air pollution controls and establishing permissible pollutant concentrations. This proposal is now being considered by the Juridical Committee of the Council of Ministers. There are 36 institutions engaged in air pollution research and a network of stations is gathering data (mostly on dust fall, SO<sub>2</sub>, and suspended particulates) but only from the more industrialized parts of the country. The actual gravity of the situation is illustrated by the fact that six million of Poland's population live in a high-pollution zone. Most affected is Katowice province, with the capital Katowice recording a dust fall of 482.4 t/sq km/yr, about 0.3 mg/cu m fumes, 0.007-1.24 mg/cu m SO<sub>2</sub>, and 73 g/1000 cu m benzopyrene. 828all of these pollutants far exceed the permissible limits. Opole province is also in the high-pollution zone as well as the cities of Krakow (100-600 t/sq km dust fall and 0.008-0.42 mg/cu m SO<sub>2</sub>), Lodz (565.3 t/sq km dust fall with significant CS<sub>2</sub> and H<sub>2</sub>S level), and Warsaw (dust fall in 1962 was 315 t/sq km, compared to 355 t/sq km 30 years earlier). The improvement in Warsaw is ascribed to the replacement of household coal by electric power and gas, to modernized and centralized heating, and to post-war reconstruction of the city with a major emphasis on green zones.##

Huenigen, E.

PRESENT STATUS OF EXHAUST GAS CONTROL IN THE DDR (EAST GERMANY). ((Bisherige Ergebnisse der Abgasbekämpfung in der DDR.)) Text in German. Freiburger Forschungsh. A. 387:17-30, 1966.

The research council on the control of internal combustion engine exhaust gases of the German Democratic Republic (DDR) set as its goals in 1964: a) the improvement of the quality of diesel motor exhausts; b) reduction of the hazards from exhausts of two-phase gasoline motors; c) development of suitable analytical methods, measurement installations and testing programs; d) an extensive detoxification of exhaust gases from the diesel motors of specialty vehicles. In the furtherance of these aims, a thorough state-of-the-art study of diesel smoke density measurement was carried out, including actual testing of over a dozen different types of instruments. The results of these tests and studies are described and illustrated. Difficulties in the determination of CO, CO<sub>2</sub>, nitrogen oxides, hydrocarbon residues, and benzopyrene, are discussed. An investigation of the influence of a French after-burner device on CO emission and smoke density showed unsatisfactory abatement results. The use in West Germany of "liquid gas" as an automotive fuel yielding low CO and hydrocarbon exhausts is mentioned.##

13366

Japan. Prime Minister's Office.

1969 WHITE PAPER ABOUT PUBLIC NUISANCES. (Kogai hakusho). Text in Japanese. (Prepared in collaboration with 11 ministries and agencies, Government of Japan, for submission to the Japanese Diet). Tokyo, Printing Bureau of the Ministry of Finance, 1969, 230p.

This report summarizes the status, monitoring techniques, and management, including laws, of air and water pollution, noise and vibration, and soil erosion in Japan in April 1969. Particulate air pollutants in Japan are of four types: falling dust, which contains large particles and includes soot from burning coal or muddy dust; sulfur oxides, which are becoming increasingly important because of the increasing use of petroleum in recent years; floating dust, which has very small particles and includes mainly molecules of metallic compounds from burning materials and carbohydrates; and engine exhaust gas containing CO, NO<sub>2</sub>, hydrocarbons, and aldehydes. The amount of falling and/or floating dust has been gradually decreasing with the decreasing use of coal, especially in large industrial cities. At the same time, sulfur oxides, especially SO<sub>2</sub>, have been gradually increasing and have the highest concentration (more than 1.5 mg SO<sub>3</sub>/100 sq cm/day) in Kawasaki, Yokohama, Nagoya, Tokyo, Osaka, Muroran, and Yokkaichi. Among the harmful effects of polluted air on the human body, the ill effects on the respiratory tract (especially on the lungs) are most important. Chronic bronchitis, bronchial asthma, pulmonary emphysema, pulmonary fibrosis, pulmonary cancer, and cor pulmonale are the main lung diseases induced by polluted air.

3, 4-Benzopyrene, which is a component of automobile exhaust gas, was experimentally proved to be carcinogenic. In May 1962, the law entitled 'Provisions on the emission of smoke' was established to control the ambient air system, and three large city groups (Tokyo-Yokohama, Osaka-Kobe, and Kitakyushu) were designated as air-polluted areas. Several cities, including Yokkaichi, were subsequently designated. This law was improved in May 1968, especially from the viewpoint of prevention. A law which sets limits for automobile exhaust-gas emissions has also been in force since September 1966. Air pollution is monitored in Japan at more than 170 points. In recent years, several techniques of preventing air pollution have been devised with varying success: use of activated carbon or activated manganese dioxide to reduce SO<sub>2</sub> concentrations; quantitative and qualitative measurement of air pollution severity using a simulation model of a polluted area; modification of internal-combustion engines; and development of electric automobile engines.

## L. STANDARDS AND CRITERIA

00157

Maga, John A. and John R. Kinoshian

MOTOR VEHICLE EMISSION STANDARDS - PRESENT AND FUTURE.

In: Vehicle Emissions, Part II, SAE Progress in Technology Series, Vol. 12, New York, Society of Automotive Engineers, Inc., 1966, p. 297-306. 10 refs. (Presented at the SAE Automotive Engineering Congress, Detroit, Mich., Jan. 10-14, 1966.)

In California, the State Dept. of Public Health has established motor vehicle emission standards for exhaust hydrocarbons, carbon monoxide and smoke; for fuel tank and carburetor evaporative losses; and for crankcase hydrocarbon emissions. The data on which the standards are based and the need for improved measurement procedures are discussed. At this time, exhaust emission standards for oxides of nitrogen and for odor are being considered as additional standards. Future standards may rate hydrocarbon emissions according to their smog potential. Another possible change that is discussed is to specify the quantity rather than the concentration of pollutants that may be emitted from the exhaust of motor vehicles.##

00411

K. Horn

(THE PROBLEM OF HYGIENICALLY PERMISSIBLE LIMITING CONCENTRATIONS OF AIR POLLUTION.) Zur Frage der Hygienisch zulässigen Grenzkonzentrationen für Luftverunreinigungen. Angew. Meteorol. (Berlin) 5 (Special Issue) :39-43, 1965. Text in Ger.

The problem of determining permissible limits of air pollution is discussed. After listing four categories of pollution ranging from decreased visibility and injury to sight and smell to acute illness and possibly death, the author states that pollution should be kept below the limits of the first category. He distinguishes between limits permissible in a factory area and in a residential area, the first being higher. Permissible limits for 40 chemicals established in 1963 for single occurrences and average 24 hour concentrations for East Germany are tabulated.##

01955

J. R. Goldsmith

SOME IMPLICATIONS OF AMBIENT AIR QUALITY STANDARDS. Arch. Environ. Health 4, 151-67, Feb. 1962. (Based in part on a

paper presented at the 54th Annual Meeting, Air Pollution Control Association, New York City, June 13, 1961.)

Author discusses the parameters of the air quality standards in California, starting with the efforts in 1959 and updating the progress to 1962. Allowable concentrations of oxidants are given; a general discussion of health based on air quality studies is given and, the general policy of California air quality standards is reviewed.##

02580

MAXIMUM PERMISSIBLE CONCENTRATIONS OF HARMFUL SUBSTANCES IN ATMOSPHERIC AIR POPULATED PLACES. (Predel' no dopustimye kontsentratsii vrednykh veschestv v atmosfernom vozdukh naselennykh mest.) Hyg. Sanit. 29, (5) 166-8, May 1964.

CFSTI: TT65-50023/5

A list of maximum permissible concentrations of harmful substances in the atmosphere of populated areas in the USSR, as of June 20, 1963.##

03007

CALIFORNIA STANDARDS FOR AMBIENT AIR QUALITY AND MOTOR VEHICLE EXHAUST (TECHNICAL REPT.) California State Dept. of Public Health, Berkeley. 1959. 129 pp.

The salient points in the table of contents are: I. The standards and their significance. II. Technical bases for standards for the quality of ambient air. III. The technical bases for motor vehicle exhaust standards. In establishing the standards, an attempt was made to determine what effects the various pollutants were known to have at various levels of concentration on human health and comfort, on animals, and plants, and on visibility. The resulting air quality standards together with data concerning motor vehicle emissions and their reactions then became the bases for motor vehicle exhaust standards. The air standards do not establish a fine line below which is good air and above which is bad air. They indicate the approximate point at which air under some circumstances may produce undesirable effects.##

03032

METHODS OF MEASUREMENT OF AIR POLLUTION. Metodi di Misura Dell'Inquinamento Atmosferico. Fumi Polveri (Milan) 6, (7-8) 217-21, 1966. It.

The Organ of Cooperation and Economic Development (O.C.D.E.) with its headquarters in Paris, decided in January 1957, to create a "work group" to study the methods of measurement of atmospheric pollution. In 1963 a document was drafted by highly qualified specialists and technicians from all the member countries of (O.C.D.E.) and it dealt with the measurement of smoke, anhydrides of sulfur, sulfuric acid, hydrocarbons and

fluorine. It is suggested that standard units of measurement be used, in the cgs system. Smoke and anhydrides of sulfur are measured in micrograms per cubic meter (0 C, 760 mm Hg). A method of measuring smoke in the atmosphere consists of passing a volume of air through a filter and measuring a color change in the machine. A correlation is obtained between the material collected in the machine and the color change based on a "standard smoke" measurement. Sedimentable materials are measured in milligrams per square meter per day. (Author summary) ##

03582

CALIFORNIA STANDARDS FOR AMBIENT AIR QUALITY AND MOTOR VEHICLE EXHAUST (TECHNICAL REPT.) (SUPPLEMENT NO. 2 ADDITIONAL AMBIENT AIR QUALITY STANDARDS). California State Dept. of Public Health, Berkeley. 28 pp., 1962.

Amended ambient air quality standards are tabulated. The basis for ethylene, hydrogen sulfide, and fluorides standards are received in terms of their effects on man, on vegetation, and on livestock. The "adverse" level for ethylene was 0.5 ppm for 1 hr or 0.1 ppm for 8 hr (damage to vegetation) and for hydrogen sulfide, 0.1 ppm for 1 hr (sensory irritation). When forage crops containing 30 to 50 ppm of fluoride, measured on a dry weight basis, are consumed over a long period, teeth and bones of cattle may show changes, depending upon age, nutritional factors, and the form of fluoride ingested.##

03583

CALIFORNIA STANDARDS FOR AMBIENT AIR AND MOTOR VEHICLE EXHAUST (TECHNICAL REPT.). California State Dept. of Public Health, Berkeley. 1959. 16 pp.

These standards are presented as a yardstick which may be applied in maintaining and improving air quality. A graded set of ambient air standards was established which recognized the relationship between the seriousness of the effect of the pollutant and the urgency of control. Three levels of air pollutants were defined: adverse, serious, and emergency. The standards of motor vehicle exhaust contaminants are: hydrocarbons-275 ppm by volume as measured by a hexane-sensitized nondispersive infrared analyzer; carbon monoxide-1.5% by volume measured by a nondispersive infrared analyzer. The exhausts are to be measured during an eleven-mode operating cycle.##

03586

J. A. Maga, G. C. Hass, and H. Wong-Woo

CALIFORNIA STANDARDS FOR AMBIENT AIR QUALITY AND MOTOR VEHICLE EXHAUST (TECHNICAL REPT.) (SUPPLEMENT NO. 1 CRANKCASE EMISSION STANDARD). California State Dept. of Public Health, Berkeley, Bureau of Air Sanitation. Aug. 1961. 15 pp.

This standard was adopted by the State Board of Public Health on December 2, 1960. The following terms were also defined:

exhaust emissions; crankcase emissions; carburetor operating losses and carburetor hot soak losses; fuel tank emissions; and hydrocarbons. The standard for motor vehicle crankcase emissions is: hydrocarbons - 0.15% by weight of the supplied fuel as measured during a three mode operating cycle by a hexane-sensitized nondispersive infrared analyzer or by an equivalent method.##

05940

V. A. Ryazanov

NEW DATA ON LIMITS OF ALLOWABLE ATMOSPHERIC AIR POLLUTANTS. (In: Limits of allowable concentrations of atmospheric pollutants. Book 6.) U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 9. pp. 1-8. (1962). Russ. (Tr.)

This volume contains material discussed by the Committee on Sanitary Air Protection during its 1959 and 1960 sessions. The material contained in this volume is of heterogeneous character in its methodological presentations and completeness and finality of the reports. The Committee took the position that the level of methodology reached during the last period of investigation and the degree of reliability of results obtained did not represent the acme of perfection, and therefore, the proposed limits of allowable concentrations should be regarded as mere points of orientation for future studies, leading to more basic, more scientific and hence, more reliable limits of atmospheric air pollutants. In this connection it is the aim and purpose of this Committee to act as the stimulator, guide and directing agent leading into investigational channels based on the outlined principles. Air pollutants studied include formaldehyde, HC1 aerosol, CS2 vapor, Mn, Hg, combined Cl2 and HCl gas, acetone, CO and Diny1 (mixture of diphenyl and diphenyl oxide).#

06677

E. V. Khukrin

MODERN APPROACH TO AIR DUSTINESS IN WORKSHOPS. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 7, 301-8, 1962. (Gigiena i Sanit.,) 24 (7) 50-5, 1959. Translated from Russian.  
CFSTI: 62-11103

Extensive data were accumulated during recent years on the study of the effect of different types of industrial aerosols. Based on the summary and evaluation of new data obtained from work institutes, university apartments and practicing physicians a list was prepared of the maximum permissible concentration of 55 dusts and aerosols. This list is presented and improvements in those standards are recommended.##

06885

Gol'dberg, M. S.

HYGIENIC CRITERIA OF AIR PURITY IN POPULATED AREAS (ACCORDING TO MATERIALS OF THE GENEVA SYMPOSIUM). (10 kriteriyakh

gigienicheskoi otsenki chistoty atmosfernogo vozdukha naselemykh mest)) ((Po materialam Zhenevskogo simpoziuma)). Hyg. Sanit. (Gigiena i Sanit.), 30(1):90-98, Jan. 1965. Translated from Russian.

CFSTI: TT 66-51033

In recent years there has been a steady increase in hygienic research on air in populated areas. The need for planning of measures for the control of atmospheric pollution is becoming increasingly urgent. The necessity for an international discussion of this subject, which would be a starting point for all measures undertaken for the sanitary protection of urban air, led the World Health Organization to convene an interregional symposium in Geneva from the 6th to the 12th of August, 1963, which was devoted to criteria for the quality of atmospheric air and methods of its investigation. The discussion was centered on the maximum permissible concentrations of harmful substances in urban air. After a lively discussion, the symposium adopted Prof. V. A. Ryazanov's proposal to establish a unified scale of standards for the quality of air by merging together the Soviet and American standards. In this way, an international scale for the atmospheric pollution has been established for the first time. The symposium drew up recommendations on the trend in medical research on the effect of atmospheric pollution on the health of the population, and a further elaboration of criteria and standards of atmospheric air quality in populated areas. Participants at the symposium also noted the necessity for the further development of scientific research on the mechanism of development of fibrotic pulmonary reaction induced by atmospheric pollutants, and for studies of the reaction of the mucosa of the respiratory tract, ciliary activity, etc. The symposium pointed out the necessity for paying special attention to studies of new synthetic chemicals which contaminate the atmosphere when discharged by industrial enterprises or when used in the household, as in the case of disinfectants.##

07079

#### MAXIMUM IMMISSION CONCENTRATIONS OF ORGANIC COMPOUNDS.

((Einführung in due Richtlinien Maximale Immissions-Konzentrationen.)) Text in German. In: VDI (Ver. Deut. Ingr.) Richtlinien No. 2306, March 1966, p. 3-4, Engl. transl: JPRS R-7481-D, Oct. 14, 1966. VDI- (Verein Deutscher Ingenieure) Kommission Reinhaltung der Luft-

The VDI Guide Lines for Maintenance of Purity of the Air fall into the following groups: 1. Maximum Immission Concentrations (MIK); 2. Dissemination of non-atmospheric substances in the atmosphere; 3. Restriction of the discharge of such substances; 4. Analyses and methods of measurement. For the purpose of maintenance of air purity, MIK values (maximum immission concentrations) are needed for numerous organic compounds. They can be used as reference values for the dimensioning of relevant installations and for evaluation of measurement data in the immediate vicinity of sources of contamination. If the MIK value for a substance is unknown it is recommended that if there are no known reasons to the contrary about 1/20 of the maximum allowable concentration value be taken as a start. Technical societies recommending personnel to serve on the VDI Commission on Maintenance of Purity of the Air are listed. Neither the MIK or MAK values are listed.##



RECOMMENDATIONS FOR ALLOWABLE CONCENTRATION (1966.) Kuki Seijo  
(Clean Air J. Japan Air Cleaning Assoc., Tokyo)  
4(4):62-66, 1966. Text in Japanese.

A report is given by a committee of the Japanese Association of Industrial Health on "Allowable concentration". The values of allowable concentration are worked out for a healthy man working 8 hr per day doing moderate work. Proper consideration must be given to cases in which more than 8 hr of exposure take place, more than one pollutant is involved, or the concentration of pollutants increases suddenly during the work schedule. Included is a discussion on dust measurement. It is important to measure dusts having a Stokes radius of less than 5 microns, especially at a height of 1 to 1.5 m from the ground. The relation between the source of dust and the point of measurement is illustrated.##

07289

Isaev, N. S., Z. B. Smelyanskii, L. K. Khotsyanov, and  
E. V. Khukhrin

PROPOSED NEW SANITARY STANDARDS FOR PROJECTED INDUSTRIAL  
PRODUCTION PLANTS. Text in Russian. Gigiena Truda i Prof.  
Zabolevaniya) 1(4):3-11, 1957. Engl. transl. by B. S. Levine,  
U.S.S.R. Lit. on Air Pollut. & Relat. Occup. Dis., Vol.  
2, p. 37-47, March 1960.  
CFSTI TT60-21188

New "Construction Standards and Regulations" are now in the process of development; simultaneously the sanitary standards for the planned industrial enterprises are also being revised. The earliest sanitary standards regulating the construction of proposed industrial enterprises were issued in 1939. The new revision of the sanitary standards is the sixth in order of legally enacted documents in the field of industrial hygiene. In developing the proposed meteorological standards the position was taken that in all production and manufacturing plans temperature, humidity and air currents must be regulated in a synchronized manner. In the meteorological standards now in existence these factors are in a sense independent of one another; this caused the practicing sanitary-physician considerable difficulty in the enforcement of the prescribed standards for work rooms and shops in which heat and humidity were constantly liberated. Tables are presented showing: temperature, humidity and air current standards for work rooms in manufacturing and production industries; meteorological standards of air ventilation, temperature and air current velocity; are maximum allowable concentrations of poisonous gases, vapors and aerosols in the air of work rooms and shops of industrial manufacturing and production plants.##

07601

MacKenzie, V. G.

THE PHILOSOPHY OF ESTABLISHING AIR QUALITY CRITERIA AS GUIDES FOR  
THE SETTING OF AIR POLLUTION CONTROL STANDARDS IN THE

UNITED STATES. Preprint, Public Health Service, Washington, D. C., Division of Air Pollution, 7p., 1963. (Presented at the Inter-Regional Symposium on Criteria for Air Quality and Methods of Measurement, Geneva, Switzerland, Aug. 6-12, 1963, Paper No. WHO/AP/17.)

The magnitude and complexity of the philosophical, scientific and sociological problems which confront governments and control agencies in their attempt to promulgate air quality criteria and to set ambient air standards for the control of air pollution are discussed.

07604

Rossano, August T., Jr.

ANALYSIS AND COMPARISON OF AVAILABLE DATA ON AIR QUALITY CRITERIA IN MEMBER COUNTRIES. Preprint, Washington Univ., Seattle, Dept. of Civil Engineering, 22p., 1963. 12 refs. (Presented at the Inter-Regional Symposium on Criteria for Air Quality and Methods of Measurement, Geneva, Switzerland, Aug. 6-12, 1963, Paper No. WHO/AP/11.)

Air quality standard-setting activities of Great Britain, West Germany, USSR, Czechoslovakia, and the United States are reviewed. In addition, an analysis and comparison is made of criteria and maximum allowable concentrations developed by these countries. Other countries of western Europe with the exception of West Germany and Czechoslovakia have not adapted air quality standards. In general the control of air pollution in Europe relies heavily upon regulations prohibiting the discharge of pollutants which may endanger the public health, be detrimental to safety, crops and public monuments or constitute a public nuisance. Air quality standards for six specific gases have been developed by the Western German Commission. Czechoslovakia and Russia have established air quality standards for a large number of pollutants. In general their values are similar. In the United States definite progress in developing air quality standards has been made in only 2 states, are similar. In the United States definitive progress in developing air quality standards has been made in only two states, Oregon and California. The air quality standards in Oregon pertain only to suspended particulate matter. The most extensive development of air quality standards in the United States has occurred in California. Direct comparisons between ambient air quality standards of the various countries are not feasible because the objective and criteria are different and the selected time exposure period varies in each country. The USSR standards are based primarily on human sub-conscious thresholds while those of California, and to a great extent West Germany, are based on human conscious thresholds. This wide difference in standards is due in part to differences in medical and public health philosophy as to what constitutes a threat to health and well-being.

07605

Middleton, John T.

AIR QUALITY CRITERIA ASSOCIATED WITH VISIBILITY REDUCTION, SOILAGE AND DAMAGE TO VEGETATION. Preprint, California Univ., Riverside, Air Pollution Research Center, 14p., 1963. (Presented

and Methods of Measurement, Geneva, Switzerland, Aug. 6-12, 1963. Paper No. WHO/AP/15.)

Particulate loading of the atmosphere is primarily responsible for reduction in visibility. The amount of visibility reduction, in turn, is due to the nature of the particle. The criterion for visibility is perhaps best given in terms of visible distance at a specific relative humidity. Air quality criteria for soilage may be developed where specific contaminants have direct effects upon particular materials. Since in general the soilage of goods is a function of multiple actions, air quality criteria for soilage are difficult of description and perhaps of lessened general utility. Air quality criteria for visible effects of vegetation damage can be developed for those toxicants which have direct effects, such as sulfur dioxide, ethylene, nitrogen dioxide, peroxyacyl nitrates, and ozone. Air quality criteria for fluorides cannot now be determined because of the multiplicity of factors which control the rate of accumulation and the subsequent effect of fluoride upon plant tissues. Levels of fluoride responsible for damage to livestock can be established and a criterion based on this is feasible.

08803

Hunigen, E., and W. Prietsch

PROBLEMS AND METHODS OF SOLUTION OF ELIMINATING NOXIOUS SUBSTANCES FROM INTERNAL COMBUSTION ENGINES. ((Probleme und Lösungswege der Schadstoffbeseitigung bei Verbrennungsmotoren.)) Translated from German. Technik, (Berlin), 21(6):377-383, June 1966.

The composition of exhaust from internal combustion engines is discussed. Maximum permissible concentrations of harmful components are tabulated for five countries with standards for the following substances: hydrocarbons (benzene, etc.), aldehydes (formaldehyde, etc.), carbon dioxide, sulfur oxides, nitrogen oxides, lead (and tetraethyl lead), mineral oil mist, and carbon. Some equipment for the measurement of air pollutants is touched upon, including a description of an East German continuous sampling apparatus for hydrocarbons, CO, CO<sub>2</sub>, and O<sub>2</sub>.##

12029

COMMUNITY AIR QUALITY GUIDES. ALDEHYDES. Am. Ind. Hyg. Assoc. J., 29(5):505-512, Sept.-Oct. 1968. 53 ref.

The multi-disciplinary backgrounds and professional competencies within the American Industrial Hygiene Association have been utilized to the fullest in the preparation of a series of ambient air quality guides. These are intended to be concise, and therefore are offered as single compounds, recognizing that other factors such as potentiation, antagonism, or other effects associated with mixtures, will create special problems from place to place and from time to time, the effects of which must be individually evaluated. These guides are based on present scientific knowledge; as new data become available, the recommended threshold values are subject to change. The literature relating to the subject matter of each of the ambient air quality guide series is constantly being reviewed, and when indicated, new guides are prepared. (Author's Abstract)##

Huenigen, Edmund and Wolfgang Prietsch

ON THE PROBLEM OF LIMITING EMISSION OF TOXICANTS BY MOTOR VEHICLES IN EUROPE. (Zum Problem der Begrenzung der Schadstoffemission bei Kraftfahrzeugen in Europa). Text in German. Motortech. Z. (Stuttgart), 30(7):256-259, July 1969. 24 refs.

Maximum allowable emission concentrations in exhaust from motor vehicles in Europe are presently being worked out by an organization of the United Nations, the European Economic Commission. It has been suggested that the MAC values be determined by the 'European driving cycle exhaust gas test' (EFA). Maximum allowable concentrations in the atmosphere have been set by individual European countries. A table compares the values set by the German Democratic Republic, the German Federal Republic, and Russia and shows that the limits are far more stringent in the GFR. The toxicological importance of carbon monoxide, hydrocarbons, and nitrogen oxides in each country will form the basis for working out uniform European limits. Based on the MAC for CO and on the premise that the MAC values should correspond to the toxicological importance of the pollutants, the MAC ratio for CO, hydrocarbons, and nitrogen oxides is 1:1.9:0.1. As measurements show, at present only CO emissions need to be limited. The other toxicants will not be limited until more measurements have brought detailed information concerning the relationship between emissions and air pollution. Limitations of CO emissions during idling is urgently needed.

14772

Weaver, Neill K.

ATMOSPHERIC CONTAMINANTS AND STANDARDS. STATUS REPORT. J. Occupational Med., 11(9):455-461, Sept. 1969. 23 refs.

The Federal Air Quality Act of 1967 furnishes the methodology for the abatement of air pollution. Its provisions include the designation of air quality control regions and the issuance of air quality criteria and control technology documents, which will be followed by the promulgation of ambient air standards and emission standards at regional, state, and local levels. The atmospheric pollutants of current major concern are sulfur oxides, particulates, nitrogen oxides, hydrocarbons, oxidants, carbon monoxide, fluorine, and lead. Their toxic and other deleterious effects, exhibited at various concentration-time exposures, can be related to levels reached by the individual contaminants in the air of cities. While such an evaluation does not allow for possible interactions between pollutants, it appears that sulfur dioxide, oxidants, and carbon monoxide may be harmful to human health when the agents are concentrated, as in focal areas of emission or during sustained meteorologic inversions. Gains to be achieved by controlling these and other contaminants during non-peak conditions are probably derived from aesthetic, economic, and welfare benefits rather than health. Abatement procedures should eliminate rises in pollutant levels beyond the average ranges generally present in urban ambient air. (Author summary modified)

Chapoux, E.

POLLUTION OF THE AIR BY AUTOMOBILES. EVOLUTION OF THE FORMULATION OF THE RULES OF THE EUROPEAN PLAN. COMPARISON OF LIMITS ANTICIPATED IN EUROPE AND THE U. S. A. (La pollution de l'air par les automobiles. Evolution de la réglementation sur le plan européen. Comparaison des limites prévues en Europe et aux U. S. A.). Text in French. Pollut. Atmos. (Paris), 11(Special):24-32, Feb. 1969.

U. S. Federal Government measurements in 1970 of emissions from automobiles on a standard U. S. run will be calculated from a given formula. In European practice, measurements are made on a European standard run. A U. S. value for carbon monoxide of 23 gm/mile is equivalent to 124 gm/mile in European calculations: a U. S. hydrocarbon figure of 2.3 gm/mile corresponds to the European 5.52 gm/mile. Germany, Italy, France, and Sweden have together proposed limits for emissions varying linearly with I, the vehicular mass in kg. The best linear fit of exhaust volume in the European run is: Vol(liters) equals  $1140 + 2.9 I$ . The limits for prototype cars in a standard run are  $48.48 + .07576 I$  (in grams) for carbon monoxide, and  $6 + 0.003 I$  (in grams), for hydrocarbons. For production control, the limits are 20% higher for CO and 30% higher for hydrocarbons. Means for satisfying these requirements, especially for cars with cylinders of less than 819 cc cm, are not yet available. Proposed techniques include electronic fuel injection, carburetor adaptation for town driving, and two-performance carburetion. Richness should be kept low in deceleration and idling, and ignition delayed. Man-Air-Ox catalysis is generally considered too expensive for application. Future research work is expected to be on design of cylinders, wall temperature, internal turbulence, spark gaps, high frequency discharges, valves, and exhaust. Oxides of nitrogen must be considered but are less dangerous in Europe than in the U. S. for climatic reasons. Increasing European and U. S. cooperation is anticipated.

15715

COMMUNITY AIR QUALITY GUIDES. ETHYLENE. Am. Ind. Hyg. Assoc. J., 29(6):627-631, Nov. - Dec. 1968. 24 refs.

The multi-disciplinary backgrounds and professional competencies within the American Industrial Hygiene Association have been utilized to the fullest in the preparation of a series of ambient air quality guides. These are intended to be concise. To be concise they are offered as single compounds, recognizing that other factors such as potentiation, antagonism, or other effects associated with mixtures, will create special problems from place to place and from time to time, the effects of which must be individually evaluated. These guides are based on present scientific knowledge; as new data becomes available, the recommended threshold values are subject to change. The literature relating to the subject matter of each of the ambient air quality guide series is constantly being reviewed, and when indicated, new guides are prepared. (Author's Abstract)

California State Dept. of Public Health, Berkeley, Bureau of Air Sanitation

NEW AND REVISED MOTOR VEHICLE STANDARDS ADOPTED. Clean Air Quart., 8(4):1-27, Dec. 1964.

California's 1970 emission standards for motor vehicles reduce hydrocarbon exhaust levels from 275 to 180 ppm by volume and carbon monoxide exhaust levels from 1.5 to 1.0 percent by volume. The crankcase hydrocarbon standard is lowered from 0.15 to 1.10 percent of the supplied fuel. For the first time the following standards are included for fuel tank and carburetor hot soak emissions respectively: 6 g/day; and 2 g/day. Approximately 95% of hydrocarbon losses are now covered by emission standards. However, further improvements in the standard are anticipated. It is hoped that the hydrocarbon standards can be eventually stated in terms of the reactive compounds producing photochemical smog. Also under consideration is a standard for nitrogen oxides. As the result of a prolonged smog attack in September and October 1964, three Southern California cities experienced more than 20 'adverse' days when the total oxidant exceeded 0.15 for one hour or longer. Unless emissions of pollutants, particularly those from automobiles, are curbed, further severe smog episodes will occur. The State Motor Vehicle Pollution Control Board has given its approval to the Chrysler exhaust control system. Current studies of carbon dioxide contamination from engine compartments show CO concentrations in closed cars of 100 to 200 ppm. Although exposure to these levels for two hours or longer could adversely affect a commuter's carboxyhemoglobin level, the CO levels are not likely to be influenced by controlling hydrocarbon and carbon monoxide emissions with afterburners. Levels of oxidants, nitrogen oxides, carbon monoxide, and sulfur dioxides recorded by state monitoring stations are tabulated.

## M. BASIC SCIENCE AND TECHNOLOGY

00001

A. P. Altshuller and I. R. Cohen

ATMOSPHERIC PHOTOOXIDATION OF THE ETHYLENE-NITRIC OXIDE SYSTEM.  
Intern. J. Air Water Pollution, Vol. 8: 611-632, 1964.

Because ethylene is not only a phytotoxicant but also is reactive in the photochemical type of air pollution, a detailed study has been made of the photooxidation of ethylene-nitrogen oxide mixtures in air. The effects were determined of varying the concentrations of ethylene between 0.1 and 5 ppm and of nitric oxide between 0.2 and 10 ppm on the rate of ethylene consumption, the rate of nitrogen dioxide formation and on the yields of various products. The greater part of the ethylene consumed could be accounted for in the products as formaldehyde or carbon monoxide. It was not possible to obtain a nitrogen balance in this system, although a small amount of methyl nitrate was produced. Ethylene-nitrogen oxide mixtures react rapidly in static irradiations at reactant concentrations below 0.5 ppm. For example, photooxidation of a mixture initially containing 0.2 ppm of ethylene and 0.2 ppm of nitric oxide resulted in a nitrogen dioxide peak in 30 min and half conversion of ethylene in about 80 min. At equal ratios of reactants, ethylene-nitric oxide mixtures actually are more reactive at lower concentrations of reactants. In order to explain the experimental results it appears that free radical chain reactions must be postulated. A discussion of various mechanistic reaction steps is given. (Author)##

00034

J.J. Bufalini A.P. Altshuller

THE EFFECT OF TEMPERATURE ON PHOTOCHEMICAL SMOG REACTIONS.  
Intern. J. Air Water Pollution, Vol 7:769-771, 1963.

Results of measurements made for the photo-oxidation of trans-2-butenenitric oxide in air and for 1,3,5-trimethylbenzene-nitric oxide in air are discussed. The initial concentrations of the reactants in the two systems were as follows: trans-2-butene, 10 ppm; nitric oxide, 4.2 ppm; 1,3,5-trimethylbenzene, 6 ppm; nitric oxide, 3 ppm. The conversion times for both systems decreased by approximately a factor of two and the rates increased by a factor of two when the temperature was increased from 20 to 40 degrees. The conversion time at the nitrogen dioxide maximum and the rate of half-conversion of nitric oxide to nitrogen dioxide are two independent measures of reactivity which give good agreement on a relative basis. Similarly which give good agreement on a relative basis. Similarly on a relative basis, good agreement

is obtained on the times at which the hydrocarbon reaches half of its initial concentration and the normalized rates at these times in the reaction although they do represent somewhat different measures of reactivity. The results from these two systems should not be taken as indicating that temperature changes are independent of the nature of the hydrocarbon used as a reactant. The investigation showed that temperature difference of a few degrees can cause measurable changes in photo-oxidation rates.##

00058

R.S. Tipson

REVIEW OF OXIDATION OF POLYCYCLIC, AROMATIC HYDROCARBONS. National Bureau of Standards, Washington, D.C., Division of Physical Chemistry. (NBS Rept. 8363.) (NBS with PHS support.) May 27, 1964. 89pp.

A survey has been made of the literature on the oxidation of polycyclic, aromatic hydrocarbons. Information has been assembled on (1) the oxidants effective in the oxidation of such hydrocarbons, (2) the relative reactivity of the hydrocarbons, (3) the conditions under which oxidation proceeds, (4) the chemical mechanisms involved when such oxidations occur, and (5) the products formed. (Author)##

00069

C. Orr, Jr., W.P. Hendrix, F.K. Hurd, W.J. Corbett

INTERACTION OF SUBMICRON SMOG PARTICLES AND VAPORS (FINAL REPT.). Georgia Inst. of Tech., Atlanta, Engineering Experiment Station. Dec 31, 1961. 94 pp.

The purpose of this investigation was to determine the physical effect of organic solvent vapors on aerosols having particle radii in the range of 0.01 to 0.1 micron. To accomplish this, an ion counter was employed to determine the particle size distribution of various aerosols both in the presence of pure gases and in the presence of gases containing foreign vapors. The size distributions were established as functions of vapor concentration. Systems consisting of aerosolized particulates (listed first) and a vapor (listed second) such as ammonium iodide and alcohol, camphor and alcohol, poly(methyl methacrylate) and methyl ethyl ketone increased in particulate size with an increase in vapor concentration below relative humidities of 100% while systems of stearic acid and turpentine, carbon and benzene, graphite and benzene, paraffin and hexane, and naphthalene and gasoline showed no size change below the saturation point. Except for the systems of graphite and benzene and carbon and benzene, the particulates were soluble to a measurable extent in the liquid phase of the vapor with which they were paired. From the results of this



investigation it may be concluded that: (1) Particulate aerosols that are soluble in volatile organic solvents increase in size with increase in solvent vapor concentrations. The extent of the size change may be predicted from theoretical considerations. (2) In general, the greater the solubility of the aerosol material the lower will be the relative humidity at which significant growth will occur. (3) For materials with a relatively low solubility (less than approximately 5% by weight) relative humidities in excess of 100% are required for growth if the nuclei size is of the order of 0.01 micron diameter. (4) An ion counter affords an excellent means for analyzing aerosol particulate radii in the range from 0.01 to 0.1 micron.##

00101

E. P. Koutsoukos and K. Nobe

CATALYTIC COMBUSTION OF HYDROCARBONS. IV. EFFECT OF PREPARATION METHOD ON CATALYTIC ACTIVITY. California Univ., Los Angeles, Dept. of Engineering. (Report No. 64-12.) Feb. 1964. 46 pp.  
CFSTI: AD 601026

Five types of CuO catalysts were prepared in this study by varying the amount of KOH used in the precipitation of Cu(OH)<sub>2</sub> from aqueous Cu(NO<sub>3</sub>)<sub>2</sub> solutions. The rate of the catalytic combustion of ethylene was used as a measure of the activity of these catalysts. Overall rate expressions of the form  $r = k p_E$  to the  $N$ th power were used to correlate the experimental data. An average reaction order of 0.60 provided the best correlation of all the kinetic data. The experimental data indicated that the temperature required for a given conversion decreased with increasing amounts of KOH used in the preparation of the catalyst (up to 25% greater than stoichiometric). The BET surface area and mechanical strength of the catalyst increased with increasing KOH used. Using the specific rate constant per unit surface area as a measure of activity it was found that the catalytic activity of CuO decreased with increasing pH (or amount of KOH used). Comparison of the activity of the stoichiometric catalyst prepared in this investigation with the activity of cupric oxide-alumina (1:1) catalyst studied by Accomazzo for the same reaction proved greatly in favor of pure CuO. (Author)##

00119

W. E. Wentworth, E. Chen, and J. E. Lovelock

THE PULSE-SAMPLING TECHNIQUE FOR THE STUDY OF ELECTRON-ATTACHMENT PHENOMENA. J. Phys. Chem. 70, (2) 445-58, Feb. 1966.

A study of the parameters characterizing the electron-capture detector operated in the pulse-sampling mode was carried out. The pulse width, approximately 0.4 microsec., applied voltage, -50v., and the pulse period approximately 1000 microsec., necessary to

collect all of the electrons and to achieve a steady state when argon-10% methane is used as a carrier gas were determined. It was assumed that the electrons acquired a thermal distribution when no potential was applied to the cell and that the results were independent of the pulse potential examined up to 80 v. A kinetic model of the processes occurring within the electron-capture detector operated in the pulse-sampling mode has been proposed. For the case in which the electron-capturing species is capable of forming a stable negative ion (in contrast to dissociative electron capture), the system of differential equations was solved using the steady-state approximation. From this solution, one can obtain the previously defined electron capture coefficient in terms of the constants for the processes proposed in the model. In certain cases one can obtain values for the rate constants and/or the electron affinity of the molecule from the temperature dependence of this electron-capture coefficient. Evidence is given for the validity of the proposed model, and the magnitude of the rate constants and the electron affinities are given for several aromatic hydrocarbons. (Author)##

00120

R. Walsh, D. M. Golden, and S. W. Benson

THE THERMOCHEMISTRY OF THE GAS PHASE EQUILIBRIUM  $I_2$  PLUS  $C_6H_5CH_3=C_6H_5CH_2I$  PLUS  $HI$  AND THE HEAT OF FORMATION OF THE BENZYL RADICAL. J. Am. Chem. Soc. 88, (4) 650-6, Feb. 20, 1966.

With the aid of a spectrophotometer modified for high-temperature systems, the equilibrium constant for the reaction  $C_6H_5CH_3$  plus  $I_2$  at equilibrium with  $C_6H_5CH_2I$  plus  $HI$  was measured over the temperature range 210-390 degrees. Thermodynamic calculations gave a value of plus 30.43 plus or minus 0.32 Kcal/mole for the heat of formation of  $C_6H_5CH_2I$  (g). Crude kinetic data were obtained within the range of 210-280 degrees. Assuming the rate-controlling step in the initial stages of reaction to be  $I$  plus  $C_6H_5CH_3$  at equilibrium with  $C_6H_5CH_2$  plus  $HI$ , Arrhenius parameters were calculated and it was found that the heat of formation for  $C_6H_5CH_2$  (g) = 44.1 plus or minus 3.1 Kcal/mole and the bond strength of  $C_6H_5CH_2-H$  at 298 degrees = 84.2 plus or minus 3.1 Kcal/mole, in good agreement with values from recent kinetic studies.##

00128

K. W. Egger and S. W. Benson

NITRIC OXIDE AND IODINE CATALYZED ISOMERIZATION OF OLEFINS. VI. THERMODYNAMIC DATA FROM EQUILIBRIUM STUDIES OF THE GEOMETRICAL AND POSITIONAL ISOMERIZATION OF N-PENTENES. J. Am. Chem. Soc. 88, 236-40, Jan. 20, 1966.

The equilibrium of the iodine catalyzed gas phase isomerization of 1-pentene and 2-pentene was studied over a temperature range

from 114.5 to 335.3 degrees. The measured values for constants of both the positional and the geometrical isomerizations yield straight lines when plotted vs.  $1/T$  (degree K). Entropy and enthalpy values were derived by application of least-square fits of data to linear equations using a standard computer regression program yield with standard errors (for a mean temperature of 500 K.) The data can be equally well fitted to both linear and quadratic equations. The data for the heats of isomerization are in very good agreement with values calculated from the data on the heat of formation reported by Prosen and Rossini and quoted in the API tables. The entropy differences between the isomers obtained from the direct experimental data agree reasonably well with the comparative estimates of Kilpatrick, et al. Values for partial group contributions and corrections thereof were calculated from the data of this work and results reported earlier from related studies on n-butenes and 1,3-pentadienes. They are in excellent agreement with earlier estimates.##

00161

C. A. Arrington, W. Brennen, G. P. Glass, J. V. Michael, and H. Niki

REACTIONS OF ATOMIC OXYGEN WITH ACETYLENE (I) KINETICS AND MECHANISMS. Harvard Univ., Cambridge, Mass., Dept. of Chemistry. Mar. 1965. 28 pp.  
CFSTI: AD 464329

The room temperature reaction of acetylene with atomic oxygen has been studied in a moderately fast flow system. The course of the reaction was followed using both the Bendix T.O.F. Mass Spectrometer and a photometric method. The major products of the reaction were carbon monoxide and hydrogen. Large amounts of atomic hydrogen were also observed. The reaction scheme presented is consistent with the results obtained. The rate of the overall reaction is determined by the first initial step in which atomic oxygen adds to acetylene to yield an excited complex which then undergoes unimolecular decomposition to give triplet methylene. The rate constant for this initial reaction was measured, at room temperature as  $(8.9 \pm 2.8) \times 10^{-14}$  per sec. The activation energy was less than 1 kcal./mole. Experiments with acetylene-d<sub>2</sub> have established the specific reactions which constitute the major pathway by which triplet methylene, produced in the first initial step is consumed. (Author abstract)##

00190

R. D. Doepker and P. Ausloos

GAS-PHASE RADIOLYSIS OF CYCLOPENTANE. RELATIVE RATES OF H<sub>2</sub>(-)-TRANSFER REACTIONS FROM VARIOUS HYDROCARBONS TO C<sub>3</sub>H<sub>6</sub>(PLUS). J. Chem. Phys. 44, (5) 1951-8, Mar. 1, 1966.

The radiolysis of cyclo-C<sub>5</sub>D<sub>10</sub> was investigated in the presence of various saturated and unsaturated perprotonated hydrocarbons.\*

On the basis of the isotopic analysis of the propanes formed in these mixtures and several other experimental observations it is concluded that the C3D6(plus)ion, which is the major ion produced in the fragmentation of C5D10(plus), reacts with various saturated hydrocarbons (AH2) as follows: (a) C3D(plus) plus AH2 yields CD3CDHCD2H plus A(plus). Rates of this process relative to that of the reference reaction (b) C3D6(plus) plus cyclo-C5D10 yields C3D8(plus) were measured with an accuracy of better than 2%. It is suggested that the saturated hydrocarbons also transfer an H(-)ion to C3D6(plus) according to the following reaction (c) C3D6(plus) plus AH2 yields C3D6H plus AH(plus). Although in agreement with theory the total rate of reaction of C3D6(plus) with AH2 is generally seen to increase with an increase in molecular weight of AH2, there are appreciable variations in the rates of the H2(-) transfer reaction (a) versus that of the H(-)-transfer reaction (c) with a change in structure of the hydrocarbon molecule. Reaction (c) is usually favored when AH2 is a branched hydrocarbon, except for neopentane which is entirely unreactive toward C3D6(plus). Unsaturated hydrocarbons do not transfer H2(-)ion to C3D6(plus) but probably undergo a condensation-type process. The radiolysis of cyclopentane was also investigated in the presence of O2, NO, and (CH3)3N. It is demonstrated that the C3H6(plus) and C5H10(plus)ions transfer their charge to NO, or (CH3)3N and that a pressure of 20 torr approximately 20% of the parent ions undergo ring opening prior to the approximately 20% of the parent ions undergo ring opening prior to the charge-transfer process. (Author)##

00231

J.W. Newton

EVIDENCE FOR A FUNCTIONAL DISULPHIDE IN PHOTOPHOSPHORYLATION.  
Nature, 195(4839):349-351, July 28, 1962.

The investigation reported here was prompted by results of immunochemical studies on chromatophores of photosynthetic bacteria and by the finding that the photochemical apparatus of Rhodospirillum rubrum yielded serologically univalent fragments after disulphide scission. The presence of these cell particles of a repeating antigenic sub-structure with individual determinant groups spaced between each pair of disulphides was therefore indicated. Production of the univalent subunits of chromatophores can be brought about by treatment with sulphite, heavy metals under alkaline conditions, mercaptans, or sonic oscillation. Since the antigens under consideration are placed in the chromatophore during photosynthetic growth, and since the photophosphorylation system appears in the chromatophore under these conditions, the possibility of a functional involvement of these structural disulphides in photophosphorylation has been examined. (Author's abstract)##

00238

E.R. Stephens, F.R. Burleson, E.A. Cardiff

THE PRODUCTION OF PURE PEROXYACYL NITRATES. J. Air  
Pollution Control Assoc. 15, (3) 87-9, Mar. 1965. (Presented  
at Sixth Conference on Methods in Air Pollution Studies,

California State Dept. of Public Health Berkeley, Jan. 6-7, 1964.)

Three different reaction systems have been used to prepare the first three members of the PAN homologous series Two of these involve photolysis by ultraviolet black light lamps and one is a dark reaction. All are carried out in the gas phase: (1) Photolysis of dilute (100 ppm) mixtures of a symmetrical olefin (e.g., 2 butene) with either nitric oxide or nitrogen dioxide in dry oxygen or air. This was the original method and it most closely resembles the way in which these compounds are formed in polluted atmospheres. (2) Photolysis of dilute alkyl nitrite in oxygen. This is the preferred method for PAN and PPN. It was successful for the preparation of the four carbon homologue. (3) The dark reaction of the appropriate aldehyde with NO<sub>2</sub> and O<sub>3</sub> at low concentration in oxygen. This is the preferred method for the preparation of the four carbon homologue. The starting material is n-butyraldehyde. In all cases the same gas chromatographic procedure is used for purification. (Author)##

00353

A. Padwa D. Crumrine

PHOTOLYTIC DESULPHURIZATION OF DIBENZOYLSTILBENE EPISULPHIDE. Chem. Commun. (21) 506-7, Nov. 10, 1965.

The photo-extrusion of sulphur from dibenzoylstilbene episulphide (I) by ultraviolet light filtered through Pyrex glass is described. Irradiation of trans-dibenzoylstilbene episulphide (I) with a Pyrex filter in benzene as solvent afforded a mixture of cis- and trans-dibenzoylstilbene (II and III) in high yield. The photolysis was followed by infrared spectroscopy and was essentially complete in 30-60 min. The photodesulphurization is markedly stereospecific. Consideration of the isomeric distribution of the olefin obtained in a number of photolyses and the irradiation time demonstrated at least 90% stereoselective removal of sulphur from (I) to give (III). Increasing the time of the irradiation gave a slightly higher proportion of the cis-olefin but resulted in a diminished overall yield of the olefinic material. The lower yields can be attributed to a competing side reaction which predominates at longer photolysis time. The loss of sulphur from the episulphide upon photolysis is most simply explained by assuming a cleavage of the C alpha-S bond of the three-membered ring followed by loss of atomic sulphur. The light absorbed by (I) possesses sufficient energy to effect a carbon-sulphur bond cleavage.##

00355

A. Padwa

PHOTOCHEMICAL TRANSFORMATIONS OF A BETA, GAMMA EPOXY KETONE. J. Am. Chem. Soc. 87, 4205-7, 1965.

In contrast to exhaustive studies concerned with the photochemistry of alpha, beta epoxy ketones there has been no attempt, to date, to examine the phototransformations of the

related beta, gamma acyl oxide system. Although a formally analogous rearrangement occurs, the mechanism of the transformation is markedly different.

trans-1,4-Diphenyl-3-buten-1-one (I) was prepared by trans-1,4-diphenyl-2-butene-1,4-diol with p-toluenesulfonic acid. Treatment of I with m-chloroperbenzoic acid afforded, in essentially quantitative yield, trans-1,4-diphenyl-3,4-epoxy-butan-1-one (II). The irradiation of II was conducted using an internal water-cooled mercury arc lamp with a Pyrex filter to eliminate wave lengths below 280 millimicrons. The photolysis was followed by withdrawal of small samples at fixed intervals and examination of these by thin-layer chromatography. Upon irradiation of 500 mg. of II in benzene for 8 hr., the spot on a thin-layer plate due to II had completely disappeared and three new spots had appeared in its place. Chromatography of the crude photolysis mixture afforded 2,5-diphenylfuran (27%) and dibenzoylthane (III, 30%) as the only isoable products. The formation of 2,5-diphenylfuran was shown to be the result of a ground-state acid-catalyzed rearrangement of II. By using scanning liquid-liquid partition chromatography the crude photolysis mixture could be resolved into two major components. In addition to dibenzoylthane (III, 18%), an alcohol was obtained. The elemental analysis of this component IV indicates that it is an isomer of II. The molecular weight is consistent with a monomeric unit. The high-resolution IR spectrum (CHC13) of IV shows a sharp strong intramolecular hydrogen bond; the IR band corresponding to a non-bonded hydroxyl stretching frequency was absent. The fact that absorption due to this bond is strong and is invariant with concentration suggests that the hydroxyl group of IV is cis to the oxide ring. The ultraviolet spectrum (95% ethanol) with maxima IV is converted rapidly to dibenzoylthane by chromatography on Woelm base-washed alumina but can be recovered unchanged from liquid-liquid partition chromatography.##

00356

H. Kristinsson G. W. Griffin

PHOTOCYCLIZATION OF 3,3-DIMETHYL-1-PHENYLBUTENE-1.  
A NOVEL PHOTOINDUCED 1,2-METHYL MIGRATION. J. Am. Chem. Soc. 88, (2) 378-9, Jan. 20, 1966.

The first example of a photoinduced 1,2-methyl migration in a simple hydrocarbon system is reported. A mixture (1.3:1) of cis- and trans-3,3-dimethyl-1-phenylbutene-1 (Ia and Ib, respectively) was synthesized. A photoequilibrium between Ia and Ib was established rapidly under the irradiation conditions, and therefore separation was deemed unnecessary. Irradiation of I in benzene (0.1 M) for 70 hr afforded almost exclusively 2,3-dimethyl-4-phenylbutene-1 (II). The primary products in this photoreaction are presumably cis- and trans-2,2,3-trimethyl-1-phenyl-cyclopropane (IVa and b, respectively). That IVa and IVb are intermediates in the conversion of I to II is supported by the observation that the isomeric cyclopropanes (IVa and IVb) are completely converted to the olefin II after only 24-hr irradiation in benzene (0.1). It is clear in view of this result why the cyclopropanes do not accumulate upon photolysis of I. It is assumed that the conversion of I to IV occurs in a concerted fashion with methyl migration accompanying

cyclization. A mechanism involving formation of a common transitory intermediate which collapses to II directly or alternatively to IVa and IVb cannot be excluded, however, even though a pathway exists for facile conversion of IV to II.##

00565

Story, Paul R. and John R. Burgess

OZONOLYSIS. EVIDENCE FOR CARBONYL OXIDE TAUTOMERIZATION AND FOR 1,3-DIPOLAR ADDITION TO OLEFINS. J. Am. Chem. Soc., 89(22):5726-5727, Oct. 25, 1967. 12 refs.

Evidence of the existence of carbonyl oxides is based on their reaction with alcohols to form alkoxy hydroperoxides. Studies report evidence for 1,3-dipolar addition of carbonyl oxides to aldehydes but none such for the similar addition to olefins. Evidence is presented for 1,3-dipolar addition of a carbonyl oxide to an olefin and further, that the olefin is a vinyl hydroperoxide, formed in the ozonolysis reaction by tautomerization of the carbonyl oxide. Upon examination of the reaction mixture from the ozonolysis of tetramethylethylene with gas and liquid chromatography, one of the major products was found to be peroxyhydroperoxide. A structural assignment was given to the compound on the basis of information obtained from the infrared absorption and nuclear magnetic resonance measurements along with observation of various other reactions. It was also established that the other product obtained from the ozonolysis reaction was hydroxyacetone. The isolation of hydroxyacetone and peroxy hydroperoxide was thought to be good evidence for the tautomerization and subsequent rearrangement of carbonyl oxides. However, the structure assigned as peroxy hydroperoxide has now been found to be incorrect. Although the evidence for carbonyl oxide tautomerization stands, the evidence for carbonyl oxide addition to an olefin is not valid. The structures are presented along with newly found proof for elimination of the original one.##

00608

E. R. Allen, J. N. Pitts, Jr.

THE VAPOR PHASE REACTION OF METHYL RADICALS WITH CROTONALDEHYDE. J. Phys. Chem., 70(6):1691-1694, June 1966. 13 refs.

The reaction of crotonaldehyde (but-2-en-1-al) with methyl radicals (produced by the photolysis of acetone at 3130 Å) at temperatures in the range 120 to 250 degrees has been investigated. The major products of the reaction were carbon monoxide, propylene, four isomeric butenes, methane, hydrogen, and ethane in decreasing order of abundance. The mechanism of the formation of products is discussed. An expression for the rate constant of the displacement reaction is presented.##

E. Sawicki, T.W. Stanley, H. Johnson

QUENCHOFUOROMETRIC ANALYSIS FOR POLYNUCLEAR COMPOUNDS.  
Mikrochim. Acta, b8vol. 1, 178-192, 1965.

Quenchofluorometry should have a wide range of application, especially in the analysis of polycyclic compounds. By varying the solvent system and thus its particular type of quenching effect fluorescence methods of analysis are made much more highly selective. The following types of determinations can be made: aza heterocyclic hydrocarbons in the presence of other polynuclear compounds and vice versa, fluoranthenic hydrocarbons in the presence of other types of aromatic hydrocarbons, aza heterocyclic hydrocarbons in the presence of some aromatic amines and vice versa, and aza heterocyclic hydrocarbons in the presence of imino heterocyclic hydrocarbons and vice versa. (Authors' summary)##

00869

E. Sawicki, T.W. Stanley, W.C. Elbert

THE APPLICATION OF THIN-LAYER CHROMATOGRAPHIC AND SPECTRAL PROCEDURES TO THE ANALYSIS FOR AZA HETEROCYCLIC HYDROCARBONS IN COMPLEX MIXTURES. Occupational Health Rev. 16, (3) 8-16, 1964.

Procedures for the separation and characterization of aza heterocyclic hydrocarbons present in complex mixtures have been developed. Of the several hundred compounds present in the basic fraction of coal tar pitch, the following aza heterocyclic hydrocarbons have been characterized by easily reproducible procedures: benzo(h)-quinoline, methylbenzo(h)quinoline, dimethyl(or ethyl) benzo(h)-quinoline, 10-alkylbenzo(h)quinoline, benz(c)-acridine, dimethyl(or ethyl)benz(c) acridine, dibenz(a,h)acridine, 10H-indeno(1,1-b)quinoline, acridine, phenanthridine, indeno(1,2,3ij)-isoquinoline, benzo(f)quinoline, alkylbenzo(f)quinoline, benzo(lmn)-phenanthridine, benz(a)acridine, alkylbenz(a)acridine, and dibenz-(a,j)acridine. Coal tar pitch was used as the standard material in the analyses because it is readily available, contains a large assortment of basic compounds and carcinogens, and is found in high concentrations in air near outdoor tarring operations. The following separation procedures were used: column chromatography (alumina-pentane with increasing amounts of ether followed by increasing amounts of acetone), circular paper chromatography (formamide: water, 35:65), thin-layer chromatography (alumina - pentane: ether, 19:1) and thin-layer chromatography (cellulose - formamide:water, 35:65). The following characterization procedures were used: ultraviolet absorption spectrophotometry of an eluent or an extract, quenchofluorometry, spectrophotofluorometry of an extract or an eluent, spectrophotofluorometry on the thin-layer plate or on paper, spectrophotophosphorimetry on paper, color tests, and observation of fluorescence colors on the thin-layer plate or on paper before and after trifluoroacetic acid fuming. The described procedures are used directly in the analysis of airborne particulates and air pollution source effluents for polynuclear aza heterocyclic hydrocarbons. (Author abstract)##



00916

E. J. Baum, J. K. S. Wan, and J. N. Pitts, Jr.

REACTIVITY OF EXCITED STATES. INTRAMOLECULAR HYDROGEN ATOM ABSTRACTION IN SUBSTITUTED BUTYROPHENONES. J. Am. Chem. Soc., 88(12):2652-2659, June 20, 1966. (Presented in part at the Symposium on Structure and Photochemistry of Excited States, 149th National Meeting of the American Chemical Society, Detroit, Mich., Apr. 1964; and the IVth International Congress on Photobiology, Oxford, England, July 1964.)

The quantum efficiency of photocycloelimination of ethylene ("type II process"),  $\Phi$  sub II, from butyrophenone and several para-substituted derivatives is highly sensitive to the electron-donating character of the substituent and to the nature of the lowest triplet state. Thus at 3130 Å, 25 degrees, and in several solvents,  $\Phi$  sub II drops from 0.42 and 0.39 in butyrophenone and p-methylbutyrophenone, respectively, to 0.00 in the p-NH<sub>2</sub>, p-OH, and p-C<sub>6</sub>H<sub>5</sub> derivatives. Energy-transfer and spectroscopic studies indicate that the photoreaction proceeds from the lowest triplet state of these ketones and that this state is n,  $\pi$  (asterisk) for reactive and  $\pi$ ,  $\pi$  (asterisk) for unreactive ketones. p-Bromo- and o-hydroxybutyrophenone do not undergo photocycloelimination. The former eliminates bromine atoms with a quantum yield of 0.25. The latter photoenolizes in a reaction similar to that observed for o-hydroxy- and o-methylbenzophenone. The photocycloelimination reaction is temperature dependent with an activation energy of about 2 kcal/mole for butyrophenone. (Author abstract)##

00917

E. J. Baum and J. N. Pitts, Jr.

INTRAMOLECULAR ENERGY TRANSFER: PHOTOELIMINATION OF HALOGEN ATOMS FROM AROMATIC KETONES. J. Chem. Phys., Vol. 70:2066-2067, 1966.

Photochemical reaction of bromine atom photoelimination in p-bromobutyrophenone, a previously unreported reaction in ring-substituted aromatic ketones, is discussed. The results obtained indicated that photoelimination of halogen atoms was quite general for aromatic ketones substituted in the ring with Br and I.##

00925

J. K. S. Wan, R. N. McCormick, E. J. Baum, and J. N. Pitts, Jr.

THE ROLES OF MOLECULAR STRUCTURE AND ENVIRONMENT IN THE REACTIVITY OF EXCITED STATES. J. Am. Chem. Soc. 87(20):4409-4414, Oct. 20, 1965. (Presented at the Symposium on Structure and Photochemistry of Excited States, 149th National Meeting of the American Chemical Society, Detroit, Mich., Apr. 1965.)

The importance of molecular structure and environment in the reactivity of excited states was discussed and demonstrated by a study of two model photochemical systems in both conventional liquid medium and solid potassium bromide matrix. The two photochemical systems are the dimerization of anthracenes, which is a bimolecular reaction involving a  $\pi, \pi$  (asterisk) excited singlet and a ground-state monomer, and the cyclo-elimination process (type-II split) of butyrophenones, which is a unimolecular decomposition involving an  $n, \pi$  (asterisk) triplet state. (Author abstract)##

01026

Foot, J.K., M. H. Mallon, and J. N. Pitts, Jr.

THE VAPOR PHASE PHOTOLYSIS OF BENZENE AT 1849 Å. J. Am. Chem. Soc., 88(16):3698-3702, Aug. 20, 1966. 28 refs.

The quantum yield of disappearance of benzene vapor at 1849 degrees is 0.9 plus or minus 0.3. The major irradiation product appears to be a valence isomer of benzene, tentatively identified as "benzvalene". Addition of diluent  $N_2$  reduces the rate of formation of the product but, up to 50mm total pressure, increases its maximum concentration. Small amounts of fragmentation products, i.e. methane, ethane, ethylene, and acetylene, are also observed as well as considerable amounts of polymeric or carbonaceous deposit on the cell walls. These products may be formed in the secondary photolysis of "benzvalene". (Author abstract)##

01034

E. Sawicki and H. Johnson

THE VARIOUS QUENCHING EFFECTS IN THIN-LAYER CHROMATOGRAPHY - APPLICATION TO AIR POLLUTION. J. Chromatog. Vol. 23:142-148, 1966.

Eight fluorescence quenching techniques of value in the direct analysis of spots on thin-layer chromatograms are discussed. Use of an insoluble quencher in the adsorbent is of benefit in the selective analysis of fluorescent compounds. It is predicted that with the help of polymeric materials containing nitro, phenolic, amino, anilino, thiocarbonyl, ketonic carbonyl, hydrazine, azo, and nitroso groups quick highly selective methods of direct quenchofluorometric analysis of spots on a plate will be possible for compounds containing various types of functional groups. This type of functional group analysis should approach the simplicity of colorimetry. Examples are given of the application of some of these techniques to the analysis of urban air pollutants. The following compounds have been readily and quickly characterized by the fluorescence quenching techniques: acridine, benz(a)acridine, benz(c)acridine, 7H-benz(d,e)-anthracen-7-one, benzo(f)quinoline, benzo(h)quinoline, phenalen-1-one and xanthen-9-one. All of these compounds have been found in the examined polluted urban atmospheres. (Author summary)##

M. C. Wani and S. G. Levine

PHOTOCHEMISTRY OF 2-ALKYLAMINOPHENOXAZ-3-ONES. North Carolina State Univ., Raleigh, Dept. of Chemistry. 1965. 17 pp.

CFSTI,DDC: AD 631 366

As a continuation of 2 previous studies in photochemistry of 2-dialkylamino-phenoxaz-3-ones has been investigated. In general these compounds have been found to be more photo-reactive than the corresponding monoalkylamino-phenoxaz-3-ones. The-dimethylaminophenoxaz-3-one 4 underwent photochemical demethylation. Irradiation of the 2-polymethyleneiminophenoxaz-3-ones gave different products depending upon the size of the polymethyleneimine ring. The phenoxazones 9, 11, and 12 gave novel pentacyclic compounds 23, 25, and 26 respectively. Stable dihydrophenoxaz-3-ones have been obtained by the reduction of compounds 10, 11, and 12. (Author abstract)##

01210

J. N. Pitts, Jr., J. K. S. Wan, and E. A. Schuck

PHOTOCHEMICAL STUDIES IN AN ALKALI HALIDE MATRIX. I. An O-nitrobenzaldehyde Actinometer and Its Application to a

Kinetic Study of the Photoreduction of Benzophenone by Benzhydrol in a Pressed Potassium Bromide Disk. J. Am. Chem. Soc. 86, 3606-10, Sept. 20, 1964.

The feasibility of quantitative photochemical studies in a solid KBr "pellet" of the type customarily used for IR studies was investigated. Irradiation was by filtered UV light at an angle to the "analyzing" IR beam from the IR spectrophotometer. An actinometer consisting of o-nitrobenzaldehyde dispersed in the KBr disk was developed to measure light intensities and was used to obtain room temperature quantum yields in the system benzophenone-benzhydrol similarly dispersed in KBr. IR spectroscopy was used to identify products and determine reaction rates by repetitive scanning in situ. In the photoreduction of benzophenone by benzhydrol at 3340 Å., the value of phi for benzophenone disappearance was a function of benzhydrol concentration and approached unity at high concentrations. Benzhydrol disappeared by an apparent first-order law. Assuming a simple mechanism, the ratio of the rate constants for the deactivation vs. the reduction of excited benzophenone to form ketyl radicals was 0.0125 mole/l. of KBr. Addition of naphthalene to the "pellet" reduced the phi of benzophenone disappearance. The ratio of the rate constants  $k_5/k_3$  for naphthalene "quenching" vs. reduction of benzophenone by benzhydrol was estimated at about 50. These experimental findings indicate that photoreduction in the KBr matrix proceeds via triplet benzophenone, as in liquid solutions. "Blending" benzophenone and benzhydrol with KBr and forming disks at a pressure of 4800 p.s.i. by the usual pelletizing technique seems to result in a uniformly dispersed "solid solution." (Author abstract modified)##

01233

P. Ausloos and R. E. Rebert

PHOTOELIMINATION OF ETHYLENE FROM 2-PENTANONE. J. Am. Chem. Soc. 86, pp. 4512, 1964.

Author reports additional information concerning photoelimination of olefins from carbonyl-containing compounds. Measurements of the light emission were observed in the energy transfer process in the photolysis of 2-pentanone. Authors conclude the probability that at any given wavelength the same process will occur from either a triplet or a single state may depend on the structure of the compound under consideration.##

01241

M. A. Accomazzo and K. Nobe

CATALYTIC COMBUSTION OF C1 TO C3 HYDROCARBONS. Ind. Eng. Chem. Prod. Res. Develop. 4, (4) 425-30, Oct. 1965. (Presented at the 149th Meeting American Chemical Society, Division of Petroleum Chemistry, Detroit, Mich., Apr. 1965.)

The catalytic combustion kinetics of methane, ethane, ethylene, acetylene, propane, propylene, propadiene, propyne, and cyclopropane on CuO:A12O3 has been investigated at initial hydrocarbon concentrations between 182 and 1450 ppm in the temperature range 140 to 510 C., and at gas flow rates of 160, 275, and 525 liters per hour (NTP. The correlation considered temperature gradients along the bed and external diffusion of reactant to the catalyst surface. The predicted results agreed within 15% of the experimental results at the higher flow rates between 10 and 80% conversion. Methane was the most difficult hydrocarbon to oxidize and acetylene was the easiest. In general, increase in carbon number decreased the temperature necessary for a given conversion. For a given carbon number, the required temperature decreased with degree of saturation. The combustion products were essentially only carbon dioxide and water. The same catalyst bed was used for approximately 1000 hours with no loss in activity. (Author abstract)##

01318

H.J.R. Stevenson, D.E. Sanderson, A.P. Altshuller

FORMATION OF PHOTOCHEMICAL AEROSOLS. Intern. J. Air Water Pollution, Vol. 9:367-75, June 1965. (Presented at the American Industrial Association Conference, Philadelphia, Pa. April 29, 1964.)

Aerosol was produced photochemically by irradiation of a number of hydrocarbon-nitrogen dioxide mixtures, some requiring sulfur dioxide. In those reactions not requiring sulfur dioxide, its addition increased the aerosol production in most cases. Mixtures of hydrocarbons gave more aerosol than expected from their production individually. Shorter wavelength illumination had little effect indicating that sulfur dioxide activation is unimportant. The size of the aerosol depended upon the conditions of the experiment. (Author abstract)##

01358

B.D. Tebbens F. Ottoboni

DYNAMICS OF VAPOR-AIR MIXTURES. Am. Ind. Hyg. Assoc. J.,  
Vol. 26:445-448, Oct. 1965.

Although it is generally recognized that density difference affects the vertical movements of gases, the downward flow of heavier-than-air mixtures has received little experimental attention. On theoretical grounds, a very small density increase can produce downward flow. Experimentally, a density difference of 0.6% was sufficient to induce vertical gas flow in a pipe. From a series of observations it was found that the relationship of density to flow rate can be characterized, and that in unrestricted systems the maximum concentration of heavy vapor is far less than that predicted from vapor pressure data. This maximum is related not only to vapor pressure, evaporation rate, temperature, etc., but also to the fact of downflow and air induction associated with it. (Author abstract)##

01579

F.C. Alley L.A. Ripperton

THE EFFECT OF TEMPERATURE ON PHOTOCHEMICAL OXIDANT PRODUCTION IN A BENCH SCALE REACTION SYSTEM. J. Air Pollution Control Assoc., Vol. 11:581-584, Dec. 1961. (Presented at the 54th Annual Meeting, Air Pollution Control Association, New York City, June 11-15, 1961.)

The tabulated results of nine irradiation runs are given for olefin and nitrogen dioxide mixtures. The oxidant production is shown as a function of time of irradiation and temperature. Oxidant production was calculated by subtracting the initial oxidant reading before the lights were turned on from the oxidant reading at the particular sample interval. The peak oxidant production was approximately doubled for each 10 degree temperature increase. The average hydrocarbon reaction rate for each four-hour irradiation period is plotted against temperature. The rate increased sharply as the reaction temperature increased from 13.5 to 25 C, then decreased slightly AS THE TEMPERATURE INCREASED TO 35.0 C. FROM THESE RESULTS IT is concluded that the peak oxidant production occurring during the irradiation of olefin and nitrogen dioxide mixtures is dependent on the reaction temperature. The magnitude of this temperature effect is of the same order as that which would be predicted for a thermal reaction.##

01628

F. A. Vingiello and T. J. Delia

CLEAVAGE OF 10-SUBSTITUTED 1,2-BENZANTHRACENES. J. Org. Chem. 26, 1005-8, Apr. 1961. (Presented before the Chemistry Section at the Southeastern Regional Meeting, American Chemical Society, Birmingham, Ala., Nov. 1960.)

Authors present information concerning the acid-catalyzed decyclization of an aromatic hydrocarbon. In order to gain information regarding the cleavage, a group of ketones was synthesized, the study of whose cyclization might give information regarding two factors thought to be important in the cleavage; namely, stability of the carbarium ion of the departing group and steric requirement of the departing group. Data in the report indicates that both alkyl and aryl groups may be lost from aromatic polynuclear compounds as a result of an acid-catalyzed reaction and that the stability of carbonium ion of the departing group as well as steric strain may facilitate the cleavage.##

01630

F. A. Vingiello, S. G. Quo, and P. Polss

7- AND 12-THIENYLBENZ(A)ANTHRACENES. J. Org. Chem. 30, 266-9, Jan. 1965.

Authors describe the preparation properties and mode of formation of 7- and 12-thienylbenz(a)anthracenes. Analysis of the spectral patterns were made.##

01631

F. A. Vingiello and W. W. Zajac

SOME NEW ALKYL 1,2,3,4-DIBENZOPYRENES. J. Org. Chem. 26, 2228-30, July 1961. (Presented before the Division of Organic Chemistry at the Southeastern Regional Meeting, American Chemical Society, Birmingham, Ala., Nov. 1960.)

Using a previously described method, the authors prepared and catalytically cyclodehydrogenated 9- mono- and dimethylphenyl-1,2 benzanthracenes to give a series of new alkyl-substituted 1,2,3,4 - dibenzopyrenes.##

01632

F. A. Vingiello and M. M. Schlechter

SYNTHESIS AND CYCLIZATION OF THE THREE ISOMERIC 2-BENZYLPHENYL PYRIDYL KETONES. J. Org. Chem. 28, 2448-50, Sept. 1963. (Presented before the Division of Organic Chemistry, Southeastern Regional Meeting, American Chemical Society, Richmond, Va., Nov. 1959.)

A considerable number of studies have been made regarding the rates of the acid-catalyzed aromatic cyclodehydration of ketones; these studies included only ketones containing one basic group, the carbonyl function of the ketone. Substituents on the ketone were restricted to alkyl groups and halogen atoms. The cyclization behavior of ketones containing a group more strongly proton accepting than the ketonic carbonyl would test a possible limitation of the Bradsher-type aromatic cyclodehydration reaction. Protonation of the substituent might retard formation of the carbonium ion needed for cyclization. This inference actually does not exist since all three isomeric 2-benzylphenyl pyridyl ketones are cyclized at a faster rate than 2-benzylbenzophenone by the usual hydrobromic acid-acetic acid-water mixture.##

01633

F. A. Vingiello, W. W. Zajac, Jr., and L. G. Mahone

THE SYNTHESIS OF NAPHTHO(2,1-A)PERYLENE AND DIBENZO(AE)PERYLENE. J. ORG. CHEM. 28, 3253-5, NOV. 1963. (Presented before the Division of Organic Chemistry, Combined Southeastern-Southwestern Regional Meeting, American Chemical Society, New Orleans, La., Dec. 1961.)

A method for synthesis of naphtho(2,1-a)perylene and dibenzo(ae)perylene is described.\* Various dehydrogenation agents and reaction procedures were used in an attempt to convert 8-(1-naphthyl) benz(a)anthracene to naphtho(2,1-a)perylene; heating with sulfur, with selenium, with palladium on carbon; vapor phase dehydrogenation at 430 C on asbestos; fusion with sodium and aluminum chloride; porolysis of 700 C; aluminum chloride in boiling benzene; and aluminum bromide in boiling benzene - all failed to give a significant yield. Finally, cyclodehydrogenation of 8-(1-naphthyl)benza(a)anthracene with stannic chloride and aluminum chloride in boiling benzene for five minutes gave a sufficient yield.##

01634

F. A. Vingiello, E. B. Ellerbe, T. J. Delia, and J. Yanez

SYNTHESIS OF THE THREE ISOMERIC 7-PYRIDYLBENZ(A)ANTHRACENES. J. Med. Chem. 7, pp. 121, 1964.

The authors, aware of the causal relationship between certain polynuclear compounds related to benz(a)anthracene and their carcinogenic effect, prepared the three isomeric 7-pyredylbenz(a)anthracenes for screening for possible carcinogenic activity. The synthetic route to these compounds involves extensions to useful cyclodehydrogenation reactions, previously recorded.##

01635

F. A. Vingiello and T. J. Delia

12-PYRIDYLBENZ(A)ANTHRACENES. J. Org. Chem. 29, 2180-3, Aug. 1964. (Presented in part before a joint meeting of the Division of Water and Waste Chemistry and the Division of Analytical Chemistry, 140th National Meeting, American Chemical Society, Chicago, Ill., Sept. 1961.)

The authors extended the dehydrogenation reaction to the 12-pyridylbenz(a)anthracenes and consequently have

azadibenzopyrenes for testing of carcinogenicity. In accomplishing this reaction five new ketones and one ketimine (amine) have been prepared and ring closed to their corresponding 12-pyridylbenz(a)anthracenes which were then studied in dehydrogenation reactions.##

01648

W. E. Morganroth and J. G. Calvert

THE PHOTOLYSIS OF 1,1'-AZO-N-BUTANE VAPOR; THE REACTIONS OF THE N-BUTYL. Preprint. (Presented before the Division of Physical Chemistry, 149th National Meeting, American Chemical Society, Detroit, Mich., Sept. 1964.)

The vapor phase photolysis of 1,1'-azo-n-butane, at 3660 Å was investigated as a function of reactant pressure, temperature, light intensity, and added gas. The sequence of listed reactions is consistent with observed results. With the assumption that the rate constant for the reaction,  $2n\text{-C}_4\text{H}_9$  yields  $n\text{-C}_4\text{H}_{18}$  is  $2.2 \times 10$  to the 13th power cc/mole-sec, and that for the reaction,  $(n\text{-C}_4\text{H}_9) 2\text{N}_2 + \text{M}$  yields  $(n\text{-C}_4\text{H}_9) 2\text{N}_2 + \text{M}'$  is  $3.2 \times 10$  to the 14th power cc/mole-sec, the rate constants for the following reactions were estimated:  $(n\text{-C}_4\text{H}_9) 2\text{N}_2$  yields  $2n\text{-C}_4\text{H}_9$  plus  $\text{N}_2$ ,  $k_2$  approx equals  $2.5 \times 10$  to the 9th power  $\times e$  to the  $-3.8/\text{RT}$  power/sec;  $n\text{-C}_4\text{H}_9$  yields  $\text{C}_2\text{H}_4$  plus  $\text{C}_2\text{H}_5$ ,  $k_5$  approx equals  $3.7 \times 10$  to the 13th power  $\times e$  to the  $-28.7/\text{RT}$  power/sec;  $n\text{-C}_4\text{H}_9$  plus  $(n\text{-C}_4\text{H}_9) 2\text{N}_2$  yields  $n\text{-C}_4\text{H}_{10}$  plus  $\text{C}_4\text{H}_8\text{N}_2\text{C}_4\text{H}_9$ ,  $k_6$  approx equals  $1.4 \times 10$  to the 11th power  $\times e$  to the  $-7.1/\text{RT}$  power cc/mole-sec. The disproportionation to the combination ratio for the  $n\text{-C}_4\text{H}_9$  radical ( $k_3/k_4$ ) is estimated as 0.14. Estimations of the thermodynamic quantities for the  $n\text{-C}_4\text{H}_9$  radical are given.##

01677

S.W. Benson G. Haugen

THE ELIMINATION OF HF FROM "HOT" FLUORINATED ETHANES.  
AN ESTIMATION OF THE ACTIVATION ENERGIES AND RATE PARAMETERS.  
J. Phys. Chem. 69, (11) 3898-3905, Nov. 1965

BASIC SCIENCE-TECHNOLOGY: Fluorinated hydrocarbons, Decomposition, Fluorides, Activation energy, Reaction kinetics, Thermodynamics

The classical Rice-Ramsperger-Kassel theory of unimolecular reactions is shown to give a quantitative description of the decomposition of a "hot" molecule of  $\text{CH}_2\text{FCH}_2\text{F}$ . The analysis also makes possible an estimate of the activation energy for the elimination of HF from this molecule within narrow limits:  $\text{CH}_2\text{FCH}_2\text{F}$  yields  $\text{CH}_2$  equal CFH plus HF; Eact equal 62 plus or minus 3 kcal./mole;  $\Delta E_{298\text{K}}$  equal 8 kcal./



mole. From the theory one predicts the observed reductions in the rate of the elimination reactions for the series of "hot" molecules  $C_2H_6-xFx$  as  $x$  is increased. A similar analysis gives a theoretical explanation of the observed pressure dependence of the rates of stabilization of the "hot" molecules ( $CH_2Cl$ ,  $CH_2Cl$ ), ( $CH_2Cl.CHCl_2$ ), and ( $CHCl_2.CHCl_2$ ). A quantum modification of the classical Rice-Ramsperger-Kassel theory was found necessary when the magnitude of the unfixed internal energy approaches the size of a quantum of vibrational energy. This approximation of the classical theory predicted the correct rate of elimination of a Cl atom from the hot radical ( $CHClCHCl_2$ ) which at the transition state had only 2 kcal./mole of unfixed energy. In these calculations the carbon-carbon bond energy in ethane was assumed to be invariant upon the replacement of hydrogen by halogen atoms. (Author abstract)##

01680

K.W. Egger S.W. Benson

IODINE AND NITRIC OXIDE CATALYZED ISOMERIZATION OF OLEFINS.  
VII. THE STABILIZATION ENERGY IN THE PENTADIENYL RADICAL AND THE KINETICS OF THE POSITIONAL ISOMERIZATION OF 1,4-PENTADIENE.  
J. Am. Chem. Soc. 88 (2) 241-6, Jan 20, 1966.

The kinetics of the iodine atom catalyzed isomerization of 1,4-pentadiene to form 1,3-pentadiene has been studied in the gas phase over a temperature range from 129 to 241. The formation of small amounts of n-pentenes and cyclopentene does not change the basically very simple rate law for the positional isomerization of n-pentadienes which is governed by the rate of abstraction of a hydrogen atom from 1,4-pentadiene by iodine. When compared with the activation energy for the analogous hydrogen abstraction from n-pentane, assuming the activation energies for the back reactions to be equal (HI attack on pentyl and pentadienyl radicals), one obtains 15.4 plus or minus 1 kcal./mole for the resonance energy in the pentadienyl radical. This value is only 25% larger than the allyl stabilization energy. These stabilization energies are discussed in terms of a simple model of three-electron bonds and related to energies in the benzene system. (Author abstract modified)##

01682

D.M. Golden, R. Walsh, S.W. Benson

THE THERMOCHEMISTRY OF THE GAS PHASE EQUILIBRIUM  $I_2$  PLUS  $CH_4$  (REVERSIBLE)  $CH_2I$  PLUS  $HI$  AND THE HEAT OF FORMATION OF THE METHYL RADICAL. J. Am. Chem. Soc. 87, (18) 4053-7, Sept. 20, 1965.

With the aid of a Cary spectrophotometer, modified for use with high-temperature gas systems, it has been possible to obtain the equilibrium constant for the reaction  $CH_4$  plus  $I_2$  yields

(reversible)  $\text{CH}_3\text{I}$  plus  $\text{HI}$  at 605, 630, and 667 K. From the measured value at 630 K. of  $\text{K}_{\text{eq}} = 2.32$  plus or minus 0.09 plus 10 to the -4 power and the known values,  $\Delta S_{630} = -3.64$  gibbs/mole and  $\Delta C_p = \text{plus } 0.63$  gibbs/mole, the heat of reaction at 298 K. is found to be  $\Delta H_{298} = -12.56$  plus or minus 0.13 kcal./mole. Combining this with known values of the heats of formation of  $\text{CH}_4$ ,  $\text{I}_2$ , and  $\text{HI}$  yields the value  $\Delta H_f 298 (\text{CH}_3\text{I(g)}) = -2.38$  plus or minus 0.016 kcal./mole. These results together with the kinetic parameters of Flowers and Benson lead to  $\Delta H_f 298 (\text{CH}_3\text{g}) = -34.1$  plus or minus 0.5 kcal./mole,  $\Delta H_{298}(\text{CH}_3-\text{H}) = -104.1$  plus or minus 0.5 kcal./mole,  $\Delta H_{298}(\text{CH}_3-\text{I}) = -56.3$  plus or minus 0.5 kcal./mole in good agreement with recent data on these quantities. (Author abstract) ##

01747

J.C.W. Chien

THE PHOTOOXIDATION OF HYDROCARBONS. Hercules Chem. (53) 19-23, Sept. 1966.

After a brief discussion of photooxidation theory, photoinitiated oxidation in the presence and absence of light absorbers is described. The effect of impurities on photooxidation of hydrocarbons is discussed. The theory of charge-transfer absorption by hydrocarbon-oxygen systems is examined. Other charge-transfer initiated reactions are mentioned. It is concluded that charge-transfer is of little significance in the photooxidation of polyolefins. Governing factors for degradation of these resins are impurities and additives. Charge-transfer, however, may be responsible for photooxidation of hydrocarbons and sulfides in the atmosphere. The author believes that the hypothesis of photoinitiation by charge-transfer will lead to an extension of knowledge of reactions occurring in the atmosphere.##

01771

R. D. Cadle and E. R. Allen

KINETICS OF THE REACTION OF  $\text{O}(^3\text{P})$  WITH METHANE IN OXYGEN, NITROGEN, AND ARGON-OXYGEN MIXTURES. J. Phys. Chem. 69, (5) 1611-5, May 1965.

Rate constants for the reaction of atomic oxygen with methane have been determined using molecular oxygen, molecular nitrogen, and argon-oxygen mixtures as the carrier gas. The reactions were first order with respect to each reactant. Rate constants were much higher for oxygen than for nitrogen as the carrier gas and were represented by the expressions  $k$  equal  $2.3$  (plus or minus 1.1) times  $10$  to the 13 power  $\exp(-6600 \text{ (plus or minus } 1500/\text{RT)})$   $\text{cm}^3/\text{mole sec.}$  and  $k$  equal  $7.1$  (plus or minus 3.5) times  $10$  to the

12 power  $\exp(-7300 \text{ (plus or minus } 1500/RT) \text{ cu cm/mole sec.)}$  respectively. Apparently, ground-state molecular oxygen, when present in appreciable quantities, took part in the reaction. (Author abstract)##

01824

R.E. Rebbert P. Ausloos

QUENCHING OF THE TRIPLET STATE OF ACETONE AND BIACETYL BY VARIOUS UNSATURATED HYDROCARBONS. J. Am. Chem. Soc. 87, (24) 5569-72, Dec. 20, 1965.

The quenching effect of several unsaturated hydrocarbons on the emission from acetone, excited at 3130 Å., has been determined in the gas phase at 32 degrees. It is noted that addition of an olefin usually results in a pronounced reduction of the phosphorescence emitted by acetone but that the fluorescence yield remains unchanged. It is suggested that acetone transfers its triplet energy to the olefin molecule. It is concluded that when the energy-transfer process is endothermic, the quenching efficiency increases with diminishing  $\Delta H$  of the reaction. When the energy-transfer process is exothermic, no correlation is seen between the quenching efficiency and the  $\Delta H$  of the reaction. Because of the low energy of the 0-0 band, corresponding to the S sub 0 - T sub 1 transition in biacetyl, triplet-state energy transfer from biacetyl to most monoolefins occurs with very low efficiency. The probability that triplet energy will be transferred upon collision is as follows: 1,3-butadiene,  $1.6 \times 10$  to the minus 4 power; styrene,  $2.5 \times 10$  to the minus 5 power; 2,3-dimethyl-2-butene,  $1.6 \times 10$  to the minus 7 power. (Author abstract)##

01833

P. Ausloos and S. G. Lias

H2-TRANSFER REACTIONS IN THE GAS-PHASE RADIOLYSIS OF HYDROCARBONS. J. Chem. Phys. 43, (1) 127-35, July 1, 1965.

The radiolysis of cyclohexane has been investigated in the presence of varying concentrations of acetylene, ethylene, propylene, butene, and cyclopropane. On the basis of a number of observations, it is concluded that, in all cases, the H2-transfer reaction  $C_{sub} n H_{sub} m$  plus cyclo-C6H12 plus yields  $C_{sub} n H_{sub} m$  plus 2 does take place. No extensive rearrangement occurs in the collision complex. For instance, a transfer of H2 to CD3CD2 results exclusively in the formation of CD3CDHCD2H, while an H2 transfer to (CD2)3 leads to the formation of CD2HCD2CD2H. Relative rate constants for the transfer of an H2 molecule to CH3CHCH2, 1-C4H8, iso-C4H8, 2-C4H8, C2H2 are, respectively, 1.00, 0.68, 0.27, 0.10, 0.11, and 0.072. Similar variations in the relative rate constants of the H2-transfer reaction  $C_{sub} n H_{sub} m$  (plus) cyclo-C6H12

yields C sub n H sub m plus 2 plus C6H10 plus are noted. The following additional information was derived in the course of the study: (1) When cyclopentane or n-pentane is substituted for cyclohexane in the reaction mixture, the H2-transfer reaction again occurs. Under comparable experimental conditions, the probability of the H2-transfer reaction is proportional to the yield of the parent ion as derived from the 70-eV mass-spectral cracking patterns. (2) An increase in the pressure of cyclopentane, from 12.7 to 210 mm, leads to approximately a 50% increase in the yield of the parent ion of cyclopentane. (3) The parent cyclohexane ion undergoes a charge transfer to NO at a rate which is comparable to the rates of the H2-transfer reactions. O2 does not interact with the parent ion. (4) The cyclopropane-d sub 6 parent ion reacts with cyclo-C6H12 to form CD3CDHCD2H, indicating that this ion acquires the propylene ion structure prior to or during reaction. (Author abstract)##

01875

M. F. Brunelle, J. E. Dickinson, and W. J. Hamming

EFFECTIVENESS OF ORGANIC SOLVENTS IN PHOTOCHEMICAL SMOG FORMATION (SOLVENT PROJECT, FINAL REPT.). Air Pollution Control District, Los Angeles County, Calif., Evaluation and Planning Div. July 1966. 188 pp.

The principal objective of this study, the determination in an environmental chamber of the smog-forming potentials of individual organic solvents likely to be emitted to the atmosphere, was accomplished and it is now possible to reach certain conclusions based on these data. By compound types, the effects to which each solvent group was found to contribute can be summarized as follows: (1) Aromatic hydrocarbons, except benzene, contribute substantially to aerosol formation, rapid O3 formation, eye irritation and total aldehyde formation. (2) Chlorinated hydrocarbons exhibit almost greater O3 forming activity than the aromatics. Eye irritation was moderate to severe, depending upon the test conditions, and aerosol formation was negligible. On the basis of an experiment with tetrachloroethylene (8 ppm) and NO (2 ppm), alone, it is concluded that most of the activity of the mixed chlorinated solvent may be attributed to trichloroethylene. (3) Aliphatic hydrocarbons (alkanes), both high-boiling and low-boiling, contribute primarily to O3 formation. They also produce total aldehyde concentrations comparable with those produced by irradiation of auto exhaust. The high-boiling alkanes tested tend to exhibit greater reactivity than the low-boiling materials. (4) Ketones contribute significantly to O3 formation (0.3 - 0.4 ppm after 5 to 6 hours' irradiation) and, to some extent to eye irritation, though mostly at higher concentrations or with mixtures. As with several other solvents, aerosol formation is negligible. A single test with acetone (8 ppm) and NO (2ppm) showed little activity by this compound with respect to ozone formation or aerosol formation, and only very slight eye irritation was indicated. Data indicate that the branched ketones are considerably more reactive than straight-chain ketones. (5) Alcohols are the least active class of compounds tested.##

01880

K. W. Egger and S. W. Benson

IODINE AND NITRIC OXIDE CATALYZED ISOMERIZATION OF OLEFINS.  
V. Kinetics of the Geometrical Isomerization of  
1,3-Pentadiene, a Check on the Rate of Rotation about Single  
Bonds, and the Allylic Resonance Energy. J. Am. Chem. Soc.  
87, (15) 3314-9, Aug. 5, 1965.

The kinetics of the nitric oxide catalyzed, homogeneous, gas phase isomerization of 1,3-pentadiene have been studied over a temperature range between 126 and 326 degrees. Analysis of the data shows that the rate-controlling step in the NO-catalyzed geometrical isomerization of pentadiene is the rotation about the single bond in the intermediate radical. Iodine is shown to form a much more stable intermediate radical, and results indicate that, in the I<sub>2</sub>-catalyzed system, the addition reaction of I atoms is rate controlling. The rotational rate constant log kc was calculated to be (11.5 plus or minus 0.3) - (5.3 plus or minus 1.0)/theta sec. compared to (11.2 - (3.8)/theta sec.) as reported earlier for the iodine catalyzed cis-trans isomerization of 2-butene. (Author abstract modified)##

01881

K. W. Egger and S. W. Benson

NITRIC OXIDE AND IODINE CATALYZED ISOMERIZATION OF OLEFINS.  
IV. Thermodynamic Data from Equilibrium Studies of the  
Geometrical Isomerization of 1,3-Pentadiene. J. Am. Chem.  
Soc. 87, (15) 3311-4, Aug. 5, 1965.

The measurement of equilibrium constants of the iodine-catalyzed gas phase reactions of olefins and their parent hydrocarbons has been shown to be a very simple, direct, and valuable method to determine precise differences in the thermodynamic properties of the reactants. Applied to the cis-trans isomerization of 1,3-pentadiene, the present paper reports an appreciable amount of side reactions and considerable difficulties in product separation. This result is in contrast to the clean-cut experiments on the isomerization of 2-butene. The important two side reactions, the polymerization of 1,3-pentadiene and the formation of diiodide in the lower temperature range, are shown to be a consequence of the considerably more stable radical intermediate formed with 1,3-pentadiene compared to 2-butene. The NO-catalyzed system showed excellent reproducibility and no measurable side reactions. NO<sub>2</sub> gave rise to the same difficulties obtained with the iodine catalysis. This is to be expected from the C-ONO bond strength of about 54 kcal.##

01891

G. R. Youngquist and J. L. Allen

KINETICS OF THE ADSORPTION OF PURE HYDROCARBONS BY SYNTHETIC ZEOLITES. Preprint. 1963.

Rate and equilibrium data for adsorption of ethane, ethylene, propane, propylene, butane and butylene on a synthetic zeolite, Davison calcium Microtraps, were obtained. Intraparticle diffusion was found to be rate limiting. Effective diffusion coefficients and their concentration and temperature dependence were determined. Equilibrium data were successfully correlated using the Potential Theory. (Author summary)##

01961

G. R. McMillan, J. G. Calvert, and J. N. Pitts, Jr.

DETECTION AND LIFETIME OF ENOL-ACETONE IN THE PHOTOLYSIS OF 2-PENTANONE VAPOR. J. Am. Chem. Soc. 86, 3602-5, Sept. 20, 1964.

The formation of the enol form of acetone in the "type II" primary photochemical process in methyl ketones containing gamma-hydrogen atoms has received general acceptance in recent years on the basis of published indirect evidence. In this work a direct observation of the transient enol form of acetone has been made by infrared absorption during the photolysis of 2-pentanone. The enol to keto conversion was studied by following both the disappearance of the enol and the appearance of the keto form using long-path infrared techniques. The half-life of enol-acetone is about 3.3 min. at 27 degrees and 750-mm. total pressure. The ketonization process seems to occur mainly at the reaction vessel wall. Photolyses of 2-pentanone were also carried out in small reaction vessels pretreated with D2O. In this case the keto-acetone ultimately produced is partly monodeuterated, and a partial exchange of the enol form at the vessel wall is indicated; this result is similar to that reported by Srinivasan in experiments with 2-hexanone. The extent of exchange exhibits a peculiar dependence on the residence time in the cell which complicates the interpretation of the ketonization step under these conditions. (Author abstract)##

01978

A. P. Altshuller, I. R. Cohen, S. F. Sleva, and S. L. Kopczynski

AIR POLLUTION: PHOTOOXIDATION OF AROMATIC HYDROCARBONS. Science 138, (3538) 442-3, Oct. 19, 1962.

A number of aromatic hydrocarbons participate as effectively as the olefins in atmospheric photooxidation reactions in the presence of nitrogen oxides and ultraviolet light. Judged both on the basis of reactivity and concentrations in the atmosphere, the aromatic hydrocarbons cannot be ignored as contributors to the photochemical type of air pollution. (Author abstract)##

01990

A. Goetz and T. Kallai

THE SYNTHESIS OF DEFINED AEROSOL SYSTEMS. Am. Ind. Hyg. Assoc. J. 24, 453-61, Oct. 1963.

Instrumentation and procedures for the synthetic production of photochemical aerosols within a laminar airflow along a tubular channel are described. Special micro-dosimetry quantitatively facilitates continuous addition of reactive trace components (hydrocarbons, NO, NO<sub>2</sub>, SO<sub>2</sub>) and of defined nucleating particulates. The flow is subsequently irradiated symmetrically in the spectral range (320-450 millimicrons) in a special channel section without temperature increase, at adjustable intensity levels and exposure durations up to several times solar intensity at ground level. The resulting aerocolloidal components are analyzed with the Aerosol Spectrometer for determining the size and mass distribution of the photoactivated particulates at various reaction stages. Examples of smog-type reactions between traces of NO<sub>2</sub> and olefins, and of modifications of natural aerosols, are presented. (Author abstract)##

02082

E. Sawicki, T.W. Stanley, J. Pfaff, H. Johnson

SENSITIVE NEW METHODS FOR AUTOCATALYTIC SPECTROPHOTOMETRIC DETERMINATION OF NITRITE THROUGH FREE-RADICAL CHROMOGENS. Anal. Chem. 35, (13) 2183-91, Dec. 1963.

Many of the methods presented here are more sensitive than any described in the literature. A molar absorptivity of 1,270,000 can be obtained in the 1-methyl-2-quinolone azine procedure, while in most other procedures molar absorptivities average over 200,000. The following reagents are compared: 1-methyl-2-quinolone azine, 3-methyl-2-benzothiazolinone azine, glyoxal bis (N,N diphenylhydrazone), 3-methyl-2-benzothiazolinone picrylhydrazone, phenothiazine, N,N,N',N'-tetramethyl-4,4'-diaminostilbene, N,N' - diphenyl p - phenylenediamine, N,N,N',N'-tetramethylbenzidine, N,N,N',N'-tetramethyl - p - phenylenediamine, and N,N,N' - trimethyl - p - phenylenediamine. The syntheses of some of the reagents are given. Evidence is presented that free radicals are obtained in all the procedures. The advantages and disadvantages of the methods are discussed. Recommendations are given for application of some of the procedures to the analysis of solutions containing dyes, large amounts of sulfite, or minute amounts of nitrite. (Author abstract)##

02160

C. A. Clemons, P. W. Leach, and A. P. Altshuller.

1,2,3,-TRIS (2-CYANOETHOXY) PROPANE AS A STATIONARY PHASE IN THE GAS CHROMATOGRAPHIC ANALYSIS OF AROMATIC HYDROCARBONS. ANAL. CHEM. 35, (10) 1547-8, SEPT. 1963

The gas chromatographic procedure described has been used successfully to follow the rate of disappearance of various aromatic hydrocarbons in dilated auto exhaust in a large photochemical reactor. Some of the concentrations of the aromatic HYDROCARBONS ARE AS FOLLOWS BENZENE, 0.07 P.P.M.; TOLUENE, 0.15 p.p.m.; ethylbenzene, 0.04 p.p.m.; and n-propylbenzene, 0.01

p.p.m. Excellent analytical results have been obtained even at low concentration levels. For example, in one series of seven experiments in which the initial concentration of m-xylene plus p-xylene was only 0.038 p.p.m., it was determined that 0.014 plus or minus 0.003 p.p.m. were photooxidized to products. Such results are possible only if column substrates such as 1,2,3-tris (cyanoethoxy)-propane, which have good selectivity and excellent stability, are available to use with flame ionization detectors operating at maximum sensitivities.##

02203

B.D. Tebbens, J.F. Thomas, M. Mukal

FATE OF ARENES INCORPORATED WITH AIRBORNE SOOT. Am. Ind. Hyg. Assoc. J. 27, (5) 415-22, Oct. 1966.

Modification of airborne arenes by environmental factors is significant not only because of possible reduction or enhancement of biologic effect on humans in contact with air contaminants, but also of the difficulty in relating arene sources to the compounds found in air. Smoke as an experimental source of arenes was diluted, then irradiated in a 22-ft. dynamic flow chamber. Samples were collected before and after irradiation and determination of concentration of 2 arenes, benzo(a)pyrene and perylene, and particle sizes were made. Irradiation caused partial modification or disappearance of the arenes by 35-65% of the original content. Without irradiation an apparent increase of arenes was noted and this was thought to be a function of the system and particle size factors. The presence of oxygen increases the degree but is not necessary for the modification of arenes. (Author abstract modified)##

02204

R.M. Teeter, C.F. Spencer, J.W. Green, L.H. Smithson

ANALYSIS OF ALPHA OLEFINS USING A GAS CHROMATOGRAPH-MASS SPECTROMETER COMBINATION. J. Am. Oil Chemists' Soc. 43, 82-6, Feb. 1966. (Presented at the American Oil Chemists' Society Meeting, Houston, Tex., Apr. 1965.)

The gas chromatograph-mass spectrometer (GCMS) combination with and without catalytic hydrogenation is the most effective way to obtain detailed analysis of commercial alpha olefin mixtures. Previous descriptions of this technique presented examples only up to C10 alpha olefins. We have extended this technique to include alpha olefins up to C20. The complete analysis of C11-C14 alpha olefin mixture is given as an example. (Author abstract)##

02243

R.E. Rebbert P. Ausloos

THE REACTIONS OF METHYL RADICALS IN THE SOLID-, LIQUID-, AND GAS- PHASE PHOTOLYSIS OF DIMETHYLMERCURY. J. Am. Chem. Soc. 85, 3086-9, Oct. 20, 1963.



The gas-phase photolysis of  $\text{CD}_3\text{COCD}_3$  has been investigated in the presence of  $\text{CH}_3\text{HgCH}_3$  from 376 to 453 K. From the isotopic distributions of the methane and ethane fractions, evidence was obtained for the occurrence of the reaction:  $\text{CO}_3$  plus  $\text{CH}_3\text{HgCH}_3$  yielding  $\text{CD}_3\text{HgCH}_3$  plus  $\text{CH}_3$  (Energy of activation equals 12.6 kcal./mole). This reaction is also postulated to occur in the liquid-phase photolysis of dimethylmercury. From the isotopic distribution of the ethane produced in the liquid- and solid- phase photolysis of  $\text{CH}_3\text{HgCH}_3$ - $\text{CD}_3\text{HgCD}_3$  mixtures, it was concluded that cage recombination of methyl radicals does take place. Contrary to the conclusions reached in an earlier work by Derbyshire and Steacie, no evidence could be obtained for hot methyl radical effects in the liquid-phase photolysis of dimethylmercury. (Author abstract)##

02253

H. C. Hottel, G. C. Williams, N. M. Nerheim, and G. R. Schneider

KINETIC STUDIES IN STIRRED REACTORS: COMBUSTION OF CARBON MONOXIDE AND PROPANE. Symp. Combust., 10th, Cambridge Univ., England, 1964. 1965. pp. 111-21.

The burning rates of carbon monoxide and of propane premixed with oxygen, nitrogen, and water vapor in various proportions were measured over ranges of equivalence ratios and pressures. Burning rates were determined from metered flow rates and analysis of reactor products. The burning rate of carbon monoxide g moles/ml (sec) is expressed mathematically. A kinetic mechanism is proposed which fits the data for CO with rate constants consistent with literature values. It calls for the rate-limiting step:  $\text{CO}$  plus  $\text{OH}$  yielding  $\text{CO}_2$  plus  $\text{H}$ ; equilibrium for the following reactions:  $\text{OH}$  plus  $\text{H}_2$  equal  $\text{H}_2\text{O}$  plus  $\text{H}$ ;  $\text{H}$  plus  $\text{O}_2$  equal  $\text{OH}$  plus  $\text{O}$ ;  $\text{O}$  plus  $\text{H}_2$  equal  $\text{OH}$  plus  $\text{H}$ ; and a three-body chain terminating step. The mechanism proposed for propane combustion involves in addition the very fast reaction of propane to  $\text{CO}$  and  $\text{H}_2\text{O}$  at the expense of  $\text{OH}$ ,  $\text{O}$  and  $\text{H}$ .##

02258

G. A. Oldershaw and R. J. Cvetanovic

PHOTOCHEMICAL ADDITION OF HYDROGEN BROMIDE TO 2-BUTENE IN THE GAS PHASE. J. Chem. Phys. 41, (11) 3639-44, Dec. 1, 1964.

The relative rates of the photochemical addition of hydrogen bromide to 2-butene, and of the simultaneous cis-trans isomerization have been measured in the gas phase at 54 C. Similar but less extensive experiments have been carried out with 1,2-dideuteroethylene. In this case, comparison of the rates with the data in the literature indicates much faster cis-trans isomerization than can be expected from the decomposition of thermalized bromoethyl radicals. Alternative explanations of the fast geometric isomerization are briefly discussed.##

C.P. Fenimore G.W. Jones

THE WATER-CATALYZED OXIDATION OF CARBON MONOXIDE BY OXYGEN AT HIGH TEMPERATURE. J. Phys. Chem. 61, 651-4, May 1967.

By sampling burnt gases from lean flat hydrocarbon flames at one atmosphere pressure, the oxidation rate in the presence of ample water at 1700-2000K is determined to be  $-1/(O_2) (d\ln(CO)/dt) + 1.2 \times 10$  to the 9th power e to the  $-24,000/RT/(\text{moles/l})/\text{sec}$ . In burnt gas from CO flames containing very little water,  $-d\ln(CO)/dt$  is independent of oxygen and roughly proportional to water. The slower rate of comparatively dry CO flames is raised toward the value appropriate to hydrocarbon flames by adding hydrogen to the CO. A partial mechanism is suggested which is consistent with these results. (Author abstract)##

02337

D. Phillips.

PHOTOLYTIC PROCESSES IN PERFLUOROCYCLOBUTANONE VAPOR. J. PHYS. CHEM. 70, (4) 1235-43, APR. 1966.  
CFSTI, DDC AD 635437

The photolysis of perfluorocyclobutanone in the vapor phase at 3130, 3340, 3660, and 4047 Å has been investigated. Fluorescence and decomposition yields have been determined at the four wavelengths and the effects of pressure and temperature upon them studied. Two modes of decomposition occur at the shortest wavelengths and at high temperatures, one producing carbon monoxide and perfluorocyclopropane, the other producing tetrafluoroethylene. A mechanism is proposed which explains the results, and rate constants for reactions are determined. Results indicate that about 7 kcal/mole excess vibrational energy can be removed from the excited ketone by each collision with an unexcited ketone molecule. (Author abstract)##

02374

H.L. Shulman, G.R. Youngquist, J.L. Allen, D.W. Ruths, S. Press

DEVELOPMENT OF A CONTINUOUS COUNTERCURRENT FLUID-SOLID CONTACTOR: II. ADSORPTION. Preprint. (Presented at the Air Pollution Symposium, National American Chemical Society Meeting, Chicago, Ill., Sept. 1964.

A continuous countercurrent contacting device for the separation of gas mixtures by adsorption was developed. The device can be used with molecular sieves to separate water and sulfur dioxide from mixtures with air, and ethylene from mixtures with air and ethane. Characteristic mass transfer coefficients were obtained and correlated diagrams. (Author summary)##

A. Goetz R. Pueschel

THE EFFECT OF NUCLEATING PARTICULATES ON PHOTOCHEMICAL AEROSOL FORMATION. J. AIR POLLUTION CONTROL ASSOC. 15, (3) 90-5, Mar. 1965. (Presented at the Sixth Conference on Methods in Air Pollution Studies, Berkeley, Calif., Jan. 6-7, 1964.)

The role of nucleating particulates in the formation of photochemical aerosols was studied in a steady, laminar flow of ultrafiltered air containing NO<sub>2</sub> and octene-1 in the concentration range of: (30 - 170 ppm), when subjected to intense irradiation under isothermal conditions. The particulates consisted of monodisperse polystyrene latex (d equal 0.36 micron) in concentrations similar to those in the atmosphere; the irradiation intensity varied between: (6 - 40,000 lumne/liter) and the mean exposure duration between 30 - 180 sec. Samples of the flow, prior to and after its photoactivation, were withdrawn either by an Aerosol Spectrometer (AS) or by a Royco Aerosol Photometer. The photometric data include all colloidal components in the airborne state, whereas the counts obtained from the AS-deposits refer only to the nucleated latex particles. The following pattern is evident: The photochemical reaction yields fractional products (less than 3%) which have the tendency to agglomerate (or polymerize) due to their relatively low volatility--independent of the presence or absence of nucleating particulates. The growth process appears principally different from that of fog formation by H<sub>2</sub>O)-condensation, where, for identical supersaturation, it is inversely proportional to the nuclear concentration. In the absence of nuclei, autonucleation, i.e. self-agglomeration, occurs at a much lesser reaction rate and higher photon demand. The growth rate of the nuclei, when present, depends on the concentration of the oxidation catalyst (NO<sub>2</sub>). Under identical conditions the mass of nuclear accumulant is directly proportional to the concentration of the reactive hydrocarbon, while the growth rate depends on the light intensity and the exposure duration. The findings indicate that density and nature of particulate matter present in an air mass prior or during photo-activation are, aside from the chemical reactant levels, of major significance in aerosol formation. (Author abstract modified)##

02443

HYDROCARBON - AIR FUEL CELLS. General Electric Co., Lynn, Mass., Direct Energy Conversion Operation. (Technical Summary Rept. No. 8, July 1-Dec. 31, 1965). 266p., 1965  
CFSTI AD 479005

Detailed information is presented on a continuing research and development program to develop a direct hydrocarbon oxidation-air fuel cell technology. Current work included research on electrochemical oxidation processes, electrocatalysts, electrolytes, electrode structures, and fuel cell life testing. Multi-pulse potentiodynamic techniques have been further developed for analyzing hydrocarbon surface processes. Performance of fuel cell systems with hydrogen fluoride and phosphoric acid

electrolytes have been studied for high performance hydrocarbon oxidation. Boron carbide and carbon have been successfully employed as substrates for high surface area platinum and the results and application to Teflon-bonded electrodes are reported. A variety of modified Teflon-bonded developmental electrodes were evaluated. (Author abstract)##

02445

G. W. Griffin

PHOTOCHEMISTRY OF UNSATURATED CARBONYL DERIVATIVES AND RELATED SMALL RING SYSTEMS (FINAL REPT. JULY 1, 1963-DEC. 31, 1965.)  
Tulane Univ., New Orleans, La., Dept. of Chemistry  
(AROD Rept. No. 4375:11.)28 pp., June 1, 1966  
CFSTI AD 635217

The photofragmentation of a variety of small ring homo- and heterocyclic systems including cyclopropanes, epoxides, aziridines, oxaziranes and spirothiophenes are studied. The photorearrangement of cyclopropanes to olefins and the photoinduced conversion of cyclopropanes to indenones also are examined. The studies are complementary and those parameters which determine the reaction course are defined in each case. For example, it is of interest to determine why certain cyclopropanes fragment to carbenes and others simply rearrange to isomeric olefins. Many of those reactions described have synthetic utility and heretofore inaccessible systems now have been synthesized. The photofragmentation of stilbene oxide is illustrative and appears to be the method of choice for preparing phenylcarbenes and thus phenylcyclopropanes and cyclopropenes.##

02467

D. Vanderwerf

A STUDY OF THE TEMPERATURE DEPENDENCE OF THE TOTAL ABSORPTANCE OF CO NEAR 4.7 MICRONS AND 2.3 MICRONS AND CH<sub>4</sub> NEAR 3.3 MICRONS. Ohio State Univ., Columbus, Research Foundation (Rept. AFCRL-64-448) (Scientific Rept. No. 5) pp. 83, May 1964.  
CFSTI, DDC: AD 442926

The dependence of the total absorptance of the bands of carbon monoxide near 4.7 microns and 2.3 microns, and of methane near 3.3 microns, on absorber concentration, pressure, and temperature was measured. Data were taken for absorber pressures between 100 and 1000 mm Hg, and at temperatures up to 400 C, for a fixed absorber path length of 30.6 cm. The nature and possible reasons for the observed temperature dependence of the total absorptance are discussed. (Author abstract)##

02472

S.S. Wilks

PRELIMINARY STUDIES ON LIGHT-INDUCED CARBON MONOXIDE IN CLOSED ENVIRONMENTS. School of Aerospace Medicine, Brooks AFB, Tex., Aerospace Medical Division. Sept. 1963. 9 pp. CFSTI, DDC AD 420946

Experimental data is presented concerning the effects of solar light upon certain classes of organic substances which may be components of the sealed environment of space vehicles. Many materials such as organic plastics, pigments, insulating material, etc., will, when exposed to light in the presence of oxygen, liberate a number of toxic end products such as carbon monoxide, aldehydes, acids and certain hydrocarbons. In a sealed environment these agents may reach levels toxic to human beings during a long sojourn in a sealed system. Therefore, along with products that may result from thermal and electrical activity (motors, generators, etc.), these products may constitute a considerable hazard in sealed environments. (Author abstract)##

02489

J. K. S. Wan and J. N. Pitts, Jr.

A SPECTROSCOPIC INVESTIGATION OF THE REACTION BETWEEN IODINE AND CYCLOPROPYLAMINE. Tetrahedron Letters, 44:3245-50, 1964

The reaction between iodine and cyclopropylamine in n-heptane solution was studied spectroscopically. Preliminary results suggest that 1:1 charge-transfer complex between iodine and cyclopropylamine was formed first; subsequently precipitation of white crystals of a 2:1 cyclopropylamine-iodine complex,  $C_3H_5NH_2)_2 I_2$  (A), occurred. Evidence suggests that the solid product (A) has probably an ionic structure.##

02493

J. K. S. Wan, L. D. Hess, and J. N. Pitts, Jr.

FREE-RADICAL ADDITION TO AZOBENZENE IN CUMENE SOLUTION. ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF SOME LONG-LIVED RADICAL INTERMEDIATES. J. Am. Chem. Soc. 86, 2069-70, 1964

A degassed solution of azobenzene in cumene was irradiated at room temperature in the microwave cavity of Varian V 4500 e.p.r. spectrometer with 100-kc. field modulation. Light source was a PEK mercury high pressure lamp equipped with filters which absorbed wave lengths shorter than 4000Å. At room temperature irradiation, a spectrum was observed with an intensity dependent upon the initial concentration of azobenzene. The spectrum is a triplet, each component of which contains 4 groups of lines with intensities following a 1:3:3:1 binominal distribution. Each of the groups is further split into 3 lines. The radical structure consistent with observed spectrum is composed of the azobenzene and

cumene structures joined at a nitrogen atom and the tert-carbon atom. Experimental coupling constants and experimental and theoretical spin densities are tabulated. Separate experiments on a larger scale in which the reaction was subjected to liquid chromatography resulted in N,N'-Diphenyl-N-(1-methyl-1-phenylethyl) hydrazine being eluted. Its identity was confirmed by IR and n.m.r. analysis.\*\*

02495

M. Mukai, B. D. Tebbens, and J. F. Thomas.

MULTIDIMENSIONAL CHROMATOGRAPHY OF ARENES PRODUCED DURING COMBUSTION. Anal. Chem., 36(6):1126-1130, May 1964. (Presented at the Division of Water and Waste Chemistry, 144th Meeting, ACS, Los Angeles, Calif., Apr. 1963.)

The polynuclear aromatic hydrocarbons synthesized in a flame during incomplete combustion of various fuels are sufficiently similar to suggest that the process of their formation is independent of the fuel used. To test this hypothesis a laboratory investigation was carried out with burner enclosed in a system which allowed controlled combustion of several dissimilar gaseous fuels and quantitative recovery of combustion products of interest. Quantitative determination of six arenes showed a constant proportional production of anthracene, pyrene, fluoranthene, benzo(a)pyrene, perylene, and benzo(e) pyrene. Analytical procedures included paper chromatography, paper-to-paper transfer, and new solvent systems which separate isomers such as pyrene and fluoranthene. The spectrofluorometer was used for quantitation of arenes after elution from the chromatogram. Types and relative quantities of arenes produced appear to depend on the temperatures of flame zones and on complexity of combustion products. (Author abstract)\*\*

02496

J. N. Pitts, Jr., E. A. Schuck, and J. K. S. Wan.

PHOTOREDUCTION OF 2,2-DIPHENYL-1-PICRYLHYDRAZYL (DPPH) IN HYDROCARBONS. J. Am. Chem. Soc. 86, 296-7, Jan. 20, 1964.

Preliminary results of an e.p.r. investigation of the photo-induced abstraction of hydrogen atoms from hydrocarbons by 2,2-diphenyl-1-picrylhydrazyl (DPPH) are reported. Light absorption by DPPH solutions at 3130 Å was determined by using the photochemical disappearance of benzophenone and the formation of acetone in isopropyl alcohol as the actinometer. In the dark no diminution of e.p.r. signal intensity was observed. During irradiation the signal decreased according to the first-order rate law. An equation for determining the reaction rates of DPPH in different hydrocarbon solvents using the quantum yield is given.\*\*

02506

R. C. Clark, Jr.

OCCURRENCE OF NORMAL PARAFFIN HYDROCARBONS IN NATURE (TABLES AND BIBLIOGRAPHY). Woods Hole Oceanographic Institution, Mass.  
JULY 1966. 56 PP.  
CFSTI, DDC AD 635898

Tables of annotated bibliography of occurrence of normal paraffin hydrocarbons (C(sub n) H(sub 2n plus 2)) in land plants and products; land organisms; marine plants and organisms; and geologic and atmospheric samples. (Author abstract)##

02517

D. Marsh and J. Heicklen

PHOTOOXIDATION OF PERFLUOROETHYL IODIDE AND PERFLUORO-N-PROPYL IODIDE. Aerospace Corp., El Segundo, Calif., Lab.  
Operations. Apr. 1966. 11 pp.  
DDC: AD 483914

Perfluoroethyl iodide and perfluoro-n-propyl iodide were photolyzed in the presence of oxygen. In both cases, the major product is CF<sub>2</sub>O. In the C<sub>2</sub>F<sub>5</sub>I system, it is produced with a quantum yield of about 2.0. CF<sub>3</sub>CFO is also produced, but is 100 times less important. With HI present, the oxidation is drastically modified, and the RO<sub>2</sub> intermediate must live at least 10 to the 7th sec. (Author abstract)##

02528

T. F. Thomas and C. Steel

PHOTOINITIATION OF UNIMOLECULAR REACTIONS. THE PHOTOLYSIS OF 2,3-DIAZABICYCLO(2.2.1)HEPT-2-ENE. J. Am. Chem. Soc. 87, (23) 5290-3, Dec. 1965

The gas-phase photolysis of 2,3-diazabicyclo(2.2.1)hept-2-ene (I) with 337-millimicrons light has been investigated in the pressure range 10-1000 microns. The variation in the yields of hydrocarbon products, bicyclo(2.1.0)pentane (II), cyclopentene (III), and 1,3-cyclopentadiene (IV), with pressure is consistent with the initial formation of "hot" II which can either be deactivated or isomerized to "hot" III. The latter can either undergo unimolecular decomposition to yield IV or be deactivated. Changing the wave length of irradiation from 313 to 334 millimicrons changed the relative yields of the products in a manner consistent with this "hot" molecule mechanism. (Author abstract)##

02534

H. S. Johnston and J. Heicklen

PHOTOCHEMICAL OXIDATIONS. III. ACETONE. J. Am. Chem. Soc. 86, 4249-54, Oct. 20, 1964.

The room-temperature photooxidation of acetone (0.25 to 17 mm.) in oxygen (0.09 to 9.7 mm.) with continuous UV radiation above 2200 Å. was studied by the method outlined in part I of this series; observations were made by leaking the reaction mixture directly into the electron beam of the mass spectrometer during photolysis. The principal products of the reaction were  $\text{H}_2\text{CO}$ ,  $\text{H}_2\text{O}$ ,  $\text{CH}_3\text{OH}$ , and  $\text{CH}_3\text{OOH}$ ; minor products were  $\text{CH}_3\text{COOH}$ ,  $\text{HC}_3\text{OOCH}_3$ , and higher molecular weight products which were probably  $\text{CH}_3\text{COCHO}$  and  $\text{CH}_3\text{COCH}_2\text{OH}$ . Because of the cracking pattern of the reactants, it was impossible to establish the presence or absence of  $\text{CH}_4$ ,  $\text{CO}$ ,  $\text{CH}_2\text{CO}$ , and  $\text{CO}_2$ . From the identified products at least 14 free radicals are inferred to be intermediates in this system. An exhaustive and impartial examination of all possible radical-radical disproportionation and recombination reactions indicates that the data excluded a large number of possible reactions but that 140 reactions could still be occurring. Formaldehyde, so far as these studies go, could be formed by 39 different reactions. Thus, this experimental method cannot give a complete mechanism, nor can any method that simply analyzes all molecular products. (Author abstract)##

02535

H. S. Johnston and J. Heicklen

PHOTOCHEMICAL OXIDATIONS. IV. ACETALDEHYDE. J. Am. Chem. Soc. 86, 4254-8, Oct. 20, 1964.

The room-temperature photooxidation of acetaldehyde (0.4 to 18 mm.) in oxygen (1.0 to 9.2 mm.) with continuous uv radiation above 2200 Å was studied by the method outlined in part I of this series. Observations were made by leaking the reaction mixture directly into the electron beam of the mass spectrometer during photolysis. The principal products of reaction were  $\text{CH}_3\text{OH}$  and presumably  $\text{CO}$  and  $\text{CO}_2$ ; other products were  $\text{H}_2\text{O}$ ,  $\text{CH}_2\text{O}$ ,  $\text{HCOOH}$ ,  $\text{CH}_3\text{OOH}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{CH}_3\text{OOCH}_3$ , and probably  $\text{CH}_3\text{C(0)OOG}$ . Because of the cracking pattern of the reactants, it was impossible to establish the presence or absence of  $\text{CH}_4$ ,  $\text{CH}_2\text{CO}$ ,  $\text{CO}$ , and  $\text{CO}_2$ . Oxidation of the primary radicals,  $\text{CH}_3$  and  $\text{HCO}$ , leads to  $\text{CH}_3\text{OO}$ ,  $\text{CH}_3\text{O}$ ,  $\text{HO}$ , and  $\text{HO}_2$ , and probably  $\text{HCO(00)}$  and  $\text{HCOO}$ . There are at least six radicals in this system that can disproportionate in 36 ways and undergo other reactions. Thus this reaction is much too complicated for its mechanism to be revealed merely by analysis of all products. (Author abstract)##

02734

PARTIAL OXIDATION PRODUCTS FORMED DURING COMBUSTION (SIXTEENTH PROGRESS REPT. JULY 1 TO DEC. 31, 1966.) California Inst. of Tech., Pasadena, Chemical Engineering Lab. 1966. 16 pp.

During the period covered by this report, primary effort was directed to the investigation of the effect of the nature of fuels upon the formation of the residual quantities of the oxides of nitrogen and upon the microscopic nature of the perturbations resulting therefrom. Tables summarize results of these studies. Table I sets forth the experimental conditions in connection



with the investigation of the behavior of the propane-air and the n-butane-air system. In Table II, the composition of the reaction products of the ethane-air system propane-air and n-butane-air systems are summarized. The analysis of the perturbations in normal stress obtained in connection with the propane-air and ethane-air systems is given in Table III. Plans for continuation of these studies upon the renewal of the Public Health Service Grant No. AP-00108-08 are discussed.

02802

E. Sawicki, T. R. Hauser, and S. McPherson

SPECTROPHOTOMETRIC DETERMINATION OF COMPOUNDS CONTAINING THE P-HYDROXYSTYRENE GROUP. 3-METHYL-2BENZOTHAZOLINONE HYDRAZONE PROCEDURE. Preprint. 1961.

3-Methyl-2-benzothiazolinone hydrazone is a versatile analytical reagent which has been used to detect, characterize and determine trace amounts of various types of strongly nucleophilic organic compounds. The mechanism of the present test is difficult to ascertain. Two possibilities are that the reagent attacks the beta-carbon atom in the p-hydroxy-styrene derivative or that the latter derivative splits at the ethylene double bond to produce at least one aldehyde which then reacts with the reagent to form a blue formazan cation. Spectrophotometric Procedure.--To 1 ml of the methanolic test solution was added 1 ml of the MBTH reagent followed by 2 ml of the ferric chloride solution. The mixture was allowed to stand for 15 minutes and then diluted to 10 ml with methanol. Absorption measurements were taken at the wave length maxima. The blank was colored light greenish yellow. Spot Plate Procedure. -- To 1 drop of methanolic test solution was added 1 drop of the MBTH reagent followed by 1 drop of the ferric chlorid solution. The mixture was allowed to stand for 5 minutes. A positive reaction is shown by a blue-green color. The blank was pale greenish yellow. The test is highly selective for phenols containing a p-vinyl type group as compared to phenols without a vinyl group. It is possible that phenols with an o- or m-vinyl type group will react as phenols to give a red-orange color. A p-hydroxystyrene derivative in which a methylene group is placed between the ethylene double bond and the benzene ring gives practically no reaction.##

02804

E. Sawicki

SPOT TEST DETECTION AND SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM AMOUNTS OF ALDEHYDES AND ALDEHYDE-YIELDING COMPOUNDS -- A REVIEW. Microchem. J., Symp. Ser. 2, 59-106, 1962. (Presented at the International Symposium on Microchemical Techniques, University Park, Pa., Aug. 13-18, 1961.)

This review covers recent advances in the detection, characterization, and determination of trace amounts of aldehydes. Some of the well-established methods are also discussed and compared with the newer methods. The analysis for non-aldehydic compounds from which an aldehyde can be obtained is discussed in the section concerned with that particular aldehyde. Discussion of general tests is followed by discussion of the more

highly selective methods. Where possible, a mechanism for each procedure is included, for only with a knowledge of the structure of the final chromogen and its manner of formation can a thorough scientific study of the procedure be made. An attempt has been made to present identification limits, spectrophotometric constants, interferences, and other appropriate data for all procedures. In many of the procedures submicrogram amounts of aldehydes can be detected and with the use of microcells submicro amounts can also be determined.##

02812

P. Urone, J. E. Smith, and R. J. Katnik

GAS CHROMATOGRAPHIC STUDY OF SOME CHLORINATED HYDROCARBONS.  
Anal. Chem. 34, 476-80, Apr. 1962.

The gas chromatographic behavior of 11 chlorinated hydrocarbons was studied on six columns and at four temperatures for possible qualitative and quantitative applications. Paraffin and Apiezon L columns gave good qualitative and quantitative performances. Peak area measurements were accurate to plus/minus 0.02 in the 0- to 5 micromole range. Carefully measured specific retention volumes made possible the calculation of partition coefficients, activity coefficients, and excess partial molar heats of solution. For column substrates with indefinite molecular weights, such as paraffin and Carbowax, relative activity coefficients were calculated. (Author abstract)##

02837

C. S. Tuesday

THE ATMOSPHERIC PHOTOOXIDATION OF TRANS-BUTENE-2 AND NITRIC OXIDE. General Motors Research Labs., Warren, Mich. 1961. 35 pp. (Presented at the International Symposium on Chemical Reactions in the Lower and Upper Atmosphere, San Francisco, Calif., Apr. 18-20, 1961.)

To elucidate the mechanism of the atmospheric photochemical reactions of olefins and nitrogen oxides, the reactions that occur upon the irradiation of oxygen-nitrogen mixtures containing several parts per million of nitric oxide and trans-butene-2 were investigated. Trans-butene-2 was used as a model olefin because of its symmetry and relatively rapid reaction rate. The effects of several variables on the rates of trans-butene-2 disappearance and nitrogen dioxide formation were determined together with the effect of these variables on the concentrations of reaction products. Reaction variables investigated include nitric oxide, nitrogen dioxide, trans-butene-2, and oxygen concentrations as well as light intensity and total pressure. A reaction scheme is proposed to rationalize the observed effects these reaction variables have on the rates of trans-butene-2 and nitric oxide photooxidation and on the concentrations of reaction products. The experimental results support the general conclusion that a free radical chain reaction initiated by the reaction of oxygen atoms with trans-butene-2 is very important in the atmospheric photo-oxidation of trans-butene-2 and nitric oxide.##

02838

W. A. Glasson, and C. S. Tuesday

THE ATMOSPHERIC THERMAL OXIDATION IN NITRIC OXIDE. General Motors Research Labs., Warren, Mich. 1963. 14 pp.  
(Presented in part at the 144th National Meeting, American Chemical Society, Los Angeles, Calif., Apr. 5, 1963.)

The kinetics of the thermal oxidation of NO in oxygen nitrogen mixtures have been determined in the parts-per-million range by long-path infrared spectrophotometry. The results of this investigation indicate that the reaction is second-order in NO, first-order in oxygen, and independent of the concentration of added NO<sub>2</sub>, with a third-order rate constant, at 23 C, of 1.57 (plus or minus .09) times 10 to the minus 9 power per (sq ppm - mn). It is concluded that the kinetics of the thermal oxidation of NO are adequately described by a simple third-order rate law and do not require the complexities suggested by Treacy and Daniels. In addition, it was found that there is no effect on the rate of the thermal oxidation due to either (a) addition of several olefins or (b) photolysis of the product NO<sub>2</sub>. (Author abstract)##

02851

E.R. Stephens

THE ROLE OF OXYGEN ATOMS IN THE ATMOSPHERIC REACTION OF OLEFINS WITH NITRIC OXIDE. Intern. J. Air Water Pollution 10, (11-12) 793-803, Dec. 1966.

The photoconversion of nitric oxide to nitrogen dioxide in the presence of olefin at low concentrations in air was studied with two objectives: (1) to test the hypothesis that oxygen atoms are the principal reagents attacking the olefin in the absence of ozone; and (2) to determine the average number of nitrogen dioxide molecules formed for each molecule of olefin consumed to see whether the conversion has the aspects of a chain reaction. On the basis of the O-atomshypothesis it is predicted that the rate of oxidation of a given olefin should be proportional to the produce of the light intensity and the nitrogen dioxide concentration. It should not be affected by the addition of a second olefin. This was found to be nearly true for a wide variety of reaction conditions. About one to two nitrogen dioxide molecules were formed for each molecule of propene oxidized.##

02853

Y. Masuda, M. Kuratsune

PHOTOCHEMICAL OXIDATION OF BENZO(A)PYRENE. Intern. J. Air Water Pollution (Presented at the 23rd Annual Meeting, Japanese Cancer Association, Tokyo, Japan, Nov. 11, 1964.) 10 (11-12):805-11, Dec. 1966.

Benzo(a)pyrene dissolved in benzene was irradiated by UV light of wave length greater than 280 millicrons. Oxygen was present in the benzene. The irradiation product was fractionated by alumina column chromatography, isolating three crystalline compounds. These compounds were determined as 6,12-benzo(a)pyrenequinone, 1, 6-benzo(a)pyrenequinone and 3,6-benzo(a)-pyrenequinone by their melting points, data of elementary analysis, and IR as well as UV absorption spectra. AA##

02935

E. Matijevic, S. Kitani, and M. Kerker

AEROSOL STUDIES BY LIGHT SCATTERING. II. PREPARATION OF OCTANOIC ACID AEROSOLS OF NARROW AND REPRODUCIBLE SIZE DISTRIBUTIONS. J. Colloid Sci. 19, (3) 223-37, Mar. 1964.

Octanoic acid aerosols, in the submicron range and of narrow size distribution, were produced with excellent reproducibility when nucleated with silver chloride evaporated in a combustion furnace. The particle size distribution could be determined uniquely and with high precision from light scattering data using the polarization ration method described in the preceding paper. The effects of the flow rate of the carrier gas, the nuclei concentration, the temperature of the furnace used for making the AgCl nuclei, and the temperature of octanoic acid in the boiler upon the size distribution of the aerosol were systematically investigated. With increasing flow rate at constant boiler temperature both the particle size and the polydispersity decrease. At a constant flow rate the particle size becomes larger with increasing boiler temperature while the polydispersity remains practically constant. Particle size also increases with decreasing furnace temperature and dilution of nuclei. (Author abstract)##

03009

P. de Mayo

THE PHOTOCHEMISTRY OF UNSATURATE SYSTEMS CONTAINING HETERO ATOMS OTHER THAN OXYGEN (FINAL REPT. SEPT. 1965-MAY 1966). Western Ontario Univ., London, Canada, Dept. of Chemistry. 6 pp., 1966

This report presents a summary of a study of the products and mechanisms of reactions wherein unsaturated systems containing nitrogen or sulfur are photolyzed. Included are studies of (1) the photochemical Beckmann rearrangement, (2) the general heteroatom transfer, (3) coumalin dimerization, and (4) the photolytic decomposition of B-ketosulphones.##

03062

S. W. Benson and G. R. Haugen.

ESTIMATED ACTIVATION ENERGIES FOR THE FOUR-CENTER ADDITION REACTION OF H<sub>2</sub>, HX, AND X<sub>2</sub> TO ACETYLENES. J. Phys. Chem. 70, (10) 3336-8, Oct. 1966

The application of an electrostatic model to predict the activation energy of the four-center addition reactions of acetylene is discussed. The transition state is considered an intimate semi-ion pair with an equivalent charge separation of plus or minus formal charge. The energy of activation can be equated to the electrostatic energy of interaction of point dipoles. Values obtained for the reacting substances (acetylene, methyl acetylenes, hydrogen halides, hydrogen, fluorine, chlorine, bromine, iodine) are tabulated. The activation energy for the molecular addition to acetylenes is about 1.5 kcal/mole smaller than that for the corresponding olefin.\*\*

03066

D. Durant and G. R. McMillan.

ENERGY DISTRIBUTION OF PHOTOCHEMICALLY GENERATED T-PENTOXY RADICALS. J. Phys. Chem. 70 (9) 2709-13, Sept. 1966.

Previous studies on excited alkoxy radicals formed in photochemical processes were extended to the t-pentoxyl species, which is well known to decompose by two parallel paths. The ratio of rate constants  $k_1/k_2$  was estimated to be 104 at 114 degrees from experiments on pyrolysis of t-pentyl nitrite. For radicals formed by photolysis of this compound,  $k_1/k_2$  depends strongly on the absorbed wavelength but does not reach the expected limiting value of 104 at the longest wavelength which could be studied. The dependence of quantum yields at 3660 Å on pressure of an added scavenger, nitric oxide, showed that the  $k_1/k_2$  obtained from photochemical experiments could be accounted for quantitatively by a contribution from excited radicals and a contribution identical with the ratio for unexcited radicals, obtained from pyrolysis experiments. These results provide limited justification for the "alpha method" often used in kinetic treatment of excited radical effects. Quantum-yield measurements at high pressures of added nitric oxide suggest preferential removal of excited radicals of lower energy and disclose a broad energy distribution of the excited radicals. (Author abstract)\*\*

03067

D. M. Golden, A. S. Rodgers, and S. W. Benson

THE KINETICS AND MECHANISM OF THE REACTION  $I_2$  PLUS  $C_3H_6$  =  $C_3H_5I$  PLUS  $HI$  AND THE HEAT OF FORMATION OF THE ALLYL RADICAL. J. Am. Chem. Soc. 88, (14) 3196-8, July 20, 1966

The reaction  $I_2$  with  $C_3H_6$  was followed spectrophotometrically in the gas phase between 208 and 300 degrees. By making use of the equilibrium constant for the system and the usual mechanism for such reactions, a value was obtained for the rate constant for I-atom abstraction of an allylic hydrogen from propylene,  $\log_{10} k_1$  (1/mole sec) =  $(10.25 \pm 0.14) - (18.04 \pm 0.32)/\theta$ . From this activation energy and values for the heats of formation of  $C_3H_6$ ,  $I_2$ , and  $HI$ , a value of the allylic stabilization energy of  $10.2 \pm 1.4$  kcal/mole is obtained. The difference in stabilization energies of methylallyl and allyl radicals is considered. Differences in A

factors for reactions of the type  $RH + I \rightarrow R + HI$  are discussed in terms of the entropy of the transition state. (Author abstract)##

03078

A.S. Rodgers, D.M. Golden, S.W. Benson

THE THERMOCHEMISTRY OF THE GAS PHASE EQUILIBRIUM  $12 + C_3H_6 \rightleftharpoons C_3H_5I + HI$ . J. Am. Chem. Soc. 88, (14) 3194-6, July 20, 1966

A Cary spectrophotometer was used to obtain the equilibrium constant for the reaction  $C_3H_6 + 12 \rightleftharpoons C_3H_5I + HI$  between 208 and 300 degrees. The heat of formation obtained for allyl iodide, g, was 22.9 plus or minus 0.6 kcal/mole. Equilibrium values calculated were 8.33 plus or minus 0.23 kcal/mole at 527 degrees, or 7.96 plus or minus 0.33 at 298 degrees. Entropy values at 527 degrees were -1.00 plus or minus 0.46 gibbs/mole or, at 298 degrees, -1.91 plus or minus 0.80 gibbs/mole. Second law values for the heat of formation for allyl iodide, g, are 21.46 plus or minus 0.25 kcal/mole and, for entropy, 74.81 plus or minus 0.80 gibbs/mole. The heat of formation values compare well with previously measured values, but the entropy calculation yields agreement with higher bond additivity and supports third law values.##

03088

R. Walsh S.W. Benson

KINETICS AND MECHANISM OF THE GAS PHASE REACTION BETWEEN IODINE AND FORMALDEHYDE AND THE CARBON-HYDROGEN BOND STRENGTH IN FORMALDEHYDE. J. Am. Chem. Soc. 88, (20) 4570-5, Oct. 20, 1966

The gas phase reaction of iodine with formaldehyde was investigated spectrophotometrically in the temperature range 180-300 degrees. The reaction is very clean, giving CO and HI as the only products except at very high conversions at the lowest temperatures, when a little  $CH_3I$  is formed as a side product. A reaction mechanism is presented in the text. Kinetic measurements over a wide range of initial conditions indicate that the rate-determining step is  $I + CH_2O \rightarrow CH_2OI + HI$ , and  $\log k_{\text{sub } 4} = 10.92 - 17.43 \theta$ , where  $\theta = 2.303 RT$  in kcal/mole. Further measurements of the inhibiting effect on HI on the reaction suggest that the back activation energy for step 4 is 1.5 kcal/mole. This difference in forward and back activation energies establishes a bond strength of 87.0 kcal/mole. The value implies a dative pi-bond energy in carbon monoxide of 68.5 plus or minus 2 kcal/mole, in good agreement with other estimates.##

03107

R.W. Boubel L.A. Ripperton

OXIDES OF NITROGEN AND UNBURNED HYDROCARBONS PRODUCED DURING CONTROLLED COMBUSTION. J. Air Pollution Control Assoc. 15, (6) 270-3, June 1965.

A diffusion flame burner was operated to determine the effect of several parameters on the quantity of NO<sub>x</sub> and unburned hydrocarbons produced. The statistical analysis indicated the unburned hydrocarbon emissions to be dependent upon the rate of heat release in the system, the amount of excess combustion air, the fuel molecular structure, and the interaction between the fuel structure, and the amount of excess air. The NO<sub>x</sub> emissions reached a maximum at the conditions which yielded minimum unburned hydrocarbon emissions. Multiple regressions were made which yielded predicting equations for both the unburned hydrocarbon and the NO<sub>x</sub> for the apparatus used. (Author abstract)##

03114

W.A. Glasson C.S. Tuesday

HYDROCARBON REACTIVITY AND THE KINETICS OF THE ATMOSPHERIC PHOTOOXIDATION OF NITRIC OXIDE. General Motors Corp., Warren, Mich., Fuels and Lubricants Dept. (Research Publication GMR-586) Aug. 15, 1966. 23 pp. (Presented at the 59th Annual Meeting, Air Pollution Control Association, San Francisco, Calif., June 20-24, 1966.)

The reactivity in the atmospheric photooxidation of NO has recently been determined for a large number of hydrocarbons. To aid in the application of these hydrocarbon reactivity measurements, the kinetics of the atmospheric photooxidation were studied. The hydrocarbon investigated covered a wide range of reactivities and structures and included: 2,3-dimethyl-2-butene, 2-methyl-2-butene, 2-methyl-1-pentene, propylene, mesitylene, and n-hexane. The rate of NO photooxidation increases less than linearly with hydrocarbon concentration for all the hydrocarbons studied. The degree of non-linearity, however, varied with hydrocarbon structure and reactivity. The effect of the NO and the NO<sub>2</sub> concentrations on the rate of NO photooxidation also depended somewhat on hydrocarbon structure and reactivity. For all of the hydrocarbons studied, however, the NO photooxidation rate increased linearly with increased light intensity. The effect of complex hydrocarbon mixtures on the rate NO photooxidation was investigated using 3 commercial gasolines. The NO photooxidation rates measured for these mixtures agreed within experimental error with calculated rates based on chromatographic analyses of the gasolines and the reactivity in NO photooxidation of the individual hydrocarbons in the gasolines. (Author abstract)##

A. Y. Ung and H. I. Schiff.

THE PHOTOLYSIS OF CO<sub>2</sub> AT 470 Å. Can. J. Chem. 44, 1981-91, 1966.

The apparatus used to study the photolysis contained a collimating region which minimized the effect of divergent light, and permitted the temperature of the cell and lamp to be controlled separately. Analytical sensitivity was such that conversions less than 0.2% were possible. Although CO and O<sub>2</sub> were the only stable products, the CO/O<sub>2</sub> ratios were higher than those required by mass balance. The product yields were found to be independent of CO<sub>2</sub> pressure and to be linear with irradiation time at 25 C. At higher temperatures the quantum yields decreased and at 200 C were no longer linear functions of irradiation time. The O<sub>2</sub> yields decreased when CO was added, the effect increasing with temperature. The overall quantum yield was less than unity. Reactions were observed with CH<sub>4</sub>, H<sub>2</sub>, and N<sub>2</sub>O when these were added in small amount. These results indicated the presence of a reactive species, capable of promoting back reactions and of being adsorbed on the walls. A mechanism is suggested which best fits the results and which postulates CO<sub>3</sub> as the reactive species. (Author abstract)##

03343

HYDROCARBON AIR FUEL CELLS (SEMI-ANNUAL TECHNICAL SUMMARY REPORT NO. 9, JAN. 1 - JUNE 30, 1966). General Electric Co., Lynn, Mass. (Order No. 247). 1966. 238 pp.  
CFSTI, DDC 640 521

Electrocatalyst Research: A portion of the research effort was directed towards the understanding of the complex processes occurring at hydrocarbon anodes. Surface species were identified as partially dehydrogenated radicals derived from fuel, cracking products and partially oxygenated species. Some are particularly refractory and contribute to limitations on performance. In all cases, the anodic performance is strongly influenced by the adsorption rate, the ability of the catalyst to promote cracking, and the reaction of C(1) radicals with water. Accumulation of the refractory species results in the lowering of maximum currents. For economic reasons, long term goals indicate the use of non-platinoid electrocatalysts in fuel cell electrodes. At present, work is being concentrated on more effective utilization of the noble metals, especially Pt, Pt-Ru, Pt-Ir, and ternary alloys of Pt, Ru and Au were evaluated as high area catalysts in thin porous electrodes, with 85% H<sub>3</sub>PO<sub>4</sub> electrolyte, and propane and octane fuels. None showed significant improvement over Pt used alone. Better results with these alloys were obtained with H<sub>2</sub>-CO fuel mixtures. Electrodes: Emphasis in this area is on the development of electrode structures which employ the catalysts developed from the above mentioned research. Basic electrode structure is the thin porous Niedrach-Alford types. Major effort was directed toward BUC supported catalysts. Multi-Component Fuels: Plans are to include research on mixtures of saturated hydrocarbons, olefins,



aromatic hydrocarbons as well as the reference fuel of octane. Electrolytes: The principal electrolyte has been concentrated H3P04. HF was used as an alternate electrolyte and did not show the same tendency to cycle as the H3P04 electrolyte.##

03428

C. S. Tuesday.

THE ATMOSPHERIC PHOTOOXIDATION OF OLEFINS: THE EFFECT OF NITROGEN OXIDES. General Motors Research Labs, Warren, Mich., 1961, 25 pp. (Presented at the Conference on Motor Vehicle Exhaust Emissions and Their Effects, Los Angeles, Calif., Dec. 5-7, 1961.) (Rept. No. GMR-355.)

The role of the oxides of nitrogen in the atmospheric photooxidation of olefins was further investigated. A previous study from this laboratory indicated, among other things, that the photooxidation of trans-2-butene was both promoted and inhibited by nitric oxide depending upon the concentration. To explain and extend this observation, the effects of various concentrations of NO2 and NO on the photooxidation rates of propylene, isobutene, trans-2-butene, and 2,3 dimethyl-2-butene were determined together with the effects of NO concentration on reaction products. The olefins investigated differed not only in photooxidation rate for a particular NO2 concentration but also in the dependence of this rate on the initial concentration of NO2. Initial increases in NO2 concentration increased the photooxidation rate of all the olefins studied. When the initial NO2 concentration was increased further each olefin behaved differently. The photooxidation rates of trans-2-butene and tetramethylethylene increased with increasing concentrations of NO up to a maximum rate. Further increases in the initial concentration of NO reduced the photooxidation rate of both these olefins. Further increases in NO concentration inhibit the olefin photooxidation rate by decreasing the concentration of ozone and the rate of the ozone-olefin reaction. The decreased rate of ozone plus olefin reaction also decreases the rate and amount of compound X formation since compound X is apparently formed by further reactions of some of the products of the ozone plus olefin reaction. The role of the oxides of nitrogen in the atmospheric photooxidation of olefins is quite complex. NO promotes or inhibits olefin photooxidation depending upon the ratio of reactants. NO2 promotes or inhibits olefin photooxidation depending both on the relative concentration of reactants and the nature of the olefin.##

03446

B. H. Croom and E. W. Leyhe.

THERMODYNAMIC, TRANSPORT, AND FLOW PROPERTIES FOR THE PRODUCTS OF METHANE BURNED IN OXYGEN-ENRICHED AIR. National Aeronautics and Space Administration, Langley Station Hampton, Va., Langley Research Center. (Rept. No. NASA SP-3035.; 1966. 90 PP. CFSTI, NASA: SP-3035

In testing materials for resistance to extremely high-temperature oxidizing environments, large-scale hypersonic test facilities for simulating flight environments to which some of these materials may be exposed are used. Combustion heating of a high-pressure airstream is one of the approaches used in this simulation. It is sometimes desirable to maintain burning in a test gas in order to determine the effect of oxidation on materials in the test gas. As combustion-product oxygen percentages approaching those in air (20% by vol) are required, the need for data on the properties of a combustion-heated, oxygen-enriched test medium is obvious. The present paper presents results of the data obtained on the properties of methane burned with oxygen-enriched air. These include calculations to determine the composition and the thermodynamic, transport, and flow properties (including normal-shock properties) of gas mixtures. These properties are computed for methane burned in air enriched with oxygen so as to maintain approximately 20% oxygen in the combustion products. Results are presented for equivalence ratios of 0.315, 0.380, 0.425, 0.480, and 0.525, for pressures varying from 0.0001 to 1000 atmospheres and for temperatures from 100 R (56K) to 6000 R (3300K). (Author summary) ##

03488

J. Heicklen and H. S. Johnston

PHOTOCHEMICAL OXIDATIONS. I. ETHYL IODIDE. J. Am. Chem. Soc. 84, 4394-4403, Dec. 5, 1962.

The room temperature (25 plus or minus 2 degrees) photo-oxidation of ethyl iodide (0.06 to 2.8 mm.) in oxygen (2.8 mm.) with continuous radiation (usually above 2200 A.) was studied by irradiation in a cylindrical volume with a pinhole leak directly into a Bendix model 14 time-of-flight mass spectrometer. The initial products observed are  $C_2H_5OH$ ,  $CH_3CHO$ , and  $I_2$  in large amounts and  $C_2H_5OOC_2H_5$ ,  $C_2H_5OOH$ , and  $C_2H_5OI$  in small amounts. Because of the cracking pattern of the reactants, it was impossible to establish the presence or absence of  $CH_4$ ,  $C_2H_2$ ,  $C_2H_4$ ,  $C_2H_6$ ,  $HCHO_2$ ,  $CO_2$  and  $HI$ . From mass balance  $HI$  was inferred to be a minor initial product. A fairly satisfactory nine-step mechanism can be found for the initial rate data, and several ratios of rate constants were evaluated from the data. The reaction was studied to about 3% completion, at which point diffusion of products through the pin-hole balanced the rate of photochemical production. The rate of attainment of this steady state and the steady-state pressures gave additional information beyond that found for the initial rates. The reaction at a few percent conversion of ethyl iodide is much more complex than the initial reaction; there is secondary production of alcohol, strong secondary destruction (perhaps largely heterogeneous) of  $C_2H_5OOH$  and  $C_2H_5OI$ , and slight over-all inhibition by  $I_2$ . Water was observed as a secondary product, coming in after a pronounced induction period. Even with a 14-step mechanism, all features of the reaction at 3% completion could not be explained. Although considerable effort was directed toward finding ozone in this system, it was never present in an amount as great as 10 to the minus 8th power. (Author abstract) ##

R. C. Cookson

ASYMMETRIC ELECTRONIC TRANSITIONS AND PHOTOCHEMISTRY. (Final Technical Status Report). Southampton Univ., England, Dept. of Chemistry. Nov. 1965. 14 pp.  
DDC: AD 479 240

Sigma to sigma transitions of organic compounds have been observed for the first time in the region of 210 to 260 millimicrons. Delocalisation of the sigma electron requires a chain of 4 atoms, the first and fourth having p orbitals parallel with the sigma bond joining the second and third. Examples are reported amongst unsaturated ketones, unsaturated amines and amino-ketones. The circular dichroism of 3 alpha- and 3 beta-phenyl-2,2 - ethylenedithio-cholestane and of some conjugated oximes is reported. The sign of rotation of the latter depends on the helicity of the chromophore in the same way as for alpha, beta unsaturated ketones. UV irradiation of hexamethylcyclohexane - 1,3,5-trione results in successive decarbonylation and beta-diketone - enol - lactone rearrangements. Photochemical isomerisation of four optically active camphenones involves intramolecular migration of the carbonyl group from one end to the other of the olefinic group, converting the bicyclo (2,2,1) heptenone into the bicyclo (3,2,0) heptenone system. The photoproducts show the high values of delta E characteristic of extensive mixing of n to pi and pi to pi transitions. (Author abstract)##

03525

V. G. Matsak

VAPOR PRESSURE AND EVAPORATION OF SUBSTANCES IN MOVABLE AIR. Gigiena i Sanit. 22, (8) 35-41, 1957.  
DDC: AD 425608

A description is given of a nomogram for the determination of saturated vapor pressure and a method of calculating the rate of evaporation of various chemically pure substances in moving air. The potential danger of toxic substances may be evaluated and industrial ventilation requirements may be calculated using this nomogram.##

03559

R. E. Rebbert and P. J. Ausloos.

COMPLICATING FACTORS IN THE GAS PHASE PHOTOLYSIS OF AZOMETHANE. J. Phys. Chem. 67, 1925-8, 1963.

In a recent publication of the gas phase photolysis of azomethane, Toby and Weiss suggested a new ethane-producing reaction:  $2\text{CH}_3\text{N}_2$  yields  $\text{C}_2\text{H}_6$  plus  $2\text{N}_2$  (a). On the other side, Rebbert and Ausloos presented evidence for the formation of ethane by a unimolecular elimination from azomethane  $\text{CH}_3\text{N}_2\text{CH}_3$  plus  $h\nu$  yields  $\text{C}_2\text{H}_6$  plus  $\text{N}_2$  (b). The present study was undertaken in order to determine if the pressure trends observed by Toby and Weiss could not at least be partly accounted for by the

occurrence of primary process (b). It is thought that an answer to this question, as well as to other related problems, could be most readily obtained by photolyzing equimolar mixtures of  $\text{CH}_3\text{N}_2\text{CH}_3$ - $\text{CD}_3\text{N}_2\text{CD}_3$ . It was concluded that reaction (a), which has been proposed by Toby and Weiss to account for the observed pressure effect, has not been clearly established.\*\*

03575

R. R. Austin, R. W. Lewis, and R. Donaldson, Jr.

A NEW ATMOSPHERE IRRADIATION CHAMBER. Intern. J. Air Water Pollution 4, (304) 237-46, 1961.

The irradiation of atmospheric samples of air with ultraviolet light produces oxidants when hydrocarbons and nitrogen dioxide are present and thus permits a measurement of the smog-forming potential of the air. A new high irradiation intensity chamber using fluorescent ultraviolet lamps has been developed. Data are given for the irradiation of some hydrocarbons in air in the presence of nitrogen dioxide. Some data are also given for atmospheric samples. The performance of the new chamber is compared to that of the fifty-liter chambers which have been in use in the past. The chamber volume is eight liters. Power required has been reduced from 1600 watts in the fifty-liter chamber to 160 watts. Oxidant levels produced at the same sampling rate on atmospheric samples are approximately equivalent to the levels produced in the fifty-liter chamber. (Author abstract)\*\*

03588

G. N. Richter, H. H. Reamer, and B. H. Sage

EFFECTS OF STABILITY OF COMBUSTION ON THE FORMATION OF THE OXIDES OF NITROGEN. California Inst. of Tech., Pasadena, Chemical Engineering Lab. Aug. 30, 1960. 111 pp.

It has been established that the nitrogen oxides are undesirable products of combustion processes from the standpoint of air pollution. An investigation concerning the effect of perturbations during combustion upon the formation of the oxides of nitrogen was carried out upon a premixed flame, utilizing air and natural gas as reactants. The first part consisted of reconnaissance measurements by which the effect of audible oscillatory combustion upon the residual quantities of nitrogen oxides in the products of reaction was determined. The second part comprised more carefully controlled and quantitative measurements by which the microscopic variations in conditions in the combustion zone were evaluated as a function of time and the effect of the variations upon the residual quantities of the nitrogen oxides was determined. The results indicate that perturbations in the combustion process exert a pronounced influence upon the formation of the nitrogen oxides. However, the nature of the oscillatory combustion appears sensitive to environment, and it is difficult to maintain sufficiently steady macroscopic conditions to avoid large variations with time in the microscopic perturbations. The variation in the mole fraction of nitrogen oxides in the products of reaction under carefully

controlled conditions was an order of magnitude less than that encountered under the less well controlled conditions of combustion. (Author abstract modified)##

03985

K. C. Salooja

STUDIES OF COMBUSTION PROCESSES LEADING TO IGNITION OF SOME OXYGEN DERIVATIVES OF HYDROCARBONS. Combust. Flame 10, (1) 11-21, March 1966.

The pre-flame and ignition behaviors of several related oxygen derivatives of hydrocarbons, acetic acid, methyl formate, methyl acetate, ethyl acetate, methyl propionate, propionic acid, ethyl formate, acetyl acetone, and acetic anhydride were investigated. Mechanisms proposed to explain observed differences are discussed in relation to: (1) a carbonyl group causes greater activation of adjacent alkyl groups than does an oxygen atom in an ether linkage; (2) peroxy radicals formed in the initial stages of oxidation can readily undergo 1,5 and 1,6 intramolecular transfer; (3) the oxygen atom in the carbonyl group tends to form hydrogen bonds intramolecularly. With acetic acid, the combustion process appeared more exothermic than of any hydrocarbons studied. Methyl formate ignited at a much lower temperature than acetic acid, with explosive violence; also greater amounts of methane and methanol were produced than by acetic acid at corresponding pre-flame stages: While CO<sub>2</sub> is formed in greater amounts than CO from methyl formate, the reverse is true with methyl acetate. In comparison with methyl acetate, ethyl acetate began to oxidize at a slightly higher temperature but ignited at a considerably lower temperature with explosive violence. In comparison with ethyl acetate, methyl propionate began to oxidize at a lower temperature but its extent of reaction increased less with temperature, and it eventually ignited at a higher temperature. Methyl propionate produced more CO<sub>2</sub> than CO until slightly below ignition temperature than ethyl acetate. Analysis of gaseous oxidation products of propionic acid and ethyl formate showed that acetaldehyde was formed in larger amounts from propionic acid and ethylene was formed in larger amounts from ethyl formate. Biacetyl traced to hydrocarbons oxidizing in the "low temperature" region, biacetyl oxidation in the low temperature region. Acetic anhydride was even more reactive than biacetyl and showed no zone of negative temperature coefficient. In its oxidative degradation, CO was formed in considerable amounts before any consumption of O<sub>2</sub> could be detected.##

03986

R. A. Davies D. B. Scully

CARBON FORMATION FROM AROMATIC HYDROCARBONS II. Combust. Flame 10, (2) 165-70, JUNE 1966.

Previous work on the yields of carbon black from aromatic hydrocarbons by injection of their vapours into the products of

combustion of a rich towns gas-air premixed flame has been continued. Yields from toluidines are higher than from aniline. The yields from cresols are the same as from phenol. The addition of oxygen to benzene and toluene decrease the yields, which eventually become the same, indicating preferential oxidation of the side chain. The NO<sub>2</sub> group in nitrobenzene does not alter the amount of soot formed relative to that from benzene. Acetylene forms soot much less readily than benzene. Cyclopentadiene does not form soot, but indene does so readily. Styrene, ethylbenzene and naphthalene have also been studied. (Author summary)##

03969

J. G. Christian and J. E. Johnson

CATALYTIC COMBUSTION OF ATMOSPHERIC CONTAMINANTS OVER HOPCALITE.  
Intern. J. Air Water Pollution 9, (1/2) 1-10, Feb. 1965.

Catalytic combustion studies showed Hopcalite, an unsupported coprecipitate of copper and manganese oxides, to provide substantially complete oxidation at ca. 300 C of vapors of several types of hydrocarbons, oxygenated compounds, nitrogen compounds, and halogenated compounds. The lower molecular weight hydrocarbons proved resistant to oxidation; methane was oxidized only to the extent of 30 per cent even at 400 C. The organic nitrogen compounds produced the theoretical amount of CO<sub>2</sub> as well as appreciable amounts of nitrous oxide (N<sub>2</sub>O). Ammonia produced 70% nitrous oxide at 315 C, and about 2% nitrogen dioxide (NO<sub>2</sub>). The decomposition of organic halogen compounds ranged from slight in the case of Freon-12 to virtually complete for methyl chloroform. In addition, new organic halides were formed by the oxidation of methyl chloroform and Freon-11. There is at least partial retention of halogen on the catalyst when Freon-114B2 and Freon-11 are decomposed. Aerosols of dioctylphthalate, a hydrocarbon-type lubricating oil, and a triarylphosphate ester lubricant were quantitatively oxidized by Hopcalite at 300 C. (Author abstract)##

04022

C. W. Zielke, R. T. Struck, J. M. Evans, C. P. Costanza, and E. Gorin

MOLTEN SALT CATALYSTS FOR HYDROCRACKING OF POLYNUCLEAR HYDROCARBONS. Ind. Eng. Chem. Process Design Develop. 5, (2) 151-7, Apr. 1966.

Batch autoclave tests have shown molten salts which are Lewis acids to be superior catalysts for hydrocracking polynuclear aromatics when used in high concentrations. These catalysts are compared with conventional supported catalysts for conversion of pyrene and a refractory hydrocracking residue from coal. Zinc chloride and aluminum bromide give high rates of conversion along with a high iso- to normal isomer distribution. Tin chloride is a very weak Lewis acid and is relatively inactive. In spite of the high cracking activity of these salts, no added hydrogenating catalyst is needed. Zinc chloride, in contrast to AlBr<sub>3</sub>, is

relatively inactive for hydrogenation and hydrocracking of single-ring aromatics producing a high yield of gasoline. Molten salts are deactivated by basic nitrogen, but are much more resistant than supported dual-function catalysts. (Author abstract)##

04201

C. P. Fenimore and G. W. Jones

OXIDATION OF SOOT BY HYDROXYL RADICALS. J. Phys. Chem. 71, (3) 593-7, Feb. 1967.

The mechanism of oxidation of soot is investigated. The soot was obtained by burning ethylene gas in two burners in series using a fuel-lean mixture. In flame gases of temperatures from 1530-1890 degree K and PO<sub>2</sub> approximately 0.0001 to 0.3 atoms, the rate of soot oxidation does not depend very strongly on PO<sub>2</sub>. The observations are consistent with the assumption that about one tenth of the collisions of OH with the soot remove a carbon atom, the number of collisions being calculated from POH by kinetic theory.##

04228L

P. Goldfinger, G. Huybrechts, and L. Meyers

THE CHLORINE PHOTOSENSITIZED OXIDATION OF HYDROCARBONS AT LOW TEMPERATURE (FINAL TECHNICAL REPT.). University Libre de Bruxelles, Belgium, Laboratoire de Chimie Physique. Jan. 1966. 30 pp.

The study of the chlorine photosensitized oxidation of trichloroethylene has been completed. A mechanism has been proposed for this reaction where dichloroacetyl chloride is the main reaction product and the rate constants of the relevant elementary reaction steps were estimated. This together with preceding studies on the oxygen effect on the photochlorination of ethane and trichloroethylene has led to a reaction theory which seems to be of general validity. In the second part of this report a new reaction theory of chlorine photosensitized oxidation of hydrocarbons is presented which describes many of the kinetic investigations that have been carried out by the present work and reported in the literature. Due to the diversity of radicals in the reaction mechanism and the formation of different products not sufficiently unreactive, the reaction mechanism is not in final form and more experimental work is needed. (Author abstract)##

04255

M. S. Bykhovskaya and R. N. Makedonskaya

DETERMINATION OF ALIPHATIC AMINES IN AIR. ((K metodike opredeleniya alifaticeskikh aminov v vozdukhie.)) Hyg. Sanit. 31, (9) 421-425, Aug. 1966. Russ. (Tr.)  
.CPSTI: T 66-55160/7-9

In studies of the primary aliphatic amines, optimum conditions were studied for their determination with ninhydrin, potassium 1, 2-naphthoquinone-4-sulfonate and p-nitrophenyldiazonium. The best reproducibility was achieved in an aqueous-pyridine solution with the addition of a little ascorbic acid. The reaction product imparts a blue-violet color to the solution, as distinguished from the control solution which displays a pinkish-violet color. The maximum light absorption of the solution occurs at the wavelength of 575 mμ. The sensitivity is 1 microgram in the volume analyzed. In the concentration range of 1 to 10 micrograms there is a linear relationship between the optical density and the amine concentration in solution. No interference is caused by secondary and tertiary aliphatic amines or by aromatic amines. Any ammonia interferes with the determination, because its presence in the sample to the extent of 1 microgram colors the solution an intense blue-violet. The most selective reaction for the determination of secondary amines is based on the formation of copper dialkyldithiocarbamate. Where an air sample is taken in ethanol, and 0.1 ml of 15% alcohol solution of CS<sub>2</sub>, 0.1 ml of 0.1% alcohol solution of copper acetate and 0.1 ml alcohol solution of NH<sub>3</sub> are added to the 2-ml sample. The addition of each reagent is followed by mixing of the solution. After 10 min. the intensity of the colored sample is compared against the standard scales, or else the optical density of the solution is measured in a cell. A method for the determination of trimethylamine in air using a citric acid solution in acetic anhydride was developed. Reactions with citric acid and acetic anhydride as well as those with phosphotungstic or phosphomolybdic acids may also be applied to studies of several tertiary amines, no interference being caused by secondary and (other) tertiary amines.##

04273

A. D. Babinsky and S. J. Derezinski

WATER AND CARBON REMOVAL FROM CARBON DIOXIDE REDUCTION SYSTEMS.  
TRW Inc., Cleveland, Ohio, Dept. of New Products. (Rept.  
Nos. AMRL-TR-66-83 and ER-6652-5.) June 1966. 51 pp.  
CFSTI, DDC: AD 642 594

Methods suitable for use in a weightless environment for removing water and carbon from carbon dioxide reduction process systems were investigated. Water removal studies were conducted using a porous metal, plate-type, condenser-separator to remove the water from the exit gas streams of both Sabatier and Bosch type carbon dioxide reduction reactors. Water remaining in the effluent stream ranged from 0.97 to 2.08 percent by volume with the Sabatier reactor, and 0.78 to 0.92 percent with the Bosch reactor. A regenerative chemical dryer used to increase the reaction rate of the Bosch reactor, resulted in relatively minor changes in the reaction rate in steady state operation. Carbon flow pattern tests were conducted to determine design characteristics of a carbon separator-filter. A combination centrifugal separator and porous metal filter was used to remove carbon from the recycle flow stream and pass approximately 99 percent of the carbon to the carbon collector. Periodic back flow through the filter removes the remaining carbon from the filter. The Bosch reactor utilizes flat iron catalyst plates stacked on a hollow rotating shaft. Carbon is dislodged from the rotating plates by carbon removal fingers projecting between the catalyst



plates. Reaction gases flowing through the reactor carry the carbon out of the reactor to the filter-separator. Filter clogging was observed due to continuance of the reaction in the filter element. Feasibility of water separation and carbon removal were demonstrated. Recommendations are made to improve long term operation of the carbon filter element. (Author abstract)##

04285L

E. J. Poziomek

PHOTOCHEMISTRY OF HETEROCYCLIC COMPOUNDS (A LITERATURE SURVEY.)  
Army Edgewood Arsenal, Md., Physical Research Lab.  
(Rept. EASP 100-4.) Sept. 1966. 35 pp.  
DDC: AD 488-239

The literature on the photochemistry of heterocyclic compounds was surveyed with a particular interest in pyridine chemistry. This listing of references was compiled as a result of searching volumes 41 to 61 of Chemical Abstracts under the headings light, photochemistry, and pyridine.##

04288

P. Budininkas, R. W. Ferris, and G. A. Remus

RESEARCH AND DEVELOPMENT STUDY RELATED TO THE SYNTHESIS OF FORMALDEHYDE FROM CO<sub>2</sub> AND H<sub>2</sub> (QUARTERLY PROGRESS REPT. NO. 2).  
General American Transportation Corp., Niles, Ill.  
General American Research Div. Jan. 1967. 12 pp.

This report summarizes the activities of the General American Research Division on the synthesis of formaldehyde. The activities during this quarter were concerned with (1) selection of solid catalysts and a correlation of their activities for the oxidation of methane to formaldehyde with their chemical and physical properties, (2) construction of an experimental system for methane oxidation to formaldehyde and the development of experimental procedures, and (3) testing solid catalysts and investigating the effects of variables such as temperature, feed gas composition, and space velocity on the yields of at concentrations below 22 ppm sulfur dioxide than would have been silica tube as the catalyst with a maximum formaldehyde yield ranging up to 0.7% of the methane in the feed gas.##

04289

P. Budininkas, R. W. Ferris, and G. A. Remus

RESEARCH AND DEVELOPMENT STUDY RELATED TO THE SYNTHESIS OF FORMALDEHYDE FROM CO<sub>2</sub> AND H<sub>2</sub> (QUARTERLY PROGRESS REPT. NO. 1).  
General American Transportation Corp., Niles, Ill.  
General American Research Division, Oct. 1966. 32 pp.

This report summarizes the activities of the General American Research Division on the synthesis of formaldehyde. The activities during this period were concerned with (1) general

survey of the published abstracts of literature pertaining to the synthesis of formaldehyde (2) a review of methods for the synthesis of formaldehyde and their suitability for space applications (3) detailed literature survey on the oxidation of methane to formaldehyde.##

04314

D. C. Bradley and C. H. Marsh

MERCAPTIDES OF COBALT, NICKEL, COPPER AND ZINC (TECHNICAL REPT. NO. 5). University of Western Ontario, Canada, Dept. of Chemistry. May 17, 1966. 6 pp.

Studies were made on the chemistry of the mercaptides of cobalt, nickel, copper and zinc. The mercaptides were synthesized and their solubilities, thermal stabilities, magnetic properties, molecular weights, absorption spectra and polymer characteristics were investigated. Normal alkylmercaptans appeared to promote the formation of cobalt (III) mercaptides while isopropyl and tert-butylmercaptans formed cobalt (II) mercaptides. Nickel mercaptides were obtained as dark brown or black powders.  $Ni(SMe)_2$  was insoluble in common organic solvents but solubility in ether, carbon tetrachloride, n-hexane or cyclohexane of the higher mercaptides increased steadily with size of the alkyl group. Cuprous isopropylmercaptide and cuprous n-amymercaptide were precipitated as pale yellow solids which were insoluble in common organic solvents and required nitric acid or hydrochloric acid and  $H_2O_2$  treatment to effect solution. Zinc isopropylmercaptide, zinc-n-amymercaptide and zinc phenylmercaptide diammoniate were obtained as white precipitates, the first two being insoluble in common organic solvents but dissolving in pyridine. The polymeric nature of the mercaptides is deduced from their solubility, volatility and other characteristics. In the case of the nickel mercaptides, it is probable that the soluble fractions contain mainly hexameric species with the possible presence of pentamers and tetramers; the insoluble fraction may be a linear polymer.##

04409

Y. Ohrn and J. Linderberg

PROPAGATORS FOR ALTERNANT HYDROCARBON MOLECULES. Phys. Rev. 139, (4A) A1063-8, Aug. 16, 1965.  
DDC, AD-631 430

The possibility of a Green's-function formulation of the molecular many-electron problem was investigated. Green's function for electron and for particle-hole propagation was calculated for even alternant hydrocarbons. With the use of three parameters ( $\gamma$ ,  $\beta$  and  $V$ , where  $\gamma$  is the difference between the ionization potential and electron affinity for a carbon atom  $\pi$ -electron when no interactions are present between atoms, or an estimated 10.53eV; and where  $\gamma$  is the unit of energy and  $\beta = 0.46 \gamma = 4.84$  eV is the appropriate value for the interatomic parameter) accurate correspondence between calculated and observed spectra for ethylene, benzene, naphthalene and anthracene was observed. (Author abstract modified)##

A. A. Armstrong, Jr. and W. K. Walsh

RADIATION-INDUCED OXIDATION OF HYDROCARBONS. North Carolina State Univ., Raleigh, Dept. of Textile Chemistry. (Rept. No. ORO-634.) July 15, 1965. 40 pp.  
CFSTI, ORO-634

The radiation-induced oxidation of ethane, propane and isobutane was studied in a flow-type reactor using hydrogen bromide as a catalyst. A Cobalt-60 source (Gammacell 220) was used for the irradiation. The exposure dose rate inside the reactor was approximately 180000 r./hr. In the oxidation of ethane, a G-value of 800 was obtained for the production of acetic acid. An increase in total flow rate of ethane to the reactor increased the production rate of acetic acid. The most pronounced effect was noted from an increase in pressure. An increase in the rate of production of acetic acid of 8 times was obtained by increasing the total pressure from 1 to 4 atm. In the oxidation of propane, a G-value of 10,000 was obtained for the production of acetone. Increases in total flow rate did not affect the rate of production. An increase in total pressure up to 3 atm. increased the rate of production of acetone but decreased the rate above that. At 4 atm., corrosion products were deposited on the reactor surface which accounted for the decrease in the rate of production of acetone. In the oxidation of isobutane, the products were t-butyl bromide, methyl bromide and water. The expected products of t-butyl hydroperoxide and di-t-butyl peroxide as reported by other investigators were not present. The radiation-induced oxidation of propane to acetone was the only reaction studied that gave a G-value high enough to look promising. Although the radiation-induced oxidation of propane to acetone looked attractive from the standpoint of radiation yield, it now is impractical from an economic viewpoint. (Author abstract)##

R. D. Doecker and P. Ausloos

PHOTOLYSIS OF CYCLOBUTANE AT PHOTON ENERGIES BELOW AND ABOVE THE IONIZATION ENERGY. J. Chem. Phys. 43 (11) 3814-9, Dec. 1, 1965.

The photolysis of cyclo-C<sub>4</sub>H<sub>8</sub> and of cyclo-C<sub>4</sub>H<sub>8</sub>-cyclo-C<sub>4</sub>D<sub>8</sub> mixtures was investigated at 1470 and 1236 Å in the absence and presence of NO. In addition, a series of experiments carried out in which H<sub>2</sub>S was used as a free-radical interceptor in the photolysis of cyclo-C<sub>4</sub>D<sub>8</sub> at 1236 Å. Approximately 90% of the observed products can be accounted for by the primary process: C<sub>4</sub>H<sub>8</sub>+hν yields 2C<sub>2</sub>H<sub>4</sub>. The extent to which the internally excited ethylene formed in this process will decompose further increases with diminishing pressure and wavelength. The photolysis of cyclobutane was investigated at energies above the ionization energy (I.E.=10.3eV), using the argon resonance lines at 11.54 and 11.72 eV. It is shown that when NO is added to the system, cis-2-butene, trans-2-butene, and 1-butene are major products. These butenes are, however, not produced when NO (I.E.=9.25 eV) is replaced by O<sub>2</sub> (I.E.=12.1 eV) and are only formed in trace amounts when no additives are present. It is suggested that the parent ion acquires the olefinic structure and undergoes charge exchange with NO. (Author abstract)##

E. L. Wong A. E. Potter, Jr.

MASS-SPECTROMETRIC INVESTIGATION OF REACTION OF OXYGEN ATOMS WITH METHANE. National Aeronautics and Space Administration Cleveland, Ohio, Lewis Research Center (Rept. NASA TN D-3371.) Apr. 1966. 15 pp.

A mass-spectrometric stirred-reactor technique was used to study the reaction of atomic oxygen with methane with low concentrations of molecular oxygen. Low concentrations of molecular oxygen were used to suppress the reactions  $O + O_2 + M$  yields  $O_3 + M$  and  $H + O_2 + M$  yields  $HO_2 + M$ . An overall rate constant for oxygen-atom disappearance due to added methane was obtained for the temperature range of 375 to 576 K. This rate constant was  $4.2 \times 10$  to the 14th power  $\exp(-10\,300/RT)$  and was compared with the previous rate constant for this reaction in the presence of a large excess of molecular oxygen. This comparison showed that the presence of an excess of molecular oxygen increased the oxygen-atom consumption only for the lower temperatures. Product analyses indicated that the stoichiometry of the reaction could be represented by :  $CH_4 + 4.09\,O$  yields  $0.91\,CO + 1.00\,O_2 + 0.95\,H_2 + 1.00\,H_2O + 0.09\,CO_2 + 0.10\,H$ . On the basis of product analyses, a reaction mechanism was proposed. From this reaction mechanism and the reaction stoichiometry the rate of the initial elementary reaction  $CH_4 + O$  yields  $CH_3 + OH$  was estimated to be about one-fourth of the overall rate for oxygen atom disappearance, or about  $9 \times 10$  to the 13th power  $\exp(-10\,000/RT)$ . (Author summary)##

04550

P. F. Woolrich

METHODS FOR ESTIMATING OXIDES OF NITROGEN EMISSIONS FROM COMBUSTION PROCESSES. Am. Ind. Hyg. Assoc. J. 22, 481-4, Dec. 1961. (Presented at the 22nd Annual Meeting, American Industrial Hygiene Association, Detroit, Mich., Apr. 1961.)

Methods for estimating emissions of oxides of nitrogen from combustion processes were developed. Nitrogen oxide formation is related to temperature or heat supplied in the combustion process; and temperature or heat supplied is related to exhaust gas volume as a function of per cent  $CO_2$  in the exhaust gas. The formation of nitrogen oxides is related to fuel consumption by a power function which is linear on a log-log plot. Equations and nomographs were derived by means of which the pounds of nitrogen oxides per hour emitted from a combustion process may be estimated. Using these values as intercepts on the logarithmic plot of emission of oxides of nitrogen in pounds per hour versus fuel heat input in Btu/hr and the reciprocal slope of 1.18 previously developed, the mathematical relationship between heat input and  $NO_x$  emission is  $\text{lbs } NO_x/\text{hr} = \text{Btu/hr over } 0.000066 \exp 1.18$ ;  $\text{lbs } NO_x/\text{hr} = \text{Btu/hr over } 0.0000444 \exp 1.18$ . Where Btu/hr = total heat input from fuel per hour.##

J. Heicklen, and H. S. Johnston

PHOTOCHEMICAL OXIDATIONS. II. METHYL IODIDE. J. Am. Chem. Soc. 84, 4030-9, 1962.

The room-temperature photo-oxidation of methyl iodide (0.2 to 3.0 mm.) in oxygen (0.030 to 10 mm.) with continuous UV radiation above 2200 Å. was studied. Observations were made by leaking the reaction mixture directly into the electron beam of the mass spectrometer during photolysis. The principal products of reaction were I<sub>2</sub>, H<sub>2</sub>CO, CH<sub>3</sub>OH and under some conditions CH<sub>3</sub>OOH; minor products were H<sub>2</sub>O, CO<sub>2</sub>, HCOOH, CH<sub>3</sub>OOCH<sub>3</sub> and CH<sub>3</sub>OI. Because of the cracking pattern of the reactants and major products and the background air peaks, it was impossible to establish the presence or absence of CH<sub>4</sub>, CO and HI. There are conflicting claims in the literature as to whether methyl radicals react with oxygen according to  $\text{CH}_3 + \text{O}_2 (+ \text{M}) = \text{CH}_3\text{O}_2 (+ \text{M})$  (followed by the Vaughn mechanism) or  $\text{CH}_3 + \text{O}_2 = \text{H}_2\text{CO} + \text{HO}$  (Followed by HO attack on loosely bound hydrogen atoms). This study indicates both processes do occur, with the first being more important under conditions used here. It seems probable that oxygen molecules abstract hydrogen atoms from CH<sub>3</sub>O radicals to produce H<sub>2</sub>CO and HO<sub>2</sub>. A fairly complete and internally consistent mechanism is developed for the initial reaction, typically the reaction of about 0.0001 or 0.001 of the methyl iodide. As the reaction progresses, inhibition caused by  $\text{CH}_3 + \text{I}_2$  equals  $\text{CH}_3\text{I} + \text{I}$  becomes very pronounced, radicals abstract from H<sub>2</sub>CO, a large number of other secondary reactions seem to occur, and the mechanism proposed is regarded as exemplary rather than established. In terms of the relatively simple initial reaction, many ratios of constants are evaluated. (Author abstract)##

04617

L. S. Caretto and K. Nobe

CATALYTIC COMBUSTION OF CYCLOHEXANE, CYCLOHEXENE, AND BENZENE (CHEMICAL AND TRANSPORT KINETICS). Ind. Eng. Chem. Process Design Develop. 5, (3) 217-22, July 1966. (Presented before the Division of Petroleum Chemistry, 149th Meeting, American Chemical Society, Detroit, Mich., Apr. 1965.)

The oxidation of benzene, cyclohexane, and cyclohexene in low concentrations over a fixed bed of copper oxide-alumina (1 to 1) catalyst was found to follow the simple rate expression,  $\text{rate} = k p$  to the 1/2 power, where  $k$  follows the Arrhenius temperature dependence at low temperatures. Deviations at high temperatures led to an investigation of pore diffusion effects, which were analyzed by a computer calculation using finite difference equations and considering the effectiveness factor to be a function of concentration. This functionality is indicated graphically, where effectiveness factor is plotted as a function of bed position. The apparent diffusivity ratio necessary to give good agreement between calculated and experimental exit conversions ranged from 0.7 to 1.6, compared with an expected value of 0.26. One possible explanation for these large diffusivity

ratios is surface diffusion. Quantitative considerations of surface diffusion showed that large diffusivity ratios could be explained by a surface diffusion contribution of 1.7 to 5.1 times as much as the gas phase diffusion in the pores. (Author conclusions)##

04633

P. A. Leighton

SOME REMARKS ON THE NITRIC OXIDE -- NITROGEN DIOXIDE CONVERSION. Preprint. (Presented at the Air Pollution Research Conference on "Atmospheric Reactions," Univ. of Southern California, Los Angeles, Calif., Dec. 5, 1961.)

Nitric oxide-nitrogen dioxide photochemical conversion theory is reviewed. It has been almost universally postulated that the products of oxygen-olefin and possibly ozone-olefin reactions, which promote the above mentioned conversion, are free radicals. The extent to which these reactions produce radicals and the nature of the radicals produced in air have not been established. Other unresolved questions pertaining to this conversion reaction involve reaction kinetics and reactant concentrations.##

04653

J. M. Singer, E. B. Cook, M. E. Harris, V. R. Rowe, J. Grumer

FLAME CHARACTERISTICS CAUSING AIR POLLUTION: PRODUCTION OF OXIDES OF NITROGEN AND CARBON MONOXIDE. Bureau of Mines, Pittsburgh, Pa. (Presented at the Symposium on Combustion Reactions of Fossil Fuels, 152nd National Meeting, American Chemical Society, New York City, Sept. 11-6, 1966 and at the Basic Research Symposium, Chicago, Ill., Mar. 14, 1967.) 40 pp.

Concentrations of nitrogen oxides and carbon monoxide in combustion gases of lean, stoichiometric, and rich propane-air flames are predicted from theoretical kinetic and thermodynamic calculations. Experimental values are higher than the theoretical by factors of 2 to 7. Lowering the primary flame temperature with cold flue gas reduces the nitric oxide and increases the carbon monoxide concentrations. Cooling rates of 5500 degrees to 10,000 degrees R/sec starting at about 3500 degrees R maintain the nitric oxide in the primary combustion zone at the initial value and do not prevent oxidation of the carbon monoxide.##

04668

W. L. Slater R. M. Dilie

PARTIAL COMBUSTION OF RESIDUAL FUELS. Chem. Eng. Progr. 61, (11) 85-8, Nov. 1965.

Partial oxidation of residual fuel oils produces high purity synthesis gas containing hydrogen, carbon monoxide, carbon dioxide, methane, and only minor traces of impurities. The methane concentration in the synthesis gas produced at elevated pressures corresponds to equilibrium conditions. Although the studies of the process have been made at pressures up to 1,500 lb/sq in gauge, there have been no indications that this pressure can not be increased several fold. The soot produced from heavy oils is water-wettable, has oil adsorption numbers of 150 to 500 lb/100 lb, and has specific surface areas of 100 to 1,200 sq m/g. The oil adsorption number of the soot increases directly with the steam/oil ratio in the feed to the synthesis gas generator. (Author conclusions)##

04926

K. C. Salooja

INFLUENCE OF POTASSIUM CHLORIDE ON COMBUSTION PROCESSES LEADING TO IGNITION. Combust. Flame 10, (1) 45-9, Mar., 1966.

Combustion studies were carried out on the following hydrocarbons: pentane, hexane, 2-methylpentane, 2,2-dimethylbutane, iso-octane, cyclohexane and methylcyclohexane. The oxygenated compounds studied included acetic acid, methyl formate, propionic acid, ethyl formate, methyl acetate, acetaldehyde, acetone, diethyl ether, isopropanol and methanol. Results are reported for only one of the hydrocarbons studied, namely pentane, because the behavior of different hydrocarbons was generally similar. KCl markedly inhibited the oxidation process at all stages leading to ignition. In marked contrast to its effect on hydrocarbons, KCl promoted the pre-flame oxidation of acetic acid, propionic acid, methyl formate, ethyl formate, methyl acetate and acetone. It markedly inhibited the combustion of methanol and isopropanol. The effect of KCl on the ignition of acetic acid and acetone was not studied since these compounds ignite well above 600 C, but with propionic acid and the esters studied KCl strongly inhibited the onset of ignition despite its promoting effect on their pre-flame oxidation. The promoting effect on the oxidation of carbonyl compounds, particularly the lowering of the temperature at which oxidation commences, suggests a direct reaction between KCl and carbonyl compounds. Another observation is that, in contrast to the behavior in the clean vessel, KCl generally causes more CO<sub>2</sub> to form than CO. Under the experimental conditions, KCl does not significantly catalyse the combustion of CO to CO<sub>2</sub>. Therefore, the greater formation of CO<sub>2</sub> must arise from attachment of oxygen to the carbonyl progenitor of CO. The inhibiting effect of KCl on the combustion of hydrocarbons would seem to arise primarily from its effect on HO<sub>2</sub> radicals formed prior to the appearance of carbonyl intermediates. The absence of any H<sub>2</sub>O<sub>2</sub> in the products in KCl-coated vessels supports this view.##

04992

A. J. Haagen-Smit, C. E. Bradley, M. M. Fox

FORMATION OF OZONE IN LOS ANGELES SMOG. Proc. Natl. Air Pollution Symp., 2nd, Pasadena, Calif., 1952. pp. 54-6.

When bent pieces of rubber were exposed to sunlight in the presence of oxygen and nitrogen dioxide no cracking took place. Rubber cracked in nitrogen dioxide in air but not when the air was filtered through charcoal. Rubber cracked in 3-methylheptane and NO<sub>2</sub> in air but not when either was used alone; it cracked when introduced to a mixture exposed to sunlight for several hours. Ozone was identified as the rubber-cracking material. Rubber cracked in some organic acids photooxidized with NO<sub>2</sub> in air; ozone was again isolated and identified. Rubber cracked in gasoline photooxidized with NO<sub>2</sub> in air. Ozone formed when 4-n-nonene was photooxidized with NO<sub>2</sub> in air. Biacetyl in air cracked rubber when exposed to sunlight; ozone was identified. Rubber also cracked with biacetyl and NO<sub>2</sub> in air. Rubber cracked in butyl nitrite in air exposed to sunlight. The concentrations of the organic materials and of NO<sub>2</sub> were of the same order as those found in Los Angeles smog.##

05043

I. R. King

RECOMBINATION OF IONS IN FLAMES EFFECT OF TEMPERATURE. Texaco Experiment Inc., Richmond, Va. (Rept. Nos. AFOSR-463, TP-165A, and EXP 2789) Aug. 1, 1961. 5 pp.

The effect of temperature on the recombination rate of ions in a hydrocarbon-air flame is presented and the results compared with predictions based on present-day theories. Measurements were conducted with an alternate-probe technique in a propane-air flame burning on a Meker-type burner 5.5 cm in diameter. Two probes of different length, mounted at right angles to each other on a common shaft (the two probes being in a plane perpendicular to the shaft), entered the flame from the side, parallel to the flame front. By measuring current first with one probe, then with the other, and subtracting the two readings, it was possible to determine the ion concentration in the center of the flame. An ion-ion process agreeing with the Langevin prediction is indicated.##

05047

N. R. Mukherjee, M. R. James, W. S. Hummers, H. Eyring, and T. Ree

STUDIES TO DETERMINE THE MECHANISM OF PRODUCTION AND REMOVAL OF ELECTRONS IN FLAMES. (Utah Univ., Salt Lake City.) (Rept. No. AFBMD-TR61-1 Aug. 8, 1961 37 pp.

Probable chain reactions and mechanism for the formation of the most abundant positive ions are summarized. A steady state analysis of reactions reveals a number of important conditions that must be fulfilled for the most abundant ion formation. Approximate values for the maximum and minimum concentrations of the most abundant ion with respect to oxygen are obtained. A semi-theoretical method is used to calculate the concentration of the most abundant ion in hydrocarbon-oxygen or hydrocarbon-air flames. Experimental studies have been performed on the effect



of ultra-violet light on ion concentration in flames. Research has also been started on the effect of the degree of unsaturation, state of oxidation, and length of the carbon chain on ionization of various hydrocarbons in a hydrogen-oxygen flame.

05051

B. S. Rabinovitch, and D. W. Setser

UNIMOLECULAR DECOMPOSITION AND SOME ISOTOPE EFFECTS OF SIMPLE ALKANES AND ALKYL RADICALS. Washington Univ., Seattle, Dept. of Chemistry and Kansas State Univ., Manhattan, Dept. of Chemistry. June 1, 1964. 142 pp.

A theoretical study is reported on the nature of unimolecular reactions, their dependence on the energy parameters of the systems involved (photo-chemical or thermal), and their dependence on molecular structure. The relevant aspects of the RRKM formulation for unimolecular reactions are discussed. Emphasis is placed upon the present status of the theory, and the best techniques for carrying out computations. Characteristics of various model hydrocarbon-type molecular species which are used in theoretical calculations are outlined. Kinetic isotope effects are considered and model calculations presented for hydrogen-deuterium substitution. Consideration of reaction processes shows that a given hydrocarbon species can be produced at many different pressures, in a variety of energy states and with various hydrogen-deuterium isotopic compositions. Specific rate constant relationships to experimental parameter are discussed. The behavior of some C(1)-C(4) alkanes and alkyl radicals are calculated as examples of highly important practical systems. It is hoped this will provide useful insights into experimental situations.##

05058

D. E. Van Sickle and R. R. Mayo

OXIDATION OF UNSATURATED HYDROCARBONS (FINAL REPT. OCT. 1, 1961-SEPT. 30, 1963). Stanford Research Inst., Menlo Park, Calif. Jan. 10, 1964. 8 pp.

Research effort for the last two years was directed principally toward product studies of low temperature, liquid-phase olefin oxidations. Pure hydrocarbons were utilized where possible, azo initiators employed, and conversions limited to 5%. Correlation of the hydroperoxide produced with the remaining products found and assignment of relative rates for two chain propagation reactions were attempted. A secondary effort was the study of autocatalysis in oxidation. Cyclopentene was chosen as a model compound, since its oxidation mechanism is the simplest of the olefins studied. Decomposition and initiating properties of hydroperoxides also received attention. (Author introduction modified)##

J. N. Pitts, Jr., H. W. Johnson, and T. Kuwana

STRUCTURAL EFFECTS IN THE PHOTOCHEMICAL PROCESSES OF KETONES IN SOLUTION. *J. Phys. Chem.* 66, 2456-61 (Dec. 1962). (Presented at the Symposium on Reversible Photochemistry Process, Durham, N.C., Apr. 1962.)

The primary objective of this investigation was to check the effect of substituent groups and location of substitution on the photoreduction of a series of benzophenone derivatives. The behavior of a series of hydroxy, methoxy, amino, and chlorobenzophenones in the photopinacol reaction was studied using product isolation, UV spectroscopy, phosphorescence, fluorescence, and EPR spectroscopy. Results and correlations derived from these studies are discussed herein. Some of these include the following: Ortho substitution by a number of functional groups has a pronounced effect on the "go - no go" photoproperties of the benzophenone derivatives. Replacing the OH or the CH<sub>3</sub> by methoxy or carboxy restored the intermolecular hydrogen atom abstracting power of the benzophenone. This suggests that the deactivating effect of o-OH, NH<sub>2</sub>, NHCH<sub>3</sub>, and methyl groups is due to their tendency to form reversible photoenols. Ten and 24-hour irradiation at room temperature of degassed 0.01 M solutions of p-aminobenzophenone in isopropyl alcohol using a medium intensity mercury lamp produced no significant permanent changes. Strong phosphorescence was noted during irradiation in the rigid medium at 77 K., and EPR resonance signal due to the triplet state of 4-aminobenzophenone was observed. Long-lived phosphorescence was also observed for p-dimethylamino and p,p'-bis(dimethylamino) benzophenone. EPR studies of these and other para-substituted compounds are in progress. A preliminary report on a similar study in the anthraquinone system is included.##

05208L

T. J. Wallace, and N. Friedman

FUNDAMENTAL INVESTIGATION OF THE CATALYTIC DEGRADATION OF HYDROCARBON FUELS (FIRST QUARTERLY PROGRESS REPT. FEB. 16-MAY 16, 1965.) ESSO Research and Engineering Co., Linden, N. J., Process Research Div. May 16, 1965. 30 pp. (Rept. No. 1).

The reactivity of dilute solutions of benzaldehyde phenyl hydrazone (BPH) and tolyl phenyl hydrazone (TPH) in benzene toward molecular oxygen has been determined at 25 to 30 C. and one atmosphere pressure of oxygen. Both hydrazones oxidized readily under these conditions with TPH being more reactive than BPH. This reactivity difference is probably due to the electron-donating capabilities of the methyl group. It suggests that electron-attracting groups will decrease the reactivity of the initial hydrazone but accelerate the decomposition of the peroxide which is formed. The stoichiometry of the above reactions was determined. Each mole of oxygen consumed reacts with one mole of hydrazone to produce one mole of peroxide. The disappearance of the hydrazone is best represented by a pseudo

first order kinetic plot. Good reproducibility of the rate constants was observed. The rate-determining step is, most likely, hydrogen atom and cumene in benzene at 25 to 30 C. About 8 to 10% oxidation of each hydrocarbon was observed under these mild conditions. In the absence of BPH, no oxidation of indene was observed over a 72 hour period. Infrared data show that indene is converted to products which contain a carbonyl linkage. To date, attempts to oxidize tetralin have been unsuccessful. (Author abstract)##

05226

E. Ferht, and R. A. Back

THE REACTION OF ACTIVE NITROGEN WITH MIXTURES OF ETHYLENE AND NITRIC OXIDE. Can. J. Chem. 43, 1899-904, 1965. (Presented at the Annual Conference, Chemical Inst. of Canada, Kingston, June 1964, N.R.C. No. 8406.)

The reaction of active nitrogen, produced in a condensed discharge at 1 mm pressure, with mixtures of ethylene and nitric oxide has been studied with mixtures ranging in composition from pure ethylene to pure nitric oxide. The sum of HCN +  $^{14}\text{N}^{15}\text{N}$  produced from mixtures of  $\text{C}_2\text{H}_4$  and  $^{15}\text{NO}$  remained constant and equal to the HCN produced from pure  $\text{C}_2\text{H}_4$  for NO concentrations up to 50 mole %. As more NO was added, this sum rose towards the value of  $^{14}\text{N}^{15}\text{N}$  produced from pure  $^{15}\text{NO}$ . These data appear to lend support to the HCN yield from ethylene as the true measure of nitrogen atom concentration. It is suggested that  $^{15}\text{NO}$  also undergoes a concerted reaction with excited  $^{14}\text{N}^{14}\text{N}$  molecules, to produce  $^{14}\text{N}^{15}\text{N}$ , and that these excited molecules can be quenched by collision with ethylene or methane without consuming nitrogen or forming HCN. (Author abstract)

05325

Long, R.

FORMATION OF POLYCYCLIC AROMATIC HYDROCARBONS DURING INCOMPLETE COMBUSTION. (Progress Rept. Oct. 1, 1964-Mar. 31, 1967). Birmingham Univ., England. (Mar. 1967). 37 pp.

This report comprises three parts: Part I: discusses the development of a rapid analytical method for polycyclic aromatic hydrocarbons in soots. Extraction with  $\text{CHCl}_3$  was followed by column chromatography and then by programmed temperature gas chromatography, with UV spectrophotometry. Certain polycyclic aromatics thus identified, have not been reported hitherto in the literature on soots from hydrocarbon flames. Investigations were made on diffusion flames in which various concentrations of  $\text{O}_2$  in  $\text{O}_2\text{-N}_2$  and  $\text{O}_2\text{-Ar}$  mixtures as oxidant were used. In other experiments oxygen and other additives were introduced into the fuel supply. The effects on the formation of total soot, carbonaceous residue,  $\text{CHCl}_3$  soluble material and polycyclic aromatics are discussed. Part II: An investigation was made of the concentrations of stable species in the pyrolysis zone and particularly in the luminous zone of propane and ethylene diffusion flames burning on a Wolfhard-Parker type of burner. The effects of

O<sub>2</sub>, H<sub>2</sub> and C<sub>2</sub>H<sub>2</sub> as additives to the fuel and of O<sub>2</sub> and N<sub>2</sub> to the air stream were examined. Results showed that the sooting rate is related to the C<sub>2</sub>H<sub>2</sub> present in the luminous zone for the C<sub>2</sub>H<sub>4</sub> flames. Part III: An investigation was made of the polycyclic aromatic hydrocarbons associated with the soot in pre-mixed C<sub>2</sub>H<sub>2</sub>-O<sub>2</sub> flames operating at 20 mm. Hg. On the assumption that the concentration of polycyclic aromatics in the soots collected at increasing heights in the flame represents the state of affairs in the flame, it appears that the polycyclic aromatics are formed principally in a lower temperature region of the flame than that corresponding to "carbon" formation. Results also indicate that C<sub>2</sub>H<sub>2</sub> is important in carbon formation in C<sub>2</sub>H<sub>4</sub> and C<sub>3</sub>H<sub>8</sub>-air diffusion flames. (Author summary modified)

05333

Purcell, T. C. and I. R. Cohen

PHOTO-OXIDATION OF HYDROCARBONS IN THE PRESENCE OF ALIPHATIC KETONES. Atmos. Environ., 1(6):689-692, Nov. 1967. 16 refs.

Products of photooxidation reactions involving ketone-hydrocarbon mixtures are reported. Reaction mixtures were prepared in plastic bags fabricated from fluorinated ethylene-propylene plastics. The containers were irradiated by fluorescent lamps with intensity maximum at 3100 Å. The ketones and/or hydrocarbon mixtures consisted of: acetone, acetone-2-methyl-1-butene, and diethyl ketone. The percentage conversions, after 1, 2, and 3 hours of irradiation, of 2-methyl-butene-1 and acetone as a function of ratio of ketone to olefin showed that the acetone conversion is essentially constant, whereas olefin conversions increase with increasing ratio. Extrapolation of zero ratios of ketone to olefin indicates an unexplainable background reaction at longer conversion times. As with the aldehyde-olefin systems, the rate of consumption of olefin increased at longer reaction times. The ketone conversion rates are virtually constant. Fast oxidants such as ozone or peroxy acid were not detected. Alkyl hydroperoxide was identified as a slow oxidant product. The portion of these products due to the ketone photooxidation and that due to the olefin has not yet been determined. A mechanism often cited to explain the photooxidation of ketones involves a free-radical scheme.##

05345

R. Long and E. E. Tompkins

FORMATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN PRE-MIXED ACETYLENE-OXYGEN FLAMES. Nature 213 (5080), 1011-2 (Mar. 11, 1967).

An investigation is reported of the polycyclic aromatic hydrocarbons associated with the soot in pre-mixed acetylene-oxygen flames operating at a pressure of 20 mm of Hg. At the specified pressure, an acetylene-oxygen ratio of about 0.95 just began to produce soot. The flame corresponded to acetylene-oxygen ratios of 1 to 2 and 1 to 5. The apparent temperatures (uncorrected) were recorded at varying heights and the results are plotted for flame 1. Soot was removed from the collecting grid,

extracted, and the extract dissolved in CS<sub>2</sub>. Analyses were carried out by chromatographic techniques and thermal conductivity. Results showed that between heights of 1 and about 4 in. in the flame there is a gradual increase in the concentration of polycyclic aromatic hydrocarbons in the soot but a considerably greater increase occurs later in the flame at heights of 6-10 in. above the burner. Assuming that the concentration of polycyclic aromatic hydrocarbons in the soot reflects the state of affairs in the flame, the formation of polycyclic aromatic hydrocarbons appears to occur principally in a lower temperature region of the flame than that corresponding to soot formation. Of the polycyclic aromatic hydrocarbons, pyrene occurs in the greatest concentration in the soot up to approximately 7 in. above the burner after which 1 : 2-benzanthracene predominates. (Although the gas chromatographic peak represented chrysene and 1 to 2-benzanthracene unresolved, spectrophotometry of this fraction indicated only a small proportion of the former.) The relative concentrations of individual hydrocarbons change with height above the burner. Formation of higher condensed ring systems by the pyrolysis of relatively low molecular weight polycyclic aromatic hydrocarbons has been established and such processes in this study appeared to be occurring in the flame.##

05423

Benson, S. W. and G. R. Haugen

THE MECHANISM OF THE HIGH-TEMPERATURE REACTIONS BETWEEN C<sub>2</sub>H<sub>2</sub> AND HYDROGEN. J. Phys. Chem., 71(13):4404-4411, Dec. 1967. 24 refs.

The observed high-temperature rates of isotope exchange between C<sub>2</sub>H<sub>2</sub> and D<sub>2</sub> have been interpreted in terms of a radical mechanism. The chain propagation steps for the system are D + C<sub>2</sub>H<sub>2</sub> yields C<sub>2</sub>HD + H and H + D<sub>2</sub> yields D + HD. The lower temperature addition kinetics to form C<sub>2</sub>H<sub>4</sub> are fitted very well by a related chain with the same initiation and termination but a different propagation. The theoretical steady-state rate expression, derived from the radical mechanism, adequately predicts the observed rates at temperatures greater than 1400 deg K. The problem of attainment of steady state during the short time interval of the experiment and the catalytic effect of traces of oxygen and organic impurities on the induction period are discussed. (Authors' abstract, modified)##

05425

Shaw, R., F. R. Cruickshank, and S. W. Benson

THE REACTION OF NITRIC OXIDE WITH 1,3- AND 1,4-CYCLOHEXADIENES. J. Phys. Chem., 71(13):4538-4543 Dec. 1967. 16 refs.

The gas-phase reactions of nitric oxide with 1,3- and 1,4-cyclohexadiene have been studied in a Pyrex reaction vessel between 306 and 359 deg. Initial pressures were varied: 1,3-CH, 3-57 torr; 1,4-CH, 10-71 torr; and NO, 64-436 torr. No pressure change could be detected. Products identified by gas chromatography and mass spectrometry were water, nitrous oxide,

benzene, and traces (about 10% of the benzene) of cyclohexene. Good mass balances were obtained for the hydrocarbons, but the water analyses were erratic and the nitrous oxide was less than given by the stoichiometric equation. The rate of production of benzene was unaffected by increasing the surface to volume ratio 20 times and was first order in cyclohexadiene and nitric oxide. The rate-determining step is given. (Authors' abstract, modified) ##

05440

R. Gelius and W. Franke

AN INVESTIGATION OF THE COMBUSTION PRODUCTS OF ALKYL-LEAD COMPOUNDS. NNZur Kenntnis der Verbrennungsprodukte von Alkylbleiverbindungen.)) Brennstoff-Chem. Essen 47(9) 280-5, Sept. 1966. Ger.

Tetramethyl-, tetraethyl-, and tetra-n-propyl lead were burned in air in the presence of n-n-heptane, isooctane, or benzene. The combustion products were collected on the surface of a cooled glass tube, in a glass wool filter, and in an electrofilter. In order to eliminate the formation of nitrites, the nitrogen in the air could be replaced by argon. The combustion of the alkyl lead compounds takes place as follows: the compounds thermolyze when the combustible mixture approaches the hot regions of the flame. The result is a smoke of fine PbO particles. The combustion residues are then almost identical to those from the alkyl lead mixture. In the third zone, behind the flame, PbCO<sub>3</sub> (52-86%), PbO (13-45%), PbO<sub>2</sub> (as Pb<sub>3</sub>O<sub>4</sub>, etc. 0.1-3%), and Pb(NO<sub>2</sub>)<sub>2</sub> is formed. In internal combustion engines the effectiveness of PbO as an antiknock agent lasts about 1 millisecond. These experiments suggest that the surfaces of the PbO particles may convert to Pb(NO<sub>2</sub>)<sub>2</sub>, thereby rendering the antiknock additive ineffective.##

05611

S. W. Nicksic, J. Harkins, and B. A. Fries

A RADIOTRACER STUDY OF THE PRODUCTION OF FORMALDEHYDE IN THE PHOTO-OXIDATION OF ETHYLENE IN THE ATMOSPHERE (PART II--THE EFFECT OF OTHER COMPOUNDS ON YIELD AND CONVERSION). J. Air Pollution Control Assoc. 14, (6) 224-8, June 1964.

In this study, the tracer procedure was used to study some aspects of the effect of composition of the irradiated mixture on the amount of formaldehyde produced from ethylene, the latter being the dominant olefin in auto exhaust. The irradiation chamber contained oxidants, NO<sub>2</sub>, CH<sub>2</sub>O, hydrocarbons and aerosols. Oxidant, nitrogen dioxide, and aerosols were measured in order to obtain a more complete monitoring record of the reaction. Chemical formaldehyde and radiochemical formaldehyde measurements together with gas chromatographic determination of hydrocarbons, were used to establish yields and conversion. Results showed: (1) Ethylene gives more formaldehyde in the presence of oxygenates and certain aromatics because the reactions are faster; the fraction converted, however, remains constant. The quantitative aspects of the effect of oxygenates remain to be studied. (2)

Formaldehyde yield from ethylene irradiated alone depends on the nitric oxide-hydrocarbon ratio. (3) In the presence of other olefins, the nitric oxide dependency is much less. (4) Production of formaldehyde from ethylene is not influenced by other olefins except for the nitric oxide effect. In reference to changing composition of exhaust, oxygenates can be expected to increase formaldehyde formed during photo-oxidations, but it is not yet possible to state how big the effect might be. The removal of olefins will probably affect formaldehyde production in proportion to the extent of removal. Removal of other olefins will not affect the reactions of ethylene per se except for the nitric oxide-hydrocarbon ratio effect.##

05613

Levine, M., W. F. Hamilton, and E. Simon

ATMOSPHERIC PHOTOCHEMICAL REACTIONS OF HALOGENS AND BUTYL HALIDES. J. Air Pollution Control Assoc., 14(6):220-223, June 1964. (Presented at the 56th Annual Meeting, Air Pollution Control Assoc., Detroit, Mich., June 9-13, 1963.)

This investigation was oriented toward delineation of the interactions involved in the chemical inhibition of smog exhibited by iodine and to a much lesser extent by the other halogens. Apparatus used for handling and irradiating polluted atmospheric air was a 500 cu ft chamber enclosed by a "Mylar" polyester film 1 ml thick. The chamber is mounted on large casters allowing positioning of the unit for optimum sunlight exposure. When thermal (dark) reactions are studied, the entire chamber is rolled into a large, light tight, thermostatically controlled oven. Other details concerning the laboratory procedure are given. The results of these tests show that neither temperature, over the range of about 100 to 200 F, nor sunlight greatly influences the reaction ratio of O<sub>3</sub> with iodine 2, and that sunlight has a much greater effect on the reaction rates of the halogens with O<sub>3</sub> than does temperature. The qualitative rates of halogen-ozone reactions in purified air in sunlight are iodine 2 greater than Br<sub>2</sub> greater than Cl<sub>2</sub>. The effectiveness of iodine 2 in reducing O<sub>3</sub> in a smoggy atmosphere is enhanced over its effect on O<sub>3</sub> in purified air, whereas the effectiveness of Br<sub>2</sub> and Cl<sub>2</sub> in quenching smog O<sub>3</sub> is diminished. The effectiveness of Br<sub>2</sub> in reducing O<sub>3</sub> is inhibited by the presence of both saturated and unsaturated hydrocarbons, whereas the iodine 2 - O<sub>3</sub> reaction is unaffected.##

05643L

H. H. Reamer

PARTIAL OXIDATION PRODUCTS FORMED DURING COMBUSTION. Preprint. 1966.

During the period covered by this report, primary effort was in the investigation of the effect of the fuel employed upon the characteristic perturbations and the residual quantities of the oxides of nitrogen. The experimental conditions encountered in connection with the investigation of the behavior of the

propane-air and the n-butane-air system are given. The average reaction pressure was approximately 41 p.s.i.a. The composition of the products of reaction for the ethane-air, propane-air, n-butane-air and natural gas-air systems are tabulated. All the measurements involving natural gas-air, ethane-air, propane-air and n-butane-air, were carried out at a stoichiometric mixture ratio of approximately 0.93. Variation in the perturbations of normal stress and the frequency, as a function of the molecular weight of the fuel are reported. The quantities of residual oxides of nitrogen increased rapidly with an increase in molecular wt from that of the natural gas-air system to that of the ethane-air system and progressively increased with further increases in molecular wt. to propane and n-butane. On the other hand, the perturbations in the double amplitude of the normal stress decreased progressively with an increase in molecular wt. of the fuel. Phase relationships between the upper and lower ports were almost exactly 180 degrees. The frequency was approximately 509 cycles per sec in the case of the natural gas-air system. An increase to 521 cycles per sec was found for the ethane-air system and a small decrease to 518 and 516 cycles per sec for the propane-air and the n-butane-air systems respectively was observed. The analysis of the perturbations in normal stress obtained in connection with the propane-air and ethane-air systems is included. It is apparent, as in the case of the ethane-air system, that a phase relationship slightly reater than 180 degrees exists between the upper and lower ports, again confirming that the primary nature of the perturbations involved a longitudinal wave.##

05824

L. G. Wayne

ON THE MECHANISM OF PHOTO-OXIDATION IN SMOG. Preprint.  
(Presented at the Joint Research Conference on Motor  
Vehicle Exhaust Emissions and Their Effects, Los Angeles,

The action of sunlight on urban atmospheres contaminated with auto exhausts promotes oxidation of hydrocarbons and NO and eventual accumulation of O<sub>3</sub>. Some very intriguing problems of chemical mechanisms are presented by these reactions. It is the purpose of this paper to subject to an elementary kinetic analysis some of the proposed reaction schemes and to introduce a mechanism which shows promise of explaining certain features of the photooxidation process. Experiments have established that the oxidant material is mainly O<sub>3</sub>. The various hydrocarbons present in automobile exhaust disappear at different rates; olefins in general react more rapidly than paraffins, and most olefins react more rapidly than ethylene, which is the predominant olefin in auto exhaust. Relevant information available from experiments involving the irradiation of synthetic atmospheres containing low concentrations of hydrocarbons and oxides of nitrogen has presented reasoning leading to the conclusion that react chains are very probably involved in these systems. Briefly, the reasoning is that, since NO<sub>2</sub> is the only likely primary absorber of actinic light products, hydrocarbons are probably involved by reaction with the oxygen atoms produced in the photolysis of NO<sub>2</sub>; but since the rate of accumulation of products is sometimes faster than the estimated rate of reaction between hydrocarbon molecules and oxygen atoms, each appropriate oxygen atom collision must lead to several subsequent steps, i.e., to a chain of reactions. Such a chain might promote the conversion of NO to NO<sub>2</sub> in either of two ways: by direct consumption of NO, or by consumption of molecular oxygen to form O<sub>3</sub>. Kinetic implications of chain mechanisms of 3 different types of examined: (1) A mechanism offered by Saltzman, in which chains are initiated by free



radicals formed in a hydrogen abstraction reaction by oxygen atoms; (2) A scheme suggested by Leighton incorporating some suggestion of Schuck and Doyle; (3) A new hypothetical mechanism, serving to illustrate the possible consequences of a chain-branching step. Further study, particularly of the relative rates of photooxidation of nitric oxide and olefins in systems with very little nitrogen dioxide, should provide evidence bearing on the importance of branching chains in the urban photochemical smog system.##

05849

N. A. Renzetti and G. J. Doyle

THE CHEMICAL NATURE OF THE PARTICULATE IN IRRADIATED AUTOMOBILE EXHAUST. J. Air Pollution Control Assoc. 8 (4), 293-6 (Feb. 1959).

The Los Angeles smog is characterized by its several manifestations namely, eye irritation, crop damage, reduced visibility, and high ozone concentrations. Since automobile exhaust is the major contributor to the pollution of the Los Angeles atmosphere, its relation to all aspects of smog formation is of prime importance. There have been three studies of the chemical nature of the particulate in non-irradiated auto exhaust. This is believed to be the first report on the nature of photochemically generated aerosol in auto exhaust. All of the aerosol collected for the chemical analyses was generated under similar conditions. The irradiated chamber was first flushed with pure air and then auto exhaust at 5000 or 7200 ppm by volume was allowed to enter the chamber after passing through the inlet filter. As soon as steady state concentrations were reached, the chamber irradiation lamps were turned on. The experiments were dynamic in nature with 1-hr residence time for the mixture in the chamber during which period the irradiation took place. The aerosol under study was that generated essentially in a stirred flow reactor. The runs lasted up to 9 hr in order to collect samples of sufficient size for the standard microanalytical techniques to be used in the analyses. Microcombustion technique, microanalytical chemical techniques and infrared absorption spectrum measurements are reported. Irradiated auto exhaust appears to be the principal source of nitrate, sulfate, lead, and organic compounds in the particulate matter of Los Angeles smog. Further, these findings explain the higher values of nitrate and sulfate found in Los Angeles and other similar West Coast cities in comparison with other cities. Assuming six million gallons of gasoline are consumed in auto engines per day in Los Angeles, about one ton per day of non-irradiated particulate and at least 10 tons per day of photochemically generated particulate are present in a typical smog.##

06056

R. J. Grant and M. Manes

ADSORPTION OF BINARY HYDROCARBON GAS MIXTURES ON ACTIVATED CARBON. Ind. Eng. Chem. Fundamentals 5(4):490-498, Nov. 1966.

The Polanyi adsorption potential theory is extended to predict the adsorption of binary gas mixtures on activated carbon. The

calculation method assumes that the adsorbate behaves as an ideal liquid mixture and that the total adsorbate volume determines the adsorption potential of each pure component and hence its adsorption pressure as a pure gas. The method in principle applies to a wide variety of binary mixtures and can be extended to multicomponent systems. It is here successfully applied to new data on mixtures of methane with propane, butane, and hexane at 25 C. and total pressures up to 1000 p.s.i.g., as well as to literature data at atmospheric pressure. (Authors' abstract)##

06102

N. Endow, G. J. Doyle, and J. L. Jones

THE NATURE OF SOME MODEL PHOTOCHEMICAL AEROSOLS. J. Air Pollution Control Assoc. 13 (4), 141-7 (Apr. 1963). (Presented at the 55th Annual Meeting, Air Pollution Control Association, Chicago, Ill., May 20-24, 1962.)

To obtain greater knowledge of the chemical nature of that part of smog which reduces visibility, its significance to health and its formation in model aerosols were generated by the photo-oxidation of a single hydrocarbon, by nitrogen oxides and, in most instances, by the co-photooxidation of a third component-sulfur dioxide. The model aerosols are the result of the same type of process which undoubtedly takes place in the atmosphere, but the complexity of the reactions is considerably reduced and the chemical composition is more closely controlled. Evidence from infrared spectra of precipitated model aerosols formed by the photo-oxidation of lower olefin homologs-nitrogen oxides-sulfur dioxide mixtures at 50% relative humidity indicated that the principal constituent of the aerosol was sulfuric acid. Other analytical data, microchemical elemental analysis, spot tests, and the like, gave support to the belief that the principal constituent of these aerosols was sulfuric acid. In addition to sulfuric acid, the aerosols contained a smaller concentration of nitrite-type material. Weight loss studies of precipitated aerosols indicated either that portions of the condensed aerosol materials were volatile or that the aerosol was unstable and a decomposition product was volatile.##

06182

Billings, C. E.

EFFECTS OF PARTICLE ACCUMULATION IN AEROSOL FILTRATION (A DOCTOR'S THESIS). For the degree of Doctor of Philosophy, California Inst. of Tech., Pasadena. (1966). 233 pp.

The filtration of solid aerosol particles produces a decrease in filter penetration and an increase in filter resistance because of the accumulation of deposited material. Functions are derived for the effects of particle accumulation on filter penetration and resistance. A new aerosol tunnel is described which provides a uniform field of particle and fluid flow for extended periods. Data are presented on the effects of accumulation of 1.3-micron polystyrene particles on the performance of filter mats tested in the aerosol tunnel. A quantitative microscopic study of accumulation of 1.3-micron particles on single isolated 10-micron glass fibers is described. Photographs of deposit structure and measurements of aggregate size are included. (Author(s abstract))

06625

R. S. Tsay

A DISCUSSION OF THE FORMULA X USED IN COMPUTING THE AMOUNT OF FUEL REQUIRED TO PRODUCE COMBUSTION GASES AT A GIVEN TEMPERATURE IN A COMBUSTION CHAMBER OR AN AFTERBURNER. Chi Hsieh Kung  
Ch'eng Hsueh Pao (Chinese J. Mechanical Engineering) 12 (3), 94-6 (1964) Chin. (Tr.).

CFSTI,DDC: AD 625 788  
AD 625 888

A generalization of 2 formulas for calculating the amount of fuel required to produce combustion gases at a given temperature in a combustion chamber or in an afterburner is presented. The applicability of the original formula based on (CH<sub>3</sub>)<sub>m</sub> fuel to other fuels is discussed. (Author's abstract, modified)##

06648

Matsak, V. G.

VAPOR TENSION AND VAPORIZATION OF SUBSTANCES IN MOVING AIR. Gigiena i Sanit., (8) 35-41, 1958. In: U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Translated from Russian by B. S. Levine, Vol. 8, 1-9, 1962

CFSTI: 62-11103

The purpose was to place at the disposal of engineers and hygienists working in the field of sanitary technology basic data regarding vapor tension and rate of vaporization of different inorganic and organic substances in moving air. Particular emphasis was placed on substances, and especially toxic substances, most commonly used in industrial technology. Such information should allow hygienists to evaluate the potential danger associated with vaporization of toxic substances in relation to their physico-chemical and toxicological properties, and sanitary engineers to apply it in their computation of air ventilation in general and of quantitative determination of the degree of air charged with vapor of high-molecular substances, and in correctly distributing incoming and exhaust air, and in computing other means required for the sanitary improvement of labor conditions. It is suggested that sanitary engineers use the nomograms presented especially where a 5% error is permissible. More than 85 chemically pure substances are represented in three nomograms and two tables.##

06698

R. W. Hurn, B. Dimitriadis, and R. D. Fleming

HOW HYDROCARBON TYPES DETERMINE SMOG-FORMING POTENTIAL OF EXHAUST GASES. S.A.E. (Soc. Automot. b8eng.) J. 74 (2), 59-61 (Feb. 1966).

Relationships between automobile exhaust gas reactivity under irradiation and composition of unburned hydrocarbons in the

exhaust was studied over a wide range of fuels and driving conditions. Indices measured were: rate at which NO is converted to NO<sub>2</sub>; oxidant formation; and formaldehyde formation. These were correlated with concentrations of; unsaturates plus oxygenates; non-aromatic unsaturates plus oxygenates; and non-aromatic unsaturates plus oxygenates, less acetylene and propylene. Correlation between composition and chemical reactivity is not consistent. Oxidant formation is constant within experimental error limits. Variability in the rate of NO<sub>2</sub> formation is considered to be due to variations in composition, including variations in molecular weight, within each of the general classifications with which reactivity correspondence was sought. Inherently low precision of the analytical method may be at fault for the + or - 34% scatter shown in formaldehyde-formation data. For exhaust samples of similar origin (that is, the same fuel), a fairly well defined correlation exists between reactivity and composition. Extracting all or part of the unsaturates and oxygenates from exhaust samples does tend to reduce their reactivity. Nitrogen oxides also play a complex role in determining reactivity. In a hydrocarbon-nitrogen oxides mixture, reactivity is more or less a monotonic function of the hydrocarbon concentration, but its dependence on nitrogen oxides is not monotonic. Comparing the reactivity of two exhaust samples, therefore, means taking account not only of reactive hydrocarbon concentrations, but also their ratios to nitrogen oxides, as well as the direction in which the hydrocarbon to nitrogen oxides ratio affects reactivity.##

06720

A. J. Patiadi

EFFECTS OF TEMPERATURE AND OF ULTRAVIOLET RADIATION ON PYRENE ADSORBED ON GARDEN SOIL. Environ. Sci. Technol. 1 (7), 570-2 (July 1967).

Irradiation of pyrene adsorbed on garden soil for 240 hrs at 32 degrees gave a mixture of products that could be separated by thin-layer and column chromatography. Eight compounds were formed, and five have been identified: 1,1'-bipyrene, 1,6- and 1,8-pyrenediones, and 1,6- and 1,8-pyrenediols. When the pyrene adsorbed on garden soil was stirred in the dark for 240 hrs at 32 degrees, the yield of 1,1'-bipyrene was lowered (from 4 to 6%) to 0.3%, and only traces of the two diones were formed; on treatment in the dark at 110 degrees for only 8 hrs, dione yields were increased to 2.5%. When other particulates (silica gel, alumina, Florisil, etc.) were used instead of garden soil, 1,1'-bipyrene was not formed. Experiments in which radical-capture agents were incorporated showed lower yields of 1,1'-bipyrene, indicating that the reaction with ultraviolet irradiation involves a free-radical mechanism. The yield of the diones was unchanged with these agents present, suggesting that they are formed by attack of adsorbed oxygen on photo-excited pyrene molecules. Irradiation of pyrene in the crystalline form without soil did not produce 1,1'bipyrene. No attempt was made to follow quantitatively the input of energy during the irradiation of pyrene on soil (a heterogeneous reaction); from the practical standpoint, however, the main objective of this study was to trace the fate of pyrene on soil, as a representative reaction of a series of polycyclic, aromatic hydrocarbons (carcinogenic and non-carcinogenic). (Author abstract)##

06980

A. J. Fatiadi

SEPARATION OF PYRENEDIONES BY COLUMN CHROMATOGRAPHY. J. Chromatog. 20, 319-24 (1965).

Pure 1,6 - 1,8 and 4,5 pyrenediones were needed as reference compounds in connection with studies on the photochemical oxidation of pyrene. The procedure reported by Vollmann for the preparation and separation of 1,6 and 1,8 pyrenediones involves a laborious series of processes. After tests with a variety of adsorbents and solvents, it was found that 1,6 and 1,8 pyrenediones, in an oxidation mixture obtained from purene, are separated directly on a column of silica gel with glacial acetic acid as an eluate. The final purification of 1,6 pyrenedione was accomplished on a column of activated alumina with benzene as a solvent. The composition of each eluted fraction was checked by thin layer chromatography. The infrared and UV spectra of the purified diones and of 1-oxo-6,7 phenalenedicarboxylic acid anhydride were recorded.##

06997

B. M. Fabuss, A. S. Borsanyi, D. A. Duncan, R. Kafesjian, J. O. Smith

RESEARCH ON THE MECHANISM OF THERMAL DECOMPOSITION OF HYDROCARBON FUELS. Monsanto Research Corp., Everett, Mass. Boston Labs. (Aug. 1964). 128 pp. (Rept. No. ASD-TDR-63-102, Part II.)

The decomposition and particle formation of 28 naphthenic and 8 paraffinic hydrocarbons were studied. The decomposition approximately a first-order kinetic process, although self-acceleration was observed with most monocyclic hydrocarbons and self-acceleration was observed with most monocyclic hydrocarbons and self-inhibition was observed for polycyclic hydrocarbons. Pressure increased the decomposition rate. A detailed study of the effects of organosulfur contaminants was made. These contaminants inhibited the cracking of naphthenes and straight-chain paraffins and accelerated the cracking of branched paraffins. An increase in contaminant concentration and an increase in the number of methyl substituent groups on a hydrocarbon increased this effect. Several binary hydrocarbon mixtures were cracked. The component hydrocarbons did not crack independently. Nevertheless, the decomposition rate of the mixture could be predicted assuming no mutual interferences in decomposition. The micro-coker, a new small-scale device for studying decomposition and deposit formation in a flow system, was developed. (Author abstract)##

07108

Renzetti, N. A. and G. J. Doyle

PHOTOCHEMICAL AEROSOL FORMATION IN SULFUR DIOXIDE-HYDROCARBON SYSTEMS. Intern. J. Air Water Pollution, 2:327-345, June 1960. 31 refs. (Presented at the Int. Clean Air Conf., London, Engl., Oct. 20-24, 1959.)

A series of photochemical experiments were conducted in a 50-1. stirred-flow reactor to study aerosol formation from different hydrocarbons in the presence of nitrogen oxides and sulfur dioxide. Irradiation by simulated sunlight of trace concentrations (p.p.m.) of the reactants, in some cases yielded particles in the size regime 0.1-0.3 microns diameter, which by scattering of light are important to visibility in the atmosphere. A large number of experiments with 3 p.p.m. of various hydrocarbons, 1 p.p.m. nitrogen oxides, and 0.1 to 0.5 p.p.m. SO<sub>2</sub> indicated that the olefinic hydrocarbons were the only important aerosol formers in contrast to the paraffinic and aromatic hydrocarbons. It was observed that the photolysis of sulfur dioxide proceeds at the rate of 0.4 per cent per minute. The high sulfate content of the particulate matter and low gaseous sulfur dioxide concentrations observed in the Los Angeles smog are consistent with the findings of this laboratory program. (Authors' summary, modified)##

07188

M. N. Poglazova, G. E. Fedoseeva, A. J. Khesina, M. N. Meissel, and L. M. Shabad

DESTRUCTION OF BENZO(A)PYRENE BY SOIL BACTERIA. Life Sci. 6(10):1053-1062, 1967.

Data are given on the presence of bacteria capable of accumulating and destroying the carcinogen, benzo(a)pyrene, which is found in the air and soil of large modern cities. Samples collected on the land of an old oil refinery contained up to 200 µg of benzo(a)pyrene per kilogram of soil. Seventeen strains of spore-forming bacteria, some of which belong to the *Bacillus megaterium* species were isolated from soil samples and grown on meat infusion agar. The cultivated bacteria accumulated and destroyed the benzo(a)pyrene in the nutrient media and in the soil. It was possible to increase the ability of the soil bacteria to destroy benzo(a)pyrene by prolonged cultivation in media containing the hydrocarbon. The benzo(a)pyrene content of the samples was followed by quantitative spectral fluorescent methods. A fundamental method of biologically reducing the carcinogenic hydrocarbons in the soils is given.##

07271

Whitby, K. T., B. Y. H. Liu, and A. R. McFarland

A STUDY OF ATOMIZER AEROSOL GENERATORS (INTRODUCTION-SECTION I). (Minnesota Univ., Minneapolis, Dept. of Mechanical Engineering), Progress rept. no. AP 00480-2, p. 1-10, Aug. 1967. 5 refs.

The further development of three generators was attempted. The first of these is an atomizer type generator which is suitable both for polystyrene latex aerosol generation and for the generation of moderately monodisperse submicron aerosols by the atomization of the dye solutions. The second is a condensation type generator capable of generating high concentrations of monodisperse aerosols from the atomization, evaporation, and recondensation of such substances as DOP, glycerol, and triphenylphosphate. The third generator is an advance version of the Model II spinning disk

aerosol generator previously developed. The principal specifications of the generators and the progress to date are reviewed.##

37272

Liu, B. Y. H.

METHODS OF GENERATING MONODISPERSE AEROSOLS (SECTION II). In: A Study of Atomizer Aerosol Generators. ((Minnesota Univ., Minneapolis, Dept. of Mechanical Engineering)), Progress rept. no. AP 00480-2, Publication no. 104, Rept. no. C00-1248-10, p. 1-34, Aug. 1967. 32 refs. Presented at the 8th Conf. on Methods in Air Pollution and Industrial Hygiene Studies, Oakland, Calif., Feb. 6-8, 1967.)

The methods of generating monodisperse aerosols are discussed. The principal characteristics, advantages and limitations of the following methods are given: spinning disk aerosol, generator, atomizer-impactor generator and condensation generator.##

07273

Whitby, K. T. and Y. H. Liu

POLYSTYRENE AEROSOLS--ELECTRICAL CHARGE AND RESIDUE SIZE DISTRIBUTION. (SECTION III). In: A Study of Atomizer Aerosol Generators. ((Minnesota Univ., Minneapolis, Dept. of Mechanical Engineering)) p. 1-32, Aug. 1967. 16 refs. Also: ((Atmospheric Environ.)), 2 (2):103-116, March 1968.

The complete size distribution of polystyrene aerosols produced from a dilute hydrosol of the polystyrene latex particles by the atomization and evaporation process has been measured over the size range, 0.002 microns to 5 microns in 18 size intervals by means of an aerosol counting and size distribution measuring system consisting of three instruments in parallel operations: a condensation nuclei counter, an electric particle counter, and an optical particle counter. The concentration of the residue particles resulting from the evaporation of the empty liquid droplets containing no PSL particles has been found to be approximately five orders of magnitude higher than the monodisperse PSL particles. The use of an impactor with a sharp 2 micron droplet cut-off has been shown to be effective in improving the monodispersity of the generated polystyrene aerosol. The improvement apparently resulted from the reduced number of multipliets formed. The electrostatic charge on the PSL particle has been measured and the median charge has been found to be on the order from 10 to 100 elementary electron units. However, some particles have been found to carry over 600 units of charge. Charges of these magnitudes are approaching or even exceeding the maximum charge that can be placed on these particles in an electrostatic precipitator and undoubtedly can have a very substantial effect on the behavior of the aerosol. A radioactive Kr-85 gas of 0.5 millicurie activity has been found to be an effective means of neutralizing the aerosol charge. (Authors' abstract, modified)##

R. D. Schwartz, R. G. Mathews, D. J. Brasseaux

RESOLUTION OF COMPLEX HYDROCARBON MIXTURES BY CAPILLARY COLUMN GAS CHROMATOGRAPHY - COMPOSITION OF THE 80 DEGREES - 180 DEGREES C AROMATIC PORTION OF PETROLEUM. J. Gas Chromatog., 5(5):251-253, May 1967. 7 refs.

The selectivity of a number of liquid substrates, for the separation of the 80 degrees -180 degrees C aromatic hydrocarbons, has been investigated. Capillary columns coated with esters which form pi-complexes with the aromatics are particularly useful for these separations. Modification of the ester substrate by the addition of other suitable solvents is necessary in order to obtain the optimum selectivity for the resolution of this complex mixture containing several closely related hydrocarbon isomers. It is possible to separate these 21 aromatic hydrocarbons, in approximately 45 minutes, with a 200 ft. length of 0.01 inch i.d. stainless steel coated with a modified pi-complexing substrate. (Authors' abstract)##

07457

Benson, S. W. and R. Shaw

KINETICS AND MECHANISM OF THE PYROLYSIS OF 1,4-CYCLOHEXADIENE. Trans. Faraday Soc., 36(532):985-992, April 1967. 18 refs.

The homogeneous gas-phase pyrolysis of 1,4-cyclohexadiene has been shown to obey the pattern of reactivity of cyclic olefins. The reaction was studied using mass spectrometry, u.-v. spectroscopy, gas chromatography, and pressure measurements. The process is first order to at least 80% decomposition. The rate constant has been measured over a range of seven powers of ten, in packed and unpacked, static and flow reactors between 250 and 620 deg C and between 0.001 and 100 torr. The absence of hydrogen atoms has been shown by the lack of exchange with hexadeuterobenzene and toluene. The chain decomposition involving cyclohexadienyl radicals is, therefore, not important, probably due to the endothermicity and low A-factor of the bimolecular initiation. From the Arrhenius parameters for the intramolecular elimination of hydrogen from 1,4-CH, and from estimates of the entropy and heat changes, the rate constant for the dienophilic 1,4-hydrogenation of benzene was calculated. (Authors' abstract, modified)##

07458

Benson, S. W. and G. R. Haugen

MECHANISMS FOR SOME HIGH-TEMPERATURE GAS-PHASE REACTIONS OF ETHYLENE, ACETYLENE, AND BUTADIENE. J. Phys. Chem., 71(6):1735-1746, May 1967.

Sufficient information concerning the rate parameters of the individual propagation and termination steps of radical reactions now exists so that it is possible to predict the kinetic behavior of a chain mechanism with better than order-of-magnitude



reliability. This precision comes from the similarities that exist between the A factors and activation energies of homologous reactions. In particular, the creditability of a proposed chain mechanism for the high-temperature gas-phase reaction of unsaturated hydrocarbons can be tested by comparing the observed kinetic behavior with that predicted by the mechanism. A pyrolytic chain was proposed that adequately describes the experimentally observed high-temperature hydrogenation of acetylene and also the high-temperature pyrolysis of ethylene. The propagation steps representing the formation of the major products of these systems are diagrammed. The minor product in both systems is 1,3-butadiene. In the pyrolysis of ethylene, the side reaction accounts for the production of butadiene. In the case of the hydrogenation of acetylene, a concurrent chain is responsible for the side products. (Authors' abstract, modified)##

07462

Egger, Kurt W. and Sidney W. Benson

SOME OBSERVATIONS ON THE KINETICS OF HYDROGEN IODIDE ADDITION TO 1,3- AND 1,4-PENTADIENE. J. Phys. Chem., 71(6):1933-1936, May 1967.

Quantitative kinetic information on the addition of HI to olefins, obtained complementary to reported studies of the iodine atom catalyzed isomerization and dimerization of n-pentadienes in the gas phase is reported. The rate of addition of HI to either 1,3- or 1,4-pentadiene was checked as a possible side reaction in these studies. It was found that, during the isomerization of 1,4-pentadiene in the presence of iodine at temperatures between 1,4-pentadiene in the presence of iodine at temperatures between 420 and 515 deg K, 5-10% monoolefins had been produced. Rate constants were calculated from pressure measurements, as only the constants were calculated from pressure measurements, as only the rate-controlling step leads to a pressure change. The iodine buildup during the reaction, monitored spectrophotometrically, checks out within experimental error limits with the amount of saturated hydrocarbon or monoolefin, respectively, measured by gas-liquid chromatography. The measured pressure changes are in reasonable agreement with the iodine produced. The method and experimental procedures used have been reported in detail earlier. The results are summarized here. A more careful and detailed study of the HI addition to 1,3-pentadiene is needed before any further conclusions can be drawn. There is no doubt, though, that HI adds much faster to the conjugated olefinic bond and it is believed that this corresponds to the homogeneous reaction rate.##

07463

Harrison, Arthur P., Jr., and Vivian E. Raabe

FACTORS INFLUENCING THE PHOTODYNAMIC ACTION OF BENZO A PYRENE ON ESCHERICHIA COLI. J. Bacteriol., 93(2):618-626, Feb. 1968. 23 refs.

Death of Escherichia coli resulted when a buffer suspension was exposed simultaneously to colloidal benzo a pyrene (BP) and 355-millimicrons illumination. Neither hydrocarbon nor illumination alone caused death; oxygen had to be present. The survival curve had a shoulder, and then death proceeded

exponentially with time. Death rate was independent of temperature between 6 and 32 C. The duration of the shoulder, however, decreased slightly with increase in temperature. The shoulder was not due to delay in BP entering the cell. Death was influenced by the composition of the medium in which the cells were grown prior to illumination. The amount of BP bound to the cells was determined after three ethyl alcohol-ether extractions. Appreciable binding occurred in the presence of 355-millimicrons illumination with air, and relatively little binding occurred under nitrogen; very little binding occurred in the dark with nitrogen or air. At the outset, rate of binding under illumination with air was not temperature-dependent, but with time it became strongly temperature-dependent. Binding under illumination with nitrogen was temperature-independent. Bound BP was associated primarily with cell protein. Cells in growth medium resisted death and BP binding. At 21 and 32 C, deoxyribonucleic acid damage occurred during exponential death. No damage was detected at 21 and 32 C in the dark with BP, under illumination in absence of BP, or under illumination with BP in a nitrogen atmosphere.

{Authors' abstract}##

{Authors' abstract}##

07495

Ciborowski, J. and R. Pohorecki

THE EFFECT OF ELECTRICAL DISCHARGES ON SUBLIMATION CONDENSATION. Int. Chem. Eng., 7(1):4859, Jan. 1967. 46 refs. Translated from Chem. Stosowana, Vol. 2B, p. 159-182, 1966.

The effect of electrical discharges on the condensation of vapor at temperatures below the triple point has been studied. A simplified schematic diagram of the apparatus used is presented. It was composed basically of a saturator, a heater, a superheater, an ionizer, and a condensation chamber. The condensation was carried out by mixing a hot stream of gas containing vapors of the condensing component (naphthalene) with a stream of cold inert gas. It was concluded that: the existence of a considerable effect of electrical discharges on the course of sublimation condensation has been established. This effect is based primarily on intensification and simultaneous stabilization of the course of the progress. The effect of discharges on the condensation process depends on the type of discharge. This effect is considerable in the case of spark discharges, but in the case of corona discharges it was not observed at all. The magnitude of the effect observed depends to a small degree on the voltage (if it is large enough for spark discharges to occur). This magnitude also depends on the thermodynamic parameters of the system; however, no dependence on the flow rate of the gas through the ionizer was observed (within the investigated limits of changes of this value). The effects of electrical discharges on the condensation process can be explained by the formation of a larger number of active condensation nuclei, which facilitate nucleation of the new phase.##

07498

Hughes, A. N., M. D. Scheer, and R. Klein

THE REACTION BETWEEN O(3P) AND CONDENSED OLEFINS BELOW 100 DEG K. J. Phys. Chem., 70(3):798-805, March 1966.

The addition of oxygen atoms to condensed simple olefins has been studied in the 77 to 90 deg K temperature range. The ground-state O(3P) atoms were generated in the gas by dissociation of O<sub>2</sub> on rhenium or tungsten surfaces heated to 2300 deg K. At 90 deg K and oxygen pressures below 40 mtorr, the major products were found to be the unfragmented epoxides and carbonyls. Above 50 mtorr, ozonides and oxygenated products characteristic of rupture at the double bond were observed. Above 100 mtorr only the ozonides and their fragments were produced. At 77 deg K, the ozonolysis reaction occurred at much lower oxygen pressures. Comparison of these results with those obtained in the gas phase at 300 deg K indicates that the low-temperature environment efficiently removes the excess energy from the excited biradical formed in the primary act of O atom addition to the double bond. In all cases studied, fragmentation was less extensive than the comparable gas phase process. (Authors' abstract)##

07509

Scheer, Milton D. and Ralph Klein

OXYGEN ATOM REACTIONS WITH CONDENSED OLEFINS. Science, 144(3623):1214, June 5, 1964. 4 refs.

Gaseous oxygen atoms, thermally generated from O<sub>2</sub> on a 2300 deg K zirconia surface, react with simple condensed olefins below 100 deg K. Initial results indicate that the distribution of products differs from that obtained in the gas phase at higher temperature. Reaction between the condensed olefins and oxygen atoms differ from the gas phase results in that neither CO nor CO<sub>2</sub> are formed as reaction products. (Authors' abstract, modified)##

07510

Schneider, Ronald A. and Jerrold Meinwald

PHOTOCHEMICAL REACTIONS OF ALPHA, BETA-UNSATURATED CARBONYL COMPOUNDS WITH OLEFINS. J. Am. Chem. Soc., 89(9):2023-2032, April 26, 1967.

The synthesis of trans-5,5,6-trimethyl-3,6-heptadien-2-one is described. Upon irradiation, it is converted into the cis isomer which undergoes two modes of intramolecular cycloaddition to form 1,4,7,7-tetramethyl-3-oxabicyclo(4.1.0)hept-4-ene and 1,3,6,6-tetramethyl-2-oxabicyclo(3.1.1)hept-3-ene. The cycloadditions are considered to proceed through a diradical intermediate formed from s-cis. It is suggested that s-cis or s-trans conformational preference may be an important factor in determining the mode of photo-reaction of alpha beta-unsaturated carbonyl compounds with olefins. The s-trans-1-acetylcyclohexene was found to react with isobutylene to form cis-1-acetyl-2-methylallylcyclohexane without side reactions. Several s-cis enones were found to be photochemically reactive. Some general rules are presented which summarize existing observations for this class of reactions.##

Slater, David H., Susan S. Collier, and Jack G. Calvert

THE PHOTOLYSIS OF 1,1'-AZOISOBUTANE VAPOR AT 3660 Å; THE REACTIONS OF THE ISOBUTYL FREE RADICAL. Preprint, Ohio State Univ., Columbus, Evans Chem. Lab., (25) p., (1967). (Presented at the Robert Livingston Photochem. Symposium, Minneapolis, Minn., May 9, 1967 and 154th Nat. Meeting, Amer. Chem. Soc., Chicago, Ill., Sept. 1967.)

The vapor phase photolysis of 1,1'-azoisobutane was studied in experiments at wavelength 3660 Å and at various temperatures and pressures. The product rate data fit well the suggested reaction scheme involving an excited azoisobutane molecule and reactions of the isobutyl free radical. The ratio of rate constants for the disproportionation and combination reactions of the isobutyl radical was estimated to be 0.075 plus or minus 0.007 (25-168 deg). Rate constants for the H-atom abstraction and the decomposition reactions of the isobutyl radical were derived. From the effects of pressure and temperature on the quantum yield of nitrogen, an estimate was obtained for the rate constant for the excited az/-molecule decomposition reaction. If the excited singlet were the reactant, then fluorescence emission should be observable from the azoisobutane. No emission was detectable even in experiments at -180 deg.##

07607

Stein, K. C., J. J. Feenan, G. P. Thompson, J. F. Schultz, L. J. E. Hofer, and R. B. Anderson

THE OXIDATION OF HYDROCARBONS ON SIMPLE OXIDE CATALYSTS. J. Air Pollution Control Assoc., 10(4):275-281, Aug. 1960. 2 refs. (Presented at the 52nd Annual Meeting, Air Pollution Control Assoc., Los Angeles, Calif., June 21-26, 1959.)

A large number of catalysts have been laboratory tested for the oxidation of various hydrocarbons for the purpose of developing catalysts which may be suitable for oxidizing hydrocarbons in automobile exhaust gas. A large number of catalysts were tested using the rapid microcatalytic- chromatographic technique. A group of eight hydrocarbons was selected for study, comprising n-pentane, isopentane, pentene-2, pentyne-1, n-hexane, cyclohexane, 2,3 - dimethylbutane, and benzene. Many oxides of some of the metals of groups IB, VB, VIB, VIIIB, and VIII of the periodic table were selected. A list selected from the oxides used, together with their B.E.T. surface areas and x-ray diffraction data is shown in Table I. Results show that: branched hydrocarbons are more difficult to oxidize than normal hydrocarbons; ease of oxidation increases with molecular weight in homologous series; unsaturated aliphatic hydrocarbons are more easily oxidized than the corresponding paraffins; in comparing open chain and cyclic compounds having the same number of carbon atoms, reactivity toward oxidation probably decreases according to the sequence; the most active single oxide catalysts were found to be the oxides of cobalt, nickel, manganese, chromium, cerium, titanium, and iron. It is conceivable that different forms or preparations of the same oxide would have different activities. The microcatalytic - chromatographic technique has proved to be a very convenient means for rapid screening in oxidation studies. It is to be recommended where a

large number of catalysts or reactants are to be investigated or where a wide range of temperatures is to be used.

07682

General Electric Company, Lynn, Massachusetts, Direct Energy Conversion Operation

HYDROCARBON - AIR FUEL CELLS. Contract No. Da 44-009 AMC 479 (T), Technical Summary Rept. No. 10, 235p., Dec. 31, 1966.

CFSTI, DDC: AD 649895

Detailed information is presented on a continuing research and development program to develop a direct hydrocarbon oxidation-air fuel cell technology. Current work included research on electrocatalysts, multi-component fuels, and investigations with alternate acid electrolytes. Phosphoric acid seemed to be the best electrolyte in spite of the anodic cycling which has been observed in single cells. Teflon-bonded platinum electrodes supported on tantalum screens were chosen in spite of their limited life and high cost. Normal octane was chosen as the fuel, even though it also is expensive. The result of the system study was, therefore, a view of the upper limit in performance attainable today, even though the system is expensive. The system analysis of a direct liquid hydrocarbon system showed the optimum components and conditions to be: (1) Phosphoric acid electrolyte about 96 w/o at 150 C, with a 1/16 inch electrolyte; (2) Platinum electrodes of active area 10 by 15 inches; (3) Normal octane as the fuel and air as the oxidant; and (4) Three times stoichiometric reaction air. Such a system is capable of delivering 540 watts net at an overall efficiency of 20 percent based on higher heating value. The system is water conservative at ambients of 85 F or lower. About 60 watts is needed for parasitic power if free convection cooling is used. Not much system weight reduction could be obtained by decreasing the electrolyte gap by half, but the weight could be reduced by 40 percent by designing for an operating temperature of 180 C. The high concentration of acid needed at 180 C poses a problem of electrolyte solidification upon cooling after shutdown of the unit. Free convection cooled auxiliaries were favored for system simplicity and higher efficiency. A conceptual layout of a 0.5 kw system for the free convection configuration operating at 150 C is presented.

07705

Asset, Gabrielle and Thomas G. Hutchins

LEEWARD DEPOSITION OF PARTICLES ON CYLINDERS FROM MOVING AEROSOLS. Am. Ind. Hyg. Assoc. J., 28(4):348-353, July-Aug, 1967. 9 refs.

A study of leeward deposition of moving aerosols on cylinders was conducted by exposing glass rods of various dimensions to aerosols in a wind tunnel. Particles of several size ranges were carried to the target at three different velocities. For each exposure, the ratio between the number of particles counted on the leeward side of the cylinder and the number counted over an equal area on the windward side was calculated, as was the impaction parameter corresponding to the mean particle size. When the impaction

parameter was smaller than 0.085, the ratio did vary, generally showing an increase with decreasing particle size and wind velocity but with increasing cylinder size.

07791

Benson, S. W.

MECHANISM OF THE DIELS-ALDER REACTIONS OF BUTADIENE. J. Chem. Phys., 46(12):4920-4926, June 15, 1967.

Kinetic data on the pyrolysis of 1,5-cyclooctadiene to give butadiene and 4-vinyl cyclohexene by parallel paths are analyzed and shown to be quantitatively consistent with a common biradical precursor, the octadien-2,6,-diyl-1,8 biradical. It is further shown that these data are in excellent agreement with independent studies of the reverse reactions; pyrolysis of 4-vinyl cyclohexene to butadiene and the dimerization of butadiene. A fourth study of the pyrolysis in solution of 1,2-divinyl cyclobutane to give butadiene, 1,5-cyclooctadiene, 4-vinyl cyclohexene, and cis-trans isomerization is shown to fit the same scheme with only minor modifications in two of the rate constants. The analysis lends support to the 12.6-kcal assignment of the allyl stabilization energy. It also resolves an apparent anomaly in the rate parameters for the reverse Diels-Alder pyrolyses of cyclohexene, 3-methyl cyclohexene, and 4-vinyl cyclohexene. Arrhenius parameters for all the elementary rate constants are assigned and shown to be reasonable compared to similar processes. Important rotation-controlled rates in the scheme are examined and conclusions drawn about the contributions of different rotameric forms of the biradical. (Author's abstract)##

07798

Hess, L. D., J. L. Jacobson, K. Schaffner, and J. N. Pitts, Jr.

STRUCTURE AND REACTIVITY IN THE VAPOR-PHASE PHOTOLYSIS OF KETONES. V. ALIPHATIC CYCLOPROPYL AND OLEFINIC KETONES. J. Am. Chem. Soc., 89(15):3684-3688, July 19, 1967. 34 refs.

Vapor-phase irradiations of the aliphatic cyclopropyl and olefinic ketones, methyl cyclopropyl ketone(I), 1-cyclopropyl-2-propanone (II), 1-cyclopropyl-3-butanone (IV), and 1-penten-4-one (III) at 3120 Å and 120 degrees have been carried out. Quantum yields of yields of carbon monoxide from the type I split are 0.04 for ketone I, 0.88 for ketone II, 0.71 for ketone IV and 0.60 for III. Other primary photochemical processes in these ketones are the isomerization of cyclopropane in compounds I and II, and the type II split in compound IV. The data from these reactions together with previously reported results provide the basis for a coherent evaluation of the relationship between structure and photoreactivity in the vapor phase at 3130 Å and 120 degrees of the two series of closely related aliphatic and cyclic ketones which possess cyclopropyl and double bonds, respectively, in the alpha, beta and gamma positions to the carbonyl group. (Authors' abstract, modified)

07806

Alley, F. C.

A BENCH SCALE REACTION SYSTEM FOR MEASURING ATMOSPHERIC SMOG POTENTIAL. Preprint, Clemson Univ., S. C., Chemical Engineering Dept., ((10p.)), 1966. (Presented at the 21st Annual Instrument Society of America Conference & Exhibit, New York City, Oct. 24-27, 1966, Paper No. 11.3-1-66.)

Photochemical smog results when the atmosphere contains certain hydrocarbons and oxides of nitrogen and is irradiated under favorable conditions of temperature and humidity. If smog control efforts are to be successful, the complex series of reactions by which smog is produced must be completely understood from a standpoint of reaction mechanism and kinetics. This paper describes a bench scale photo-chemical reaction system for simulating the processes occurring when a polluted atmosphere is irradiated by sun light. The flexibility of the system as well as the capabilities and limitations of several existing pollutant monitoring devices are discussed. (Author's abstract)

07988

Norris, Logan A. and David Greiner

THE DEGRADATION OF 2,4-D IN FOREST LITTER. Bull. Environ. Contamination Toxicol., 2(2):65-74, 1967. 9 refs.

The influence of forest litter type and several chemical factors on the persistence of 2,4-D in forest litter was determined. 2,4-D is rapidly degraded in forest litter and the rate of degradation varies with the type of litter, herbicide formulation and the presence of DDT. The degradation of 2,4-D varies slightly in litter from different vegetation types when incubated under similar environmental conditions. Greater variation in herbicide degradation rates may be expected in the field; but this will be due primarily to differences in the site microenvironment, rather than inherent differences in the litter. Various formulations of 2,4-D are degraded at different rates in forest litter although this is believed to be more a function of constituents of formulation than a direct effect of the technical acid, salt or ester. Finally, these experiments have shown that up to 4 gallons per acre of diesel oil has little or no effect on the decomposition of 2,4-D isooctyl ester, while 1 lb./A. of DDT appears to stimulate herbicide degradation. ASM##

08078

Kamel, Mostafa M. and Eric A. Lundstrom

CONTINUOUS GAS MIXING BY THE USE OF CRITICAL FLOW THROUGH SMALL DIAMETER TUBES. California Univ., Berkeley, Coll. of Engineering, Grant AF-AFOSR-129-67, TN-2-67, AS-67-3. ((60))p., March 1967. 10 refs.

CFSTI, DDC: AD 651637

A continuous-flow gas mixing device is introduced utilizing critical flow in small-diameter tubes and commercially available hypodermic needles, where the flow rate is fixed by the stagnation pressure upstream. The assumption of laminar adiabatic flow of a perfect gas with friction is found to be adequate for smaller I.D. tubes. This assumption becomes less accurate for larger tubes or higher stagnation pressures due to increasing Reynolds numbers beyond the laminar-transition region. The continuum assumption holds for all gases considered (hydrogen, helium, hydrogen, acetylene, Nitrogen, oxygen, and argon) excepting hydrogen and helium where slip flow occurs at low pressures for small diameter tubes. This effect can be neglected experimentally where it is over-shadowed by the larger effect due to tolerance in the inside diameter of the tubes. Hypodermic needles of regular tip and nominal length equal to the required length can be used directly introducing an error less than 10 percent due to the combined effect of tolerance, pointed tip, and longer actual length. Less error can be obtained by painting the needle with insulating material to reduce heat transfer and by grinding the tip to the required length. In the latter case, care must be taken to keep the tip clean and undistorted. For greater accuracy each needle should be calibrated individually. AS

08105

R. S. Juvet, Jr. P. L. Tanner, J. C. Y. Tsao

PHOTOLYTIC DEGRADATION AS A MEANS OF ORGANIC STRUCTURAL DETERMINATION. J. Gas Chromatog., 5(1):15-21, Jan. 1967. 15 refs.

Difficulty reported by many authors obtaining reproducible results in inter-laboratory studies using the pyrolysis-gas chromatographic technique prompted an investigation of other, more reproducible, methods of sample decomposition. The method chosen was mercury-sensitized photolytic decomposition because of the simplicity of the experimental technique, the simplicity of the fragmentation patterns, the predictability of the decomposition products, and the availability of ultraviolet light sources in many well-equipped laboratories. This proved to be a particularly fortunate choice since, not only are results highly reproducible, but preliminary work led to the discovery that functional groups present in a sample may be identified by characteristic constants related to the retention of certain irradiation product peaks called homologous peaks and common peaks, eliminating the need for identification of the decomposition products in evaluating the structure of the sample. In this paper, the procedure is discussed in detail and the decomposition product retention parameters are tabulated for aldehydes, ketones, alcohols, esters, and ethers. (Authors' abstract)##

08118

C. J. Thompson, H. J. Coleman, R. I. Hopkins, H. T. Rall

HYDROGENOLYSIS-AN IDENTIFICATION TOOL. J. Gas Chromatog., 5(1):1-10, Jan. 1967. 7 refs.



The development of equipment and techniques that permit application of Sabatier's classical discoveries in vapor-phase hydrogenation to micro samples was accomplished just six years ago in Bartlesville Petroleum Research Center. Since then, many improvements in the procedure have been made. Identifications of sulfur compounds in petroleum, previously thought impossible with the quantities of materials available, are now being made routinely. Many laboratories around the world are using the procedure and modifications thereof. The hydrogenolysis apparatus for structure determination of naturally occurring organic compounds is described. This technique rapidly and quantitatively removes the sulfur atom from organic sulfur compounds to produce paraffins or cycloparaffins. Identification of the produced hydrocarbon identifies or contributes to the identification of the precursor. The technique is direct, applicable to extremely small samples (0.000005 ml), and requires no costly apparatus. The method also has been applied successfully to halogen-, oxygen-, and nitrogen-containing compounds. In addition it has been applied, with success, to the removal of other hetero atoms such as phosphorus, silicon, and metals. Only a few anomalies have been found, principally in the deoxygenation reaction. The basic technique, with recent improvements, permits structure characterization that would be difficult or impossible by any other procedure.##

08337

Naumann, Peter

THE VOLATILITY OF AEROSOLS. Staub (English translation), 27(8):4-5, Aug. 1967. 5 refs.

CFSTI: TT 67-51408/8 (HC \$2.00)

Many organic compounds occurring as suspended matter have a volatility (i.e., the maximum possible vapor concentration) which is many times higher than the maximum allowable concentration value. Although these substances occur in the form of suspended matter, it must be taken into account that they may also be present in the form of gas (vapor). This fact is important in the selection of a suitable respirator. It is proposed, therefore, to give in the MAC list, in the case of these substances, the MAC value not only in mg cu m but also in ppm, and to emphasize the necessity of using a combined suspended matter gas filter. (Author's summary, modified)##

08353

Hoare, E. E. and D. A. Whytock

PHOTO-OXIDATION OF DIETHYL KETONE VAPOR. Can. J. Chem. (Ottawa), Vol. 45, p. 2841-2845, 1967. 9 refs.

Results from studies of the photo-oxidation of diethyl ketone are reported. Quantum yields of the products of the reaction of diethyl ketone when photolyzed in the presence of oxygen with eight of 3130A were studied as a function of time at 150 and 100 C. The reaction products were mostly the same as those from the photo-oxidation of methyl ethyl ketone. In addition, propionic acid and ethylene were products at 150 and 100 C, while trace amounts of acetone and methyl ethyl ketone were detected at 150 C.

The variety of the reaction products and the absolute values of their quantum yields indicate that the reaction is a complex chain reaction of short length. The primary photolysis split is well established. The chain reaction must be caused by hydrogen abstraction from the ketone molecule by a radical during which two types of 3-pentanonyl radical may be formed.##

08558

Hamming, Walter J.

PHOTOCHEMICAL REACTIVITY OF SOLVENTS. S.A.E. (Soc. Automotive Engrs.), Preprint 670809, 14p., 1967. 5 refs. (Presented at the Aeronautic & Space Engineering and Manufacturing Meeting, Los Angeles, Calif., Oct. 2-6, 1967.)

Evaluative studies of relative photochemical reactivities of various organic solvents for purposes of emission control are reported. Solvents include olefins, xylenes and other aromatics of comparable weight, toluene, branched ketones, tri- and tetrachloroethylene; benzene, and saturated halogenated hydrocarbons. Criteria used to judge relative photochemical reactivity were mainly eye irritation and ozone formation. Initial judgments based on these standards were also influenced by aerosol formation, aldehyde production, and effect of test substances on rate of conversion of NO to NO<sub>2</sub>. The results of the entire study show clearly that xylene is more reactive than toluene and some olefins. However, the latter, as a group, appear to have the greatest photochemical reactivity of all hydrocarbon types. Normal ketones, such as methyl ethyl ketone, are slightly reactive, but branched ketones, such as methyl isobutyl ketone, are somewhat more reactive than their normal isomers. Chlorinated ethylenes, except perchloroethylene, appear to be photochemically active to a degree roughly comparable with branched ketones and toluene. Alcohols and aldehydes are less reactive than toluene; and branched hydrocarbons, cyclic paraffins, and normal paraffins, still less so. Benzene, perchloroethylene, saturated halogenate hydrocarbons and acetone appear virtually unreactive. The results of this study clearly demonstrated that both the quantity of organic solvent emissions in Los Angeles County and their overall photochemical reactivity were such that a reduction was necessary. The results of the studies were utilized to construct Rule 66 for the control of organic solvent emissions in Los Angeles County.

08645

Lichtenstein, Stanley

INSIDE AIR POLLUTION--THE VIEW FROM NBS. Ind. Heating, 34(7):1250, 1252, 1254, 1258, 1260, July 1967. Also: Air Eng., 9(11):12-15, Nov. 1967.

Investigations by U.S. Bureau of Standards are finding out what happens to estimated total of 140 million tons of pollutants fed into atmosphere annually by motor vehicles, industry, power plants, space heating and refuse disposals. Various methods used in studies of air pollution are discussed. Several scientific teams making important contributions to air pollution are listed.

Wei, Kei, Jean-Claude Mani, and J. N. Pitts, Jr.

THE FORMATION OF POLYENIC DIALDEHYDES IN THE PHOTOOXIDATION OF PURE LIQUID BENZEN. J. Am. Chem. Soc., 89(16):4225-4227, Aug. 2, 1967. 14 refs.

The photooxidation of dry, liquid benzene, has been investigated and among the several products that were formed, two polyenic dialdehydes; trans, trans-2,4-hexadienedial (mucondialdehyde, I) and 2,4,6,8,10-dodecapentaenedial, II, were isolated. Unfiltered radiation from a medium-pressure mercury lamp was used to irradiate at room temperature pure, dry, liquid benzene through which oxygen was continuously bubbled. The irradiated benzene was chromatographed twice on silica gel, giving three fractions. The first fraction eluted with an 80:20 pentane-ether solution, contained mucondialdehyde (I). The second fraction, eluted with a 70:30 pentane-ether solution, contained dialdehyde II. Infrared, ultraviolet, and nmr techniques were used to determine the physical and spectroscopic properties of I and II. Confirmatory evidence was obtained by mass spectrometry and by microhydrogenation which, in the case of II, yielded a product identical with an authentic sample of 1,12-dodecanediol. The physical and spectroscopic properties of the products, specifically infrared spectrum comparisons, confirm the all-trans configurations for both compounds. Results suggest that benzene ring opening by oxygen may also be involved.##

08845

Altshuller, A. P., S. L. Kopczynski, W. A. Lonneman, T. L. Becker, and D. Wilson

PHOTOOXIDATION OF PROPYLENE WITH NITROGEN OXIDE IN THE PRESENCE OF SULFUR DIOXIDE. Preprint, Public Health Service, Cincinnati, Ohio, National Center for Air Pollution Control, ((10))p., ((1967)). 13 refs.

The photooxidation of 2 ppm of propylene and 0.5 ppm of nitrogen oxide was investigated under dynamic flow conditions with sulfur dioxide present in the reaction mixtures at concentrations from 0.0 to 1.2 ppm. Application of the statistical 't' test showed no significant differences in rates of consumption of propylene and nitrogen oxide or in yields of oxidant, peroxyacetyl nitrate, formaldehyde, and acetaldehyde among tests at the various levels of sulfur dioxide, including zero ppm. Amounts of sulfur dioxide consumed in the reactions ranged from 25 to 60%. Although a sulfur balance was not obtained, appreciable amounts of sulfate were measured as a product of the oxidation of the sulfur dioxide. On the basis of previous investigations, the sulfate is believed to be present as sulfuric acid aerosol. These results suggest that appreciable levels of oxidant may occur in urban atmospheres even when high concentrations of sulfur dioxide are present. (Authors' abstract)##

Hess, L. D. and J. N. Pitts, Jr.

STRUCTURE AND REACTIVITY IN THE VAPOR-PHASE PHOTOLYSIS OF KETONES. IV. CYCLOPROPYL AND OLEFINIC CYCLIC KETONES. J. Am. Chem. Soc., 89(9):1973-1979, April 26, 1967. 32 refs.

Vapor-phase irradiation of bicyclo((3.1.0))hexan-3-one (I) and 3-cyclopentenone (III) at 3130 and 2380-2654 Å results in the formation of carbon monoxide and hydrocarbon products with high quantum efficiencies,  $\phi$  (sub CO) equals 0.77 and 0.87 for I and II, respectively, under a variety of experimental conditions. The hydrocarbon products from I and 1,4-pentadiene (major), vinylcyclopropane, and 1,3-butadiene, while III gives almost exclusively butadiene ( $\phi$  (sub CO) equals 0.88) over a wide range of temperatures. In contrast, irradiation of bicyclo((3.1.0))hexan-2-one (II) and 2-cyclopentenone (IV) under identical conditions produces only trace amounts of CO and no detectable hydrocarbons. However, compound II does undergo a photoinduced rearrangement to form 3-methyl-2-cyclopentenone. The cyclopropyl and double-bond groups were found to exhibit similar effects on the modes of photoreactivity of these four cyclic ketones. Either of these groups conjugated with the carbonyl chromophore stabilize the ketone, whereas their location in the homoallylic position greatly facilitates photodecomposition. (Authors' abstract)##

09030

B. A. Lombos, P. Sauvageau, C. Sandorfy

THE ELECTRONIC SPECTRA OF NORMAL PARAFFIN HYDROCARBONS. Chem. Phys. Letters (Amsterdam), Vol. 1, p. 42-43, March-April 1967. 3 refs.

The far ultraviolet absorption spectra of the normal paraffin hydrocarbons from C1 to C8 were photoelectrically recorded with a double beam instrument down to 1150 Å under 0.2 Å resolution. An attempt is made to interpret the spectra in terms of Mulliken's united atom treatment of the excited states of methane and ethane. (Authors' abstract)##

09046

Sage, B. H.

PARTIAL OXIDATION PRODUCTS FORMED DURING COMBUSTION. (EIGHTEENTH PROGRESS REPORT: JULY 1 TO DECEMBER 31, 1967.) Preprint, California Inst. of Tech., Pasadena, Chemical Engineering Lab., ((65))p., 1967. ((21)) refs.

The modifications in the pressure combustor were found to function satisfactorily and have permitted measurements of both the perturbations in normal stress and the perturbations in total and monochromatic optical intensity. Experimental activities have been limited primarily to obtaining information concerning the perturbations in total and monochromatic optical intensities

utilizing air and natural gas as fuel. Results are presented in several tables. To more fully explain the behavior in the pressure combustor, a set of routine computer programs to permit the prediction of the composition of the products of reaction for any mixtures of air and any hydrocarbon was completed. The calculations have been carried out for varying rates of heat loss from the combustor. The exit temperature from the combustor was computed in this fashion. It was also computed from the rate of flow of gas through the converging-diverging nozzle at the exit of the combustor. Rather good agreement was obtained between these widely different means of evaluating the exit temperature. The complicated behavior of the perturbations in normal stress at the two ends of the combustor is depicted. The behavior depicted can be explained by the difference in temperature at the two ends of the combustor and the markedly greater radial temperature distributions near the exit of the combustor. Furthermore, the velocity of wave propagation is somewhat different at the same point in the combustor depending on the direction of propagation as a result of the local momentum velocity of the gases. A manuscript derived from the work upon the oscillatory combustion in the pressure combustor, has been completely reworked. A significant amount of additional experimental information was included. The revised manuscript which covers all of the experimental work that has been completed with the pressure combustor for the air-natural gas system, is appended.##

09078

Cadle, R. D. and F. E. Grahek

PHOTOCHEMISTRY OF THE SYSTEM KETENE-NO-H<sub>2</sub>. In: International Conference on Photochemistry Held at Munchen, September 6-9, 1967, Part I, Preprints. Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr, West Germany, p. 113-125, Sept. 1967.  
CFSTI: PB 176466

Nitric oxide has been found to react rapidly with singlet methylene produced by the photolysis of ketene and possibly also with excited ketene, judging from the ratios ethylene produced/ketene reacted. The presence of nitric oxide prevented the formation of methane and ethane when ketene-NO-H<sub>2</sub> mixtures were irradiated at room temperature or 200 C. The products resulting from the presence of nitric oxide were all of low molecular weight, judging from the mass spectra. Eight products were separated using gas chromatography and their mass and infrared spectra determined. Only one, hydrogen cyanide, was definitely identified. (Authors' abstract)

09079

K. F. Preston, R. J. Cvetanovic

THE PHOTOOXIDATION OF BUTENE-1 BY NITROGEN DIOXIDE AT SHORT WAVE-LENGTHS. In: International Conference on Photochemistry Held at Munchen, September 6-9, 1967, Part I, Preprints. Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr, West Germany, p. 166-192. Sept. 1967.  
17 refs.  
CFSTI: PB 176466

The photooxidation of butene-1 by nitrogen dioxide has been studied at 2288 Å and at longer wavelengths. From the measured effects of additions of inert and other gases on the product yields it is concluded that 1D2 oxygen atoms participate in the photooxidation at 2288 Å. Ground state oxygen atoms, produced by the photodissociation of NO2 and possibly by quenching of O(1D) by the olefin, are also important in the photooxidation at 2288 Å, and are believed to give rise to practically all of the observed yields of the addition products, n-butanal and 1,2 epoxybutane. The indications are that the reaction of O(1D) with butene-1 at total pressures below one atmosphere yields very little stabilized addition product. (Authors' abstract) ##

09080

Peter Borrell, P. Cashmore

THE UNSENSITISED ((SIC)) PHOTOLYSIS OF BUT-1-ENE AT 1849 Å.

In: International Conference on Photochemistry Held at Munchen, September 6-9, 1967, Part I, Preprints. Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr, West Germany, p. 193-210, Sept. 1967. 16 refs.

CFSTI: PB 176466

On photolysis at 1849 Å, but-1-ene yields 25 hydrocarbon products and a solid polymer. In order to elucidate the mechanism, the effects of added gases, time, pressure of reactant gas and temperature were investigated. A free radical mechanism is postulated in which there are six primary reactions to account for the products and their relative yields. The two major primary reactions are cleavage of the C-C and C-H bonds in the Beta position to the double bond in a 6:1 ratio. Addition of foreign gases to the system caused a decrease in the product yield which was shown to be due to quenching of the reaction. This is attributed to the collisional deactivation of an excited state intermediate of which the decomposition lifetime has been estimated to lie within the values of  $2.6$  to  $6.4 \times 10^{-10}$  to the minus 10th power sec. (Authors' abstract) ##

09082

Paul Suppan

SOLVENT AND TEMPERATURE EFFECTS IN THE PHOTOREDUCTION OF KETONES. In: International Conference on Photochemistry Held at Munchen, September 6-9, 1967, Part II, Preprints. Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr, West Germany, p. 643-658, Sept. 1967. 15 refs.

CFSTI: PB 176466

The dependence of the quantum yield of photoreduction on solvent polarity and on temperature has been investigated for a number of substituted aromatic ketones. An interpretation in terms of the dipole moments in excited states to account for the solvent effect is discussed. From the temperature effect it is suggested that the different reactivities of n- $\pi^*$ ,  $\pi$ - $\pi^*$ , and CT states is related to an activation energy. (Author's abstract) ##

090851

Smith, C. W., C. M. Ablow, S. V. Hanagud, E. M. Spurlock, and D. R. Grine

ULTRASONIC DISSEMINATION OF AEROSOLS. Stanford Research Inst., Menlo Park, Calif., Contract DA-18-035-AMC-122(A), Proj. PAU-4900, Task 1B522301A08101, SRI-TR-9, 67p., July 1967. 9 refs.  
CFSTI, DDC: AD 818285

The basic mechanism of sonic aerosol formation was investigated. Aerosol production from a thin liquid layer on a vibrating surface has been known for many years, yet the basic mechanism controlling the drop formation is not known with certainty. Two possibilities are generally suggested. One is that capillary waves, excited on the surface, grow to an unstable size and throw off droplets from the peaks of the waves. The other possibility is the mechanism of cavitation. The theory of a liquid flow over the surface of an oscillating reed was studied to help the understanding of high flow-rate devices. A simple resonance theory has been developed which contrasts with the usual parametric capillary wave theory. An experimental photo-optical technique has been devised and used to give quantitative information on droplet size and velocity distributions. Capillary wave behavior has been examined experimentally and compared with existing theory. A possible explanation of the transition of capillary waves to an aerosol has been suggested. The existence of cavitation during sonic aerosol production from water was verified.

09099

E. C. Kuster, D. Comery

DETERMINATION OF WATER SOLUBLE ADDITIVES IN LIQUID HYDROCARBON FUELS. Australian Defence Scientific Service, Melbourne, Defence Standards Labs., TN-103, 8p., Sept. 1967.  
CFSTI, DDC: AD 822973

Ethylene glycol monomethyl ether, with or without glycerol, is currently being used as an additive to inhibit ice formation at low operating temperatures, or microbiological growth at ambient temperatures in liquid hydrocarbon fuels. A simple, efficient testing technique for use in the field to determine additive concentrations in fuel storage tanks has been developed and is based on the determination of refractive index of an aqueous extract. It consists of extracting a measured .80 ml of fuel, in a 100 ml rubber-capped serum bottle, with 1.00 ml of distilled water injected from a calibrated 1 ml hypodermic syringe. After adequate shaking and settling, the aqueous extract is removed, again with a hypodermic syringe, and its refractive index read on a conventional Abbe type refractometer. Under field conditions, tests on samples of known concentration show that results accurate to 0.004% can be easily obtained with concentrations up to 0.20% additive in fuel.\*\*

09116

Horvath, H.

THE REFRACTIVE INDEX OF FREON 12. Appl. Opt., 6(6):1140, June 1967. 2 refs.

The refractive index of Freon 12 (dichlorodifluoromethane) was measured with a Michelson interferometer by counting the fringes during evacuation and refilling the gas cell. The results were reduced to 20 C and 760 mm Hg and can be easily converted to other working conditions. Refractive index has the greatest influence on the scattering coefficient. The amount of scattered light is estimated to be 14.4 times larger for Freon than for air. Using a very sensitive light scattering instrument (integrating nephelometer), the ratio was found to be 15.4 plus or minus 0.7.##

09172

Pejack, Edwin R., and Henry R. Velkoff

EFFECTS OF A TRANSVERSE ELECTRIC FIELD ON THE CHARACTERISTICS AND HEAT TRANSFER OF A DIFFUSION FLAME. Ohio State Univ., Research Foundation, Columbus, Contract DA-31-124-ARO-D-246, Proj. 1864, TR-8, 134p., Nov. 1967. 52 refs.  
CFSTI, DDC: AD 664180

Effects of a transverse electric field on a parallel flow diffusion flame in a flat combustion chamber were investigated. Various mixtures of propane, nitrogen, and air were introduced separately at the base of an experimental combustion chamber and burned in a diffusion flame sheet located between flat walls of the chamber which served as anode and cathode. The electrode walls were instrumented to measure the local heat transfer rate, local current density, and pressure. It was found that the application of a voltage difference across the electrodes moved ions out of the burning zone and resulted in a current at the electrode walls. The heat transfer rate near the base of the flame was considerably increased on the cathode and decreased on the anode; at positions further from the base of the flame the electric effect was lessened. Flame distortion was thought to be caused by electrically induced gas motion derived from a gradient in current density in the flow direction and by the onset of an electrically induced flame flickering. An analysis of the products of combustion revealed that the applied electric field acted to increase the amount of unburnt solid carbon and decrease the quantities of unburnt fuel and carbon monoxide. (Authors' abstract) ##

09197

W. J. Thomas, B. John

KINETICS AND CATALYSIS OF THE REACTION BETWEEN SULPHUR AND HYDROCARBONS. Trans. Inst. Chem. Engrs. (London), 45(3):T119-T127, 1967. 23 refs.



A study of the thermodynamics of the synthesis of carbon disulphide from sulphur and hydrocarbons reveals those conditions which are most favourable for high yields of carbon disulphide without the disadvantages of carbon deposition. Although high molecular weight hydrocarbons should give equilibrium yields of carbon disulphide, some qualitative experiments showed that only the side-chain carbon atoms of aromatic hydrocarbons are active in forming carbon disulphide. Catalyst-activity tests that both silica-gel and vanadium pentoxide are superior catalysts for the formation of carbon disulphide from methane and sulphur. A detailed quantitative kinetic investigation, supplemented by adsorption studies, shows that the formation of carbon disulphide on a sulphided vanadium pentoxide catalyst proceeds via the chemisorption of sulphur, and in this respect differs from the formation of carbon disulphide on a silica-gel catalyst. Although the products retard the reaction rate, the activation energy is lower on the supported vanadium pentoxide catalyst. The advantages of using a vanadium pentoxide catalyst are briefly discussed. A suitable design equation for the rate of formation of carbon disulphide from methane and sulphur over a vanadium pentoxide catalyst is also presented. (Authors' abstract, modified)##

09200

Tipson, R. S., A. Cohen, and A. J. Patiadi

AIR POLLUTION STUDIES. In: Robert Schaffer (ed.), Organic Chemistry. July 1966 through June 1967, National Bureau of Standards, Washington, D. C., NBS-TN-427, 11p., Oct. 1967.

Studies have been conducted on polycyclic aromatic hydrocarbons and certain of their oxidation products. A description is given here of the detection of impurities in commercial preparations of polycyclic aromatic hydrocarbons. The procedures used to purify these preparations are discussed. The presence of an impurity in zone refined anthracene was demonstrated. Upon isolation with the use of thin-layer chromatography, carbazole was found to be an impurity. Upon re-examination by thin-layer chromatography two other impurities were discovered. A dimer of anthracene, 9,9:10,10-bianthracene, was prepared. Its ultraviolet and infrared spectra were recorded. In order to establish specifications of purity for anthracene as a possible standard a comparison was made between three commercial samples of anthracene: high purity, synthetic and zone-refined. It was shown that the synthetic anthracene is the purest of the three samples. Fluorene was similarly studied.##

09267

Doepker, R. D., S. G. Lias, and P. Ausloos

PHOTOLYSIS OF CYCLOPENTANE AT 1470, 1236, AND 1048-1067 Å.  
J. Chem. Phys., 46(11):4340-4346, June 1, 1967. 23 refs.

The photolysis of cyclopentane has been investigated at wavelengths of 1470, 1236, and 1048-1067 angstroms. The primary process, which is the elimination of a hydrogen mole from

cyclopentane, is of major importance at 1470 angstroms but its quantum yield diminishes at shorter wavelengths where processes involving C-C cleavage becomes more predominant. The products formed in the gas-phase photolysis of cyclo-C5-D10-H2S mixtures and in the solid-phase photolysis of cyclo-C5H10 indicate that the excited cyclopentane molecule undergoes ring opening to form a 1-pentane molecule. In the gas phase, the internally excited 1-pentane decomposes to form methyl and ethyl radicals. At 1048-1067 angstroms, ionization is extensive. On the basis of an isotopic analysis of the propane formed in the photoionization of C5D10-C5H10-O2 mixtures the pattern of the dissociation of the parent ion is determined. Fragmentation of the parent ion diminishes with an increase in pressure. The collisional deactivation process is more pronounced for the perdeuterated than for the perprotonated cyclopentane ion. The data also indicate that a fraction of the parent ions undergoes ring opening to form cis or trans-2pentene as a final product. (Authors' Abstract)##

09700

Benson, S. W. and R. Shaw

KINETICS AND MECHANISM OF HYDROGENOLYSES. THE ADDITION OF HYDROGEN ATOMS TO PROPYLENE, TOLUENE, AND XYLENE. J. Chem. Phys., 47(10):4052-405 Nov. 15, 1967. 29 refs.

Previously measured rates of hydrogenolysis of propylene, toluene, and xylene all fit, within a power of 10, an empirical equation over an unusually wide range of conditions. The observed fractional -order kinetics require a radical chain mechanism; one is proposed which gives a theoretical rate equation which is in excellent agreement with all reliable data.

09745

Mieville, Rodney L. and Garbis H. Mequerian

MECHANISM OF SULFUR-ALKYLLEAD ANTAGONISM. Ind. Eng. Chem., Prod. Res. Develop., 6(4):253-257, Dec. 1967. 16 refs. 6(4):253-257, Dec. 1967. 16 refs.

Sulfur compounds reduce the antiknock effectiveness of alkylleads by a dual mechanism involving the induced decomposition of alkylleads by thiyl radicals and the deactivation of active PbO by SO2. With a fuel containing either tetraethyllead or tetramethyllead, octane losses in an engine and reductions in autoignition temperatures in a tubular reactor were determined for thiophene, thiophenol, butyl mercaptan, ethyl sulfide, ethyl disulfide, and di-tert-butyl polysulfide. The two effects correlate directly with each other. Autoignition experiments with an unleaded fuel in a tubular reactor coated with lead oxide showed that reduction in autoignition temperature was caused by SO2 produced by the oxidation of sulfur compounds. However, rates of SO2 production correlate with octane losses only for thiophene, ethyl sulfide, and disulfide. Octane losses caused by mercaptans and the polysulfide are high relative to their ability to induce decomposition of alkylleads at lower temperatures. The initiation of the decomposition is postulated to occur through thiyl radicals

in the liquid phase. Engine results with several fuels containing different sulfur compounds are consistent with the proposed dual mechanism. (Authors' abstract)

09750

Chaudhuri, J., J. Jagur-Grodzinski, and M. Szwarc

ELECTRON AFFINITIES OF AROMATIC HYDROCARBONS IN THE GAS PHASE AND IN SOLUTION. J. Phys. Chem. 71(9):3063-3065, Aug. 1967. 7 refs

Recent studies led to reliable determination of absolute values of electron affinities of aromatic hydrocarbons in the gas phase. The electron affinities were deduced from temperature dependence of the experimentally obtained electron-capture coefficients,  $K$ . To obtain a reliable value for electron affinity,  $K$  should be determined over a sufficiently wide temperature range within the high-temperature region. The experimental data show that the plots their slopes the values of electron affinity were obtained. The intercepts vary within plus or minus 1 of their mean value, and such variations are plausible because the ratios  $k_L/k_D$ , as well as  $f(\text{aromatic.} \rightarrow \text{neg. radical})/f(\text{aromatic})$  depend on the nature of the aromatic hydrocarbon. These ratios may vary by a factor of 2 or 3 when different aromatic hydrocarbons are compared, leading to uncertainty of more than 1 in the intercept. The assumption of a constant intercept, introduced by previous authors may not be justified. The accuracy of the calculated electron affinity, claimed by the authors and resulting from this assumption, would be  $f(\text{aromatic})$  varies by not more than 6 deg. A plot of the change in electron affinities obtained from the present studies vs. electron affinity deduced from studies of previous authors are plotted. The resulting points fit a straight line having a slope of 45 deg., indicating that free energy of solvation of aromatic.-ions (or more correctly the difference in the free energy of solvation of aromatic.- and aromatic) is virtually constant and independent of the nature of the hydrocarbon, at least within the investigated series.

09764

Altman, Philip L. and Dorothy S. Dittmer (comps. and eds.)

ATMOSPHERE AND POLLUTANTS. (CHAPTER V.) In: Environmental Biology, Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio, Contract AF33(615)-2252, NIH-GM-06553, NASA-NASr-238, Proj. 7164, Task 716406, AMRL-TR-66-194, p. 269-329, Nov. 1966. (300) refs.

Numerical data on air pollutants are compiled and tabulated for a broad range of problems. The effects of pollutants on human health, plants and livestock are presented. Characteristics and chemical composition of the atmosphere and its pollutants are compiled. Data on emission sources of pollutants and their distribution at various periods of time in different locales are presented. Other categories covered are air dispersion of small organisms, biological effects of gaseous ions, and spacecraft and nuclear submarine atmospheres.

Laseter, J. L., J. Weete, and D. J. Weber

ALKANES, FATTY ACID METHYL ESTERS, AND FREE FATTY ACIDS IN SURFACE WAX OF USTILAGO MAYDIS. *Phytochemistry*, Vol.7, p.001-005, 1968. refs.

The wax fraction from chlamdospores of *Ustilago maydis* (Basidiomycetes) were analyzed by gas chromatography and mass spectrometry combination. The hydrocarbon fraction contained predominantly C25, C27, and C29 n-alkanes. A second fraction eluted from a silica gel column contained natural methyl esters of both saturated acids with predominant esters being from C16 through C20. The methyl esters of C18 mono and dienolic fatty acids were present in abundance. The free fatty acid fraction contained fatty acids ranging in carbon number from C12 through C20. In both the free acid and natural methyl esters the distribution of carbon skeletons were similar with the predominant compounds having even carbon number chains. (Authors' abstract)

10039

Sternberg, H.W., C.L. Delle Donne, and I. Wender

SIMILARITY BETWEEN THE ELECTROCHEMICAL ELIMINATION OF SULPHUR FROM COAL AND FROM DIBENZOTHIOPHENE. *Fuel*, 47(3):219-222, May 1968. 5 refs.

When dibenzothiophene was reduced electrochemically under the same conditions as coal, sulphur was eliminated only after four hydrogen atoms had been added to the dibenzothiophene ring. A similar pattern of sulphur removal had been observed previously during the electrochemical reduction of coal where sulphur was eliminated only after 25 hydrogen atoms per 100 carbon atoms had been added to the coal. The hypothesis is that the first step in the electrochemical reduction of dibenzothiophene is addition of hydrogen to the aromatic ring. No carbon-sulphur bonds are broken and no sulphur is eliminated until partial hydrogenation of the aromatic ring has taken place.

10041

Goetz, Alexander and Olgierd J. Klejnot

TRANSFORMATION OF GASEOUS REACTIVE HYDROCARBONS INTO AEROCOLLOIDS BY ULTRAVIOLET IRRADIATION. *J. Air Pollution Control Assoc.*, 17(9):600-603, Sept. 1967.

A substantial variety of hydrocarbons, particularly the reactive types, can be converted from the gaseous into the aerocolloidal state by brief exposure to UV-irradiation. The procedure for evaluating the capacity of various hydrocarbons to form aerocolloids, and thus to define the difference between non-reactive and reactive types, is illustrated. Two sensing devices were utilized; an aerosol photometer and a moving slide impactor. A summary includes these observations: the aerocolloid formation by ultraviolet exposure is due to intermediate oxidation states of the molecules with a high

tendency to polymerize into sub micron particulates. High humidity levels increase the reaction rate and thus the aerosol formation. The characteristic difference between saturated and unsaturated HC types is the much lesser VU-reactivity of the former. This method permits the tracing of organic components in the open atmosphere. I promises to facilitate the simple and rapid discrimination between the neutral and potentially reactive HC types.

10045

Nemeth, Andras and Robert F. Sawyer

THE OVERALL KINETICS OF HIGH TEMPERATURE METHANE OXIDATION IN A FLOW REACTOR. California Univ., Berkeley, Division of Thermal Systems, 68-2, 20p., (1968). 20 refs.

The rate of methane consumption in an oxidation reaction was measured in a non-isothermal flow reactor in the temperature range of 1180-1282 deg. K. The reaction was monitored by mass spectrometric analysis. The following overall rate expression was found valid, however, only for temperatures greater than 1200 deg. K. The result is in reasonable agreement with data measured by another method in the high temperature range. (Authors' abstract modified)

10119

Laseter, J. L., D. L. Weber, H. Schneider, and J. Oro

STUDIES ON THE INCORPORATION OF ACETATE-1-14C AND STEARATE-UL-14C INTO THE HYDROCARBONS OF CHLORELLA PYRENOIDOSA. Houston Univ., Tex. Dept. of Biology and Biophysical Sciences, 10p., April 8, 1968. 10 refs.

Both labelled acetate and stearate were found to serve as precursors for the formation of hydrocarbons in Chlorella pyrenoidosa. Acetate incorporation was inhibited in the dark. Of particular interest was the observation that the carbon skeleton of stearic acid could be converted into heptadecane but not into the predominant monounsaturated C17 hydrocarbon. This study presents the first evidence that straight-chain fatty acids serve as precursors for short-chain saturated hydrocarbons. (Authors' abstract)

10129

Hurn, R. W., Basil Dimitriadis, and R. D. Fleming

EFFECT OF HYDROCARBON TYPE OF REACTIVITY OF EXHAUST GASES. In: Vehicle Emissions, Part II, SAE Progress in Technology Series, Vol. 12, New York, Society of Automotive Engineers, Inc., 1966, p. 1-9. 6 refs. (Presented at the Mid-Year Meeting, Society of Automotive Engineers, Chicago, Ill., May 1965.)

Unburned hydrocarbons and other products of combustion are recognized as contributors to photochemical air pollution. The work reported here was a first approach in finding an expression of exhaust gas quality--or compositional characteristic--that

would associate directly with the photochemical activity of the composite sample. Olefins, aromatics, and partial oxidation products have been cited as the principal smog precursors in exhaust gas. However, results of this study indicate that for the general case, collective determination of these classes provides and unreliable indication of reactivity. The findings are expected to be useful in further development of methods to measure -- or predict -- the air polluting potential of exhaust gas with increased reliability. (Authors abstract)

10512

Simonaitis, R. and J. N. Pitts, Jr.

PHOTOCHEMISTRY OF GAMMA-BUTYROLACTONE IN THE LIQUID PHASE. Preprint California Univ., Riverside, Dept. of Chemistry, 18p., (1965/)

The photolysis of gamma-butyrolactone was investigated in the liquid phase with the 2537A line of a mercury resonance lamp. The major products were allylformate, succinaldehyde, cyclopropane, and carbon dioxide with quantum yields at 25 deg. C of the 0.23, 0.06, 0.013 and 0.015, respectively. From product quenching data, it is suggested that triplet-triplet energy transfer from gamma butyrolactone to cis-butene, transbutene, cyclohexene and biacetyl occurs at a diffusion controlled rate and that the allylformate and cyclopropane originate from one state, probably a triplet, but that succinaldehyde originates from a different state. Added isopropyl alcohol quenched the formation of allylformate and cyclopropane, but acetonitrile as a solvent had no effect on their yields over the concentration range of 0.3-16.0 moles/liter. An increase in temperature from 25 deg. C to 98 deg. C increased the yields of succinaldehyde and cyclopropane and decreased the yield of allylformate, but the sum of the quantum yields of these products remained relatively constant. (Authors' abstract)

10519

Cowell, Gawin W. and James N. Pitts, Jr.

PHOTOCHEMICAL STUDIES IN RIGID MATRICES. II. A STUDY OF THE PHOTOCHEMICAL REACTIVITY OF ANTHRACENE IN POLYSTYRENE AND THE DEVELOPMENT OF AN O-NITROBENZALDEHYDE ACTINOMETER IN POLYMETHYLMETHACRYLATE. Preprint, California Univ., Riverside, Dept. of Chemistry, (19)p., (1967/).

The photochemistry of o-nitrobenzaldehyde and anthracene in rigid polymer films has been studied at 25 deg. and 3340 and 3660A. o Nitrobenzaldehyde 'dispersed' in polymethylmethacrylate, M.W. < 20,000 plus or minus 3,000, undergoes the well known photo isomerization to o-nitrosobenzoic, the quantum yield being 0.05 plus or minus 0.06. Within experimental error, this is the same as in fluid solutions and in the pure solid. In view of the stability and convenience of this system, its use as an actinometer in the spectra region 2800-4100A is envisaged. Anthracene 'dispersed' in polystyrene, M.W. < 47,000 plus or minus 4,000, undergoes photodimerization at a rate much reduced from that in fluid solution or in a potassium bromide pellet. The nature of the 'dispersion' of the nathracene in the film differs significantly from its state in

potassium bromide matrices. In the presence of oxygen, the major part of the photochemical reaction leads to the formation of the photooxide of anthracene. Kinetic and mechanistic details are discussed. (Authors' abstract)

10520

Mainster, M. A. and J. D. Memory

SUPERDELOCALIZABILITY INDICES AND THE PULLMAN THEORY OF CHEMICAL CARCINOGENESIS. Biochim. Biophys. Acta, Vol. 148(3):605-608, 1967 4 refs.

Alternative electronic indices, based upon the use of superdelocalizability as a measure of reactivity, are used to obtain an alternative formulation of the Pullman theory of chemical carcinogenesis. Although the alternative formulation of the Pullman theory of chemical carcinogenesis does not offer improved correspondence with experimental results, it is of interest for several reasons. The success of the superdelocalizability criteria demonstrates that at least one index of reactivity other than localization energy may be used to characterize molecular carcinogenicity accurately. The reformulation successfully incorporates the description of the reactivity of a region in terms of single atom parameters only, and permits greater computational ease for potential extensions to substituted hydrocarbons, because only the fundamental molecular framework must be considered, whereas a calculation of the complex localization energy indices usually involves seven different structures. Furthermore, criteria can be expressed explicitly in terms of molecular orbital coefficients and energies. Since many experimental spectroscopic parameters may be described theoretically by molecular orbital methods, this characterization suggests that correlation of carcinogenicity with these experimental quantities may be possible.

11050

E. R. Stephens

CHEMISTRY OF ATMOSPHERIC OXIDANTS. Preprint, California Univ., Riverside, Statewide Air Pollution Research Center, 12p., 1968. 15 refs. (Presented at the 61st Annual Meeting of the Air Pollution Control Association, St. Paul, Minnesota, June 23-27, 1968, Paper 68-57.)

All of the important oxidants in polluted air are formed there by chemical reactions which occur among the primary pollutants. The most abundant of these oxidants is ozone which is formed in a cycle involving nitric oxide, nitrogen dioxide, atmospheric oxygen, and hydrocarbons. This ozone is best understood, not as a reaction product, but as an intermediate in steady state concentration between formation and disappearance reactions. Hydrocarbons permit accumulation of ozone by reacting to scavenge the nitric oxide which would otherwise remove the ozone. The amount of ozone which can be formed in ambient polluted air is limited to about one ppm because these scavenging reactions become less effective when the nitric oxide concentration becomes very small. The peroxyacetyl nitrates are a group of oxidants which result from reactions between oxides of nitrogen and organic pollutants. Olefinic and aromatic hydrocarbons make

the largest contribution to PAN formation; saturates contribute little if any. the role of nitrogen dioxide and other oxidizing agents is also discussed. (Author's abstract) ##

11097

Crider, Walter L.

HYDROGEN-AIR FLAME CHEMILUMINESCENCE OF SOME ORGANIC HALIDES. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Association, ((17))p., ((1968)). 8 refs.

The effects of hydrogen and air flow rates on the flame chemiluminescent spectra emitted by some organic halides are illustrated. Flame chemiluminescent spectra of an organic phosphite and an organic sulfide over the same range of burner operating modes are presented for comparison. Detection limits of halide vapors in air were found to be 0.01 ppm (v/v) for  $\text{CH}_3\text{I}$ , 0.03 ppm for  $\text{Br}(\text{C}_2\text{H}_4)\text{Br}$ , 1.4 ppm for  $\text{CHCl}_3$  and  $\text{CCl}_4$ , and 3.0 ppm for  $\text{CH}_2\text{Cl}_2$  and  $\text{Cl}(\text{C}_2\text{H}_4)\text{Cl}$ . (Author's abstract) ##

11147

Fatiada, A. J.

PERIODIC ACID, A NOVEL OXIDANT OF POLYCYCLIC, AROMATIC HYDROCARBONS. J. Res. Nat. Bur. Std. A, 72A(4):341-350, July-Aug. 1968.

Certain polycyclic, aromatic hydrocarbons can be oxidized with periodic acid in aprotic solvents containing a small proportion of water. A unique, two-fold character of response to periodic acid by these hydrocarbons has been found: (1) production of a coupling reaction through a radical intermediate ((conversion of pyrene into 1,1'-bipyrene, and fluorene into 1,2-bis (2,2'-biphenyl)ethylene)) or (2) conversion into quinones by a two-equivalent oxidation mechanism that does not involve a radical intermediate ((acenaphthenem and tracen, anthrone, benz((a)) anthracene, naphthalene, and phenanthrene)). Little or no reaction was observed when oxidation was attempted with sodium metaperiodate instead of periodic acid. Electron-spin resonance revealed no radical intermediate in the oxidation of malonic acid with either periodic acid or sodium periodate. (Author's abstract)

11188

Windsor, M. W., and J. R. Novak

STUDIES OF RADIATIONLESS TRANSITIONS IN CORONENE USING NANOSECOND LASER PHOTOLYSIS AND SPECTROSCOPY. Preprint, TRW Systems, Redondo Beach, Calif. Chemical Sciences Dept., (18)p., 1968. 20 refs. (Presented at the International Conference on Molecular Luminescence Loyola Univ., Chicago, Ill., Aug. 20-23, 1968.)  
CFSTI: AD 672997



We have used the technique of nanosecond laser photolysis and spectroscopy to observe absorption from both the lowest excited singlet state  $S_1$ , and the lowest triplet state  $T_1$ , of coronene. The technique employs a Q-switched ruby laser to produce both a 30 nsec pulse at 347 nm for excitation, plus, at the same time, a laser-induced spark which provides a background continuum for absorption spectroscopy. Time-resolved spectra are obtained with an image converter camera. We have observed new transient absorption bands for coronene at 520 and 380 nm and attribute these to absorption by the  $S_1$  state. The new bands locate previously unobserved higher singlet level of g parity. These bands decay over a period of several hundred nanoseconds and are concomitantly replaced by absorption bands characteristic of the lowest triplet state, thus providing a pictorial record of the process of intersystem crossing. We have also obtained the T-T absorption spectrum of coronene in epoxy plastic out to 1.14 microns using a double-beam cross-irradiation technique. New maxima in the infrared serve to locate the energies of three low-lying excited triplet levels. From the energy level data we believe that in coronene intersystem crossing from higher singlet states to the triplet manifold may occur. We discuss how our kinetic observations of the decay of the lowest excited singlet and the build-up of the lowest triplet state bear on a recently proposed stationary state model of radiationless transitions. (Authors' abstract)

11210

Miller, William J.

FLAME IONIZATION AND COMBUSTION INHIBITION. (TECHNICAL REPORT NO. 1.) Aerochem Research Labs. Inc., Princeton, N.J. CST-102, TP-151, 23p., Jan. 1967. 17 refs.

The inhibition of spherically symmetrical low-pressure  $CH_4$  or  $C_2H_2/O_2$  diffusion flames by a variety of additives has been studied. The relative efficiencies of the compounds studied have been found to be very nearly the same as in 1-atm flames. A detailed examination of the effects of  $CCl_4$ ,  $Fe(CO)_5$ , and  $CrO_2Cl_2$  upon ion content and emission spectra has been made and the results interpreted in terms of previously postulated correlations between the ability of a given compound to reduce electron concentrations and its effectiveness as a flame inhibitor. No such correlation was found to exist and it has been concluded that for these flames no causal relationship exists between the two phenomena. The relatively large inhibition efficiencies of  $Fe(CO)_5$  and  $CrO_2Cl_2$  are attributed to in situ ultrafine particle formation downstream of the flame front and their subsequent diffusion into the reaction zone. The formation of these particles is indicated by ion profiles of nucleating species; the presence of the particles in the reaction zones of inhibited flames is further evidenced by the emission of continuum radiation. The dominance of diffusional over convective mass transport is the characteristic of the system which accounts for its susceptibility inhibition by these compounds. (Author's summary) \*\*

11239

S. Susan, D. H. Slater, and J. G. Calvert

THE PHOTOCHEMISTRY OF THE AZOALKANES. Preprint, Ohio State Univ., Columbus, Evans Chemical Lab., ((29))p., ((1968)). ((34)) refs.

The photochemistry of the azoalkanes has been the subject of many studies in several laboratories. The major interest developed because of their attractiveness as free radical sources. The first absorption band lies in the accessible near ultraviolet, and in the gas phases a large fraction of the light-absorbing molecules decompose to form free radicals. In the gas phase photolysis of azoalkanes of higher complexity, a significant fraction of the light-excited molecules do not decompose, but are stabilized by a second order kinetic process which is often termed "collisional deactivation". A description of the photochemistry of 1, 1'-azoisobutane is given. A kinetic study of the products of the gas phase photolysis of 1,1'-azoisobutane is presented.##

11248

David H. Slater, and Jack G. Calvert

THE PHOTOOXIDATION OF 1,1'-AZOISOBUTANE: THE REACTIONS OF THE ISOBUTYL FREE RADICAL WITH OXYGEN. Preprint, ((19)) p., 1967. (Presented at the International Oxidation Symposium, San Francisco, Calif., Aug. 29, 1967.)

A study has been made of the photooxidation of 1,1'-azoisobutane in experiments at 3660 Å and full mercury arc and at temperatures from 308 to 405 degrees K. The data prove the unimportance of energy transfer and singlet oxygen involvement for this system. The rates of products and their quantum yields are consistent with a mechanism involving the reactions of the isobutyl free radical with oxygen. The product distribution suggests that the isobutylperoxyl and/or isobutoxyl free radicals are unstable toward a decomposition reaction even at 308 degrees K for our conditions (Authors' abstract)##

11543

DeGrazio, Robert P. and Robert G. Auge

EVALUATION OF A GAS MIXING SYSTEM. Dow Chemical Co., Denver, Colo., Rocky Flats Div., Contract AT(29-1)-1106, RFP-1143, 7p., May 1968. CPSTI: RFP-1143

Because of the need to obtain standard gas mixtures in concentrations ranging from parts per million to percent for infrared and gas chromatographic analysis, a gas mixing apparatus was developed. To evaluate its capability, the apparatus was used to prepare mixtures of different concentrations of gases. The mixed gases were analyzed by gas chromatography and infrared spectroscopy. The results of the analyses of the prepared mixtures were then compared statistically with standard mixtures of the

same gases obtained commercially. The comparison of these analyses showed that the apparatus can effectively and reproducibly prepare gas mixtures over the ranges studied. The apparatus is described and the precision and accuracy data are presented. (Authors' abstract)##

11571

Kutscher, W., R. Tomingas and H. P. Weisfeld

STUDY OF THE HAZARDS PRESENTED BY SOOT AND AIR DUST WITH PARTICULAR EMPHASIS ON THEIR CARCINOGENIC ACTION. PART 9 - SEPARATION OF 3,4-BENZOPYRENE FOLLOWING SOOT INHALATION IN THE LUNG OF LIVE RATS. ((Untersuchungen über die Schädlichkeit von Russen und Luftstäuben unter besonderer Berücksichtigung ihrer kanzerogenen Wirkung.)) Text in German. Arch. Hyg. Bakteriol., 152(3):258-288, June 1968. 9 refs.

The separation of benzopyrene from soot was investigated in the lung of rats, following inhalation or tracheal injection of soot suspensions. Isolated benzopyrene was found in the rat lung 4 hours following soot inhalation. Benzopyrene separated from soot was found in rat lung tissue 2 hours following tracheal injection. Isolated carcinogen was no longer present in the lung at the end of 15 hours, but the lung soot still contained benzopyrene 4 months following treatment.##

12058

Solooja, K. C.

COMBUSTION STUDIES OF OLEFINS AND OF THEIR INFLUENCE ON HYDROCARBON COMBUSTION PROCESSES. Combustion Flame, 12(5):401-410, Oct. 1968. 21 Ref.

Comparative studies of the pre-flame and ignition behaviours of ethylene, propane, but-1-ene, cis-but-2-ene, trans-but-2-ene, isobutene, hex-1-ene and hexa-1,5-diene have been made. Moreover, the effect of all these olefins on the combustion of hexane at different oxidation stages leading to ignition has been studied. The observed relative order of ease of combustion of some of the olefins is different from that observed in laboratory studies by other workers but agrees with the relative order of knocking tendencies in engines. It is shown that, in general, olefins are less prone to oxidative degradation than the conjugate alkanes, and not vice versa as has been presumed recently in proposals for a new mechanism for the combustion of hydrocarbons. All the olefins studied markedly affect the combustion of hexane from the earliest stage of its oxidation. The earliest pre-flame stage is inhibited while the final stage leading to ignition is promoted. The nature of the effect on the intervening stages, varies widely, however, ethylene and isobutene inhibit, while hex-1-ene, hexa-1,5-diene and but-2-enes promote; propane and but-1-ene have a negligible effect. The results facilitate understanding of the mechanism of combustion of olefins and of their role as intermediates in the combustion of hydrocarbons in general. Mechanisms are proposed to explain the various observations. Author's Abstract##

J. N. Pitts, Jr., and J. K. S. Wan

THE PHOTOCHEMISTRY OF KETONES AND ALDEHYDES. Preprint, California Univ., Riverside, Dept. of Chemistry, 103p., Dec., 1964. 272 refs.

With the development of modern experimental techniques, particularly in analysis of complex mixtures by liquid-gas chromatographic methods, photochemistry has assumed an increasing importance in studies of free radical reactions, energy transfer processes and the synthesis of new and unique organic compounds. Perhaps the most widely studied class of compounds, historically and today, is that containing the carbonyl chromophore. The absorption spectra of most carbonyl compounds fall in the experimentally readily accessible region of the ultraviolet where quanta has high transmission and mercury arcs produce strong line emission spectra. In order to obtain a thorough understanding of the photochemistry of a given system, one must elucidate the entire "life history" of the photoprocess; this includes the primary process (es) and all secondary reactions in the system.##

12172

Hilis O. Folkins, and Elmer L. Miller

ROLE OF THE CATALYST IN THE REACTION OF ALCOHOLS AND HYDROGEN SULFIDE. Preprint, 9p., 1962. 15 refs. (Presented at the Session on Processes during the 27th Midyear Meeting of the American Petroleum Institute's Div. of Refining, in the Fairmont Hotel, San Francisco, Calif., May 15, 1962.)

The main products formed in the high-temperature catalytic reactions of aliphatic alcohols and hydrogen sulfide are the corresponding mercaptans and sulfides. Minor amounts of other compounds such as ethers, aldehydes, and olefins are also produced. The reaction can be controlled to produce either mercaptan or sulfide by judicious choice of catalyst composition. Operating conditions play an important but secondary role in product distribution. Catalysts including alkali metal salts and oxides incorporated with activated alumina and similar supports promote mercaptan formation almost exclusively, whereas acidic-type catalysts favor sulfides as the product. The effects of general composition, promoter concentration, and the nature of the catalyst support upon activity and selectivity are discussed for reactant alcohols from methanol through octanol. Processes for both mercaptan and sulfide production have resulted from these catalyst studies. (Authors' abstract)##

12949

Soda, Reiten

POLLUTED AIR PRODUCTION WITH GASEOUS PARTICLES. (Gasujo no osenbutsu ni yoru osen-kuki sakuseiho). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 6(7):10-17, 1969. 17 refs.

Special techniques have been devised using scattering cells, permeation tubes, or multiple step dilution to obtain a reproducible contaminated atmosphere. Artificially polluted air is used not only in the evaluation of a high efficiency air filter, but also in the experimental analysis of harmful effects on animals. Different gas particles are used and gas concentrations are also varied for different experiments. For example, CS<sub>2</sub> (0.1 ppm) and C<sub>6</sub>H<sub>6</sub> (1 ppm) are used for animal inhalation experiments and hydrocarbons (100 ppm), SO<sub>3</sub> (10 ppm), and nitrogen oxides (10 ppm) are used for the measurement of collection ratios of high efficiency air filters. To perform these experiments and measurements correctly, purity, concentration, temperature, and pressure of the polluted gas should be stable.

13034

Weaver, E.E., J.S. Ninomiya, L.M. Skewes, and C.H. Ruof

OXIDATION OF GASEOUS HYDROCARBONS IN CONCENTRATIONS OF PARTS PER MILLION IN FLOW SYSTEMS. OXIDATION OF 1-BUTENE IN TYPE 410 STAINLESS STEEL TUBES. Environ. Sci. Technol., 3(1):57-62, Jan. 1969. 6 refs.

1-Butene was oxidized in concentrations of 7 to 350 ppm in 90% nitrogen-10% oxygen blends flowing laminarly in fresh and aged Type 410 stainless steel tubes with residence times of 0.10 to 0.25 sec at temperatures between 450 and 800 C. In the fresh tubes, the reaction appears to be largely homogeneous, since nearly identical oxidation rates are obtained in tubes of different diameters and hence of different surface-volume ratios. However, on prolonged use the tubes become increasingly catalytic, showing an order of magnitude increase in rates of oxidation; simultaneously, the surface area of the tube increases by an order of magnitude as shown by BET measurements. The rates of disappearance of the 1-butene approach first-order with respect to hydrocarbon concentration as the tubes are aged; they become independent of oxygen concentration when about 20 times the stoichiometric amount of oxygen is present. (Author abstract modified)

13062

Carson, John F. and Francis F. Wong

SEPARATION OF ALIPHATIC DISULFIDES AND TRISULFIDES BY GAS-LIQUID PARTITION CHROMATOGRAPHY. J. Org. Chem., 24(2):175-179, Feb. 1959. 17 refs.

The application of gas-liquid partition chromatography to the separation and isolation of some aliphatic disulfides and trisulfides is discussed in connection with a study of the volatile components of onions. The polar phases, Carbowax and Reoplex, and a nonpolar phase, Apiezon M, were compared in the separation. It was found that mixtures of disulfides and trisulfides can be separated at 150 C without serious decomposition. No exchange reactions occurred between mercaptans, disulfides, and trisulfides, and allytic disulfides were

separated without the formation of monosulfides. Absence of decomposition during chromatographic separation was confirmed by infrared analysis of collected fractions. The polar phases were particularly useful for separating unsaturated disulfides from the corresponding saturated compounds.

13078

Beytia, Enrique, Pablo Valenzuela, and Osvaldo Cori

TERPENE BIOSYNTHESIS: FORMATION OF NEROL, GERANIOL, AND OTHER PRENOLS BY AN ENZYME SYSTEM FROM PINUS RADIATA SEEDLINGS. Arch. Biochem. Biophys., 129(1):346-356, Jan. 1969. 37 refs.

The properties of a soluble enzyme system obtained from *Pinus radiata* seedlings, which transforms 2-C-14-mevalonic acid (MVA) into C5 and C10 alcohols, were studied. The system incorporated 6 to 7% of the radioactivity from MVA into isopentenol, dimethyl allyl alcohol, nerol, and geraniol and required  $Mg(2=)$  or  $Mn(2=)$  and SH groups for optimal activity. Five and ten-carbon prenyls are formed from the corresponding phosphorylated derivatives by a phosphatase, which may be partially inhibited by NaF. About 1% of the radioactivity from MVA remains bound to the proteins in an apparently non-covalent association. This radioactivity, which behaves mainly as C15 prenyls, may be related to the biosynthesis of carotenes or phytol, and not to monoterpenes. It can be extracted with 1-butanol. The identification of C-14-isopentenol in a hexane-soluble fraction, after incubation of the enzyme system with MVA, suggests that isopentenyl pyrophosphate (IPP) is hydrolyzed by an acid phosphatase. Dimethyl allyl alcohol, identified in the same fraction, is probably formed by enzymic hydrolysis of dimethyl allyl pyrophosphate (DMAPP). The sensitivity of the enzyme system forming allylic phosphates also suggests the isomerization of IPP to DMAPP. Formation of geraniol and geranyl pyrophosphate (GPP) is probably related to the biosynthesis of diterpenes, carotenes, and phytol. There is no evidence that GPP is the precursor of monoterpenes.

13278

Rehwooldt, R. E., B. L. Chasen, and J. B. Li

2-CHLORO-5-CYANO-3,6-DIHYDROXYBENZOQUINONE, A NEW ANALYTICAL REAGENT FOR THE SPECTROPHOTOMETRIC DETERMINATION OF CALCIUM (II). Anal. Chem., 38(8):1018-1019, July 1966. 8 refs.

A new analytical reagent, 2-chloro-5-cyano-3,6-dihydroxybenzoquinone (HDDQ), for the spectrophotometric determination of calcium is described. The reagent is the product of the decomposition of 2,3-dichloro-5,6-dicyanobenzoquinone (DDQ) by water. Its disodium salt was prepared from DDQ. Experiments to study the nature of disodium HDDQ solution and complexes revealed that dilutions of the solutions followed Beer's Law, and that the precipitations varied in color and structure. A series of disodium HDDQ and  $Ca(NO_3)_2$

solutions were prepared and a linear plot was obtained for the calibration curve for the HDDQ supernatant solutions of the Ca complex. The sensitivity of the determination was found to decrease when the pH was less than four. Spectrophotometric analyses were performed on several aquaria water samples.

13364

Gariabyan, T. A., A. A. Mantashyan, and A. B. Nalbandyan

FORMATION OF PEROXIDE RADICALS DURING PHOTOCHEMICAL OXIDATION OF HYDROCARBONS. (K obrazovaniyu perekisnykh radikalov pri fotokhimicheskom okislenii uglevodorodov). Text in Russian. *Armenian Khim. Zh.* (Erevan), 22(4):285-287, 1969. 3 refs.

A previously described apparatus for electron paramagnetic resonance determination of radicals formed from hydrocarbons was modified to determine whether the peroxide radical was formed from the free alkyl radical according to the equation  $R + O_2 \rightarrow RO_2$  or heterogeneously on the cold surface. It was shown that the peroxide radicals were formed just in the zone of the gas phase reaction.

13391

Aarvik, Jon

CATALYST FOR THE REACTION BETWEEN HYDROCARBONS AND SULFUR DIOXIDE FOR THE PREPARATION OF PURE SULFUR. (Norg. Geol. Undersokelse Torondheim, Norway) U. S. Pat. 3,369,872. 1p., Feb. 20, 1968. 3 refs. (Appl. Aug. 10, 1965, 1 claim.)

Carbon formation can essentially be eliminated in the reduction of sulfur dioxide with hydrocarbons such as mineral oil by the use of a cordierite catalyst or other material with uniformly sized pore of molecular dimensions. Sulfur dioxide is contacted with the mineral oil and catalyst at 800 to 1300 C to produce sulfur and reaction gases free of carbon. Sulfur dioxide and H<sub>2</sub>S occur in a 1:2 ratio. The SO<sub>2</sub> and H<sub>2</sub>S may be reacted to form more sulfur.

13453

Crowell, E. P. and B. B. Burnett

MICRO DETERMINATION OF ROSIN AND FATTY ACIDS IN TALL OIL. TAPPI, 49(7):327-328, July 1966. 4 refs. (Presented at the 51st Annual Meeting of the Technical Association of the Pulp and Paper Industry, held in New York, N. Y., Feb. 20-24, 1966.)

The standard procedure for the determination of total rosin acids and acid number, ASTM D-803, requires 9 g of sample for single determinations. Therefore, it is not applicable to situations where large quantities of tall oil are not available. Such is the case with samples of crude tall oil from black liquor streams of the kraft pulping process. The boron trifluoride-methanol esterification procedure for selectivity masking fatty acids in the rosin acid determination was investigated and found to be

attractive because it is simple to use and has proven applicability to small samples. Gas chromatographic investigation showed that this methylation procedure is selective for fatty acids and is therefore acceptable for this purpose. The minimum sample requirement for the determination of both fatty and rosin acid is 75 mg of tall oil. Acceptable agreement between the ASTM procedure and this micro method was observed for samples with greater than 15% rosin acids. (Authors' abstract)

13465

Wicke, Alfred F., Henry E. McLaughlin, and Joseph H. Stump, Jr.

PROCESSES FOR REMOVING STILBENE FROM TALL OIL FATTY ACIDS. (Tenneco Chemicals, Inc., Delaware) U. S. Pat. 3,257,438. 4p., June 21, 1966. 11 refs. (Appl. May 18, 1962, 5 claims.)

The process utilizes catalytic amounts of boron trifluoride to convert a major portion of the stilbene compounds in tall oil fatty acids to higher-boiling derivatives. The catalyst is removed and the treated fatty acids are distilled. The reactions occur readily at room temperature, but the process is successful up to 100 C. Tall oil fatty acids containing 0.1% or more stilbene can be treated to obtain a product containing less than 0.04% stilbene.

13494

Dryden, I. G. C.

CHEMICAL CONSTITUTION AND REACTIONS OF COAL. In: Chemistry of Coal Utilization, Supplementary Volume, H. H. Lowry (ed.), National Academy of Sciences, Washington, D. C., Committee on Chemistry of Coal, p. 232-295, 1963. 392 refs.

Various methods of determining the chemical composition of coal are surveyed. Solvent extraction yields little information about the coal molecule, apart from a molecular weight distribution. If solvent extracts contain more than 1 to 5% of the parent coal, they resemble it closely, provided they are prepared below 250 C. If prepared above this temperature, pyrolysis has clearly modified their composition. The best specific solvents for coal contain a nitrogen atom with a readily available pair of electrons. Evidence from polarography has suggested that certain nuclei containing one, two, and three rings play an important part in coal structure. X-ray histograms suggest that about one-half of the carbon in the nuclei is almost equally distributed between one, two, and three rings, but these estimates may be biased toward the larger ring systems. In the polarography of coal extracts, the frequent occurrence of half-wave potentials, for the reduction of aromatic systems, points to the presence of a considerable proportion of biphenyl, naphthalene, phenanthrene, and triphenylene structures. The extent of reduction suggests a minimum polycyclic aromaticity between 0.35 and 0.5. Methods of functional group analysis and polarography at lower potentials have shown that the hydroxyl and carbonyl group concentrations account for 70 to 90% of the O2 in bituminous coal. Hydrogenation, extensive oxidation, hydrolysis, pyrolysis, and fluorination are the most interesting reactions of coal, but furnish only limited information about the structure of coal itself.



13499

Bagliano, G. and L. Ossicini

THE ADSORPTION OF METAL IONS FROM HF-HC104 MIXTURES ON SOME ION EXCHANGE PAPERS. J. Chromatog., 21(3):499-502, March 1966. 2 refs.

A comparison of ion exchange from HF-HC1 and HF-HC104 mixtures for ions known to adsorb from these solutions is made using two types of anion and one cation exchange paper. The concentration of HC1 or HC104 was maintained constant at 1N and the HF concentration was varied from 1 to 10%. Experimental results show that, while there are considerable differences in adsorption from HF-HC1, very few ions were adsorbed from HF-HC104. Tantalum may be adsorbed from mixtures with Hf, Zr, Ti, Nb, Mo, W, and U on an anion exchange resin paper from HF-HC104.

13505

Marton, Joseph

DETERMINATION OF LIGNIN IN SMALL PULP AND PAPER SAMPLES USING THE ACETYL BROMIDE METHOD. TAPPI, 50(7):335-337, July 1967. 10 refs. (Presented in part at the 51st Annual Meeting, Tech. Assoc. of the Pulp and Paper Industry, New York, Feb. 20-24, 1966.)

The acetyl bromide method of determining lignin in wood was extended to determine lignin in unbleached softwood pulps. Small (5-30 mg) pulp and uncoated paper samples are dissolved in an acetyl bromide-acetic acid mixture. The absorbance of the solutions at 280 nm is related to the absorptivity of reference lignin preparations. The calculated lignin content correlates excellently with Kappa number determinations. A correction is applied to compensate for background absorption at zero Kappa number. The precision of the lignin determination method is plus or minus 2 relative percent. It has potential advantages where micro sampling is involved and the pulps are modified or the pulp lignin contains solubilizing groups. (Author's abstract modified)

13544

Starkman, E. S. and H. K. Newhall

THERMODYNAMIC PROPERTIES OF METHANE AND AIR, AND PROPANE AND AIR FOR ENGINE PERFORMANCE CALCULATIONS. Preprint, Society of Automotive Engineers, Inc., New York, 13p., 1967. 16 refs.

A chart-form review of the thermodynamic properties of selected fuel-air mixtures suitable for utilization in engine performance calculations was presented. Methane and propane, representative of natural gas, and LPG were the fuels considered. Comparisons were made between the performance to be expected with these gaseous fuels compared to octane as representative of gasoline. Cycle analysis showed loss in power could be anticipated when converting from gasoline fuel to LPG with further loss between LPG and natural gas.

Cronan, C. S.

OIL REFINING TANDEM PULLS...HIGH PURITY AROMATICS FROM COKE-OVEN OIL. Chem. Eng., 66(2):110-113, Jan. 12, 1959.

The Jones and Laughlin Steel Corp. has been successfully producing high-purity aromatics from crude coke oven light oils since 1957. The light oil is produced during the high temperature carbonization of coal to make metallurgical coke, and is recovered from the coke oven gas by scrubbing with an absorbent oil. It is then sent to stripping towers to remove carbon disulfide and other light ends. After pretreatment, the light oil is heated and fed to a Hydrofiner reactor. After caustic scrubbing, benzene, toluene, and xylene products are separated from gases and sent to a stream stripper where residual H<sub>2</sub>S is removed; they then proceed to Udex extraction. The Udex process extracts aromatics from paraffins using aqueous diethylene glycol, then strips pure aromatics from the glycol. Final fractionation of the finished products is done in three towers: two continuous towers for benzene and toluene, and a batch column for xylene. A flowsheet illustrating the process of hydrofining and extraction is included.

13580

Slutsky, S., J. Tamagno, and I. Fruchtman

AN ANALYSIS OF HYDROCARBON-AIR COMBUSTION FLAMES. Preprint, American Inst. of Aeronautics and Astronautics, New York, Technical Information Service, 51p., 1966. 11 refs. (Presented at the AIAA Second Propulsion Joint Specialist Conference, Colorado Springs, June 13-17, 1966, Paper 66-573.)

The overall structure of the combustion process in a jet flow of hydrocarbon-air mixtures was studied both experimentally and analytically. The hydrocarbons considered were methane, ethane, propane, and ethylene, with flame stabilization assured by a small oxy-hydrogen pilot. This research was essentially basic in nature; however, in choosing particular aspects for investigation, the selection was oriented toward fuels and conditions pertaining to supersonic combustion in ramjet engines. Flame propagation angles were determined by means of time exposure direct photographs, supplemented by measurements of mean total temperature and total static pressures for various values of stoichiometric equivalence ratios. The progress made in the incorporation of finite rate hydrocarbon chemistry with numerical techniques for the computation of flows with viscosity, diffusion, and heat transport is presented. The first case to date has been for the methane-air combustion system and has resulted in numerical solutions which are in good agreement with experiments. The formulation of mathematical models for the description of high speed combustion flames as described by the foregoing methane-air combustion has resulted in new insights into the mechanism of combustion rate phenomena in flames.

13636

Whitehouse, A. G. R.

THE HEAT OF ADSORPTION OF GASES BY COAL AND CHARCOAL. J. Soc. Chem. Ind., 45:13T-20T, Jan. 15, 1926. 18 refs.

Although the adsorption of gases by charcoal and other substances has been investigated extensively during recent years, the thermal change accompanying this phenomenon has received much less attention. In view of this experiments were conducted with different types of coal and charcoal to measure the adsorption of SO<sub>2</sub>, nitrogen, methane, CO, CO<sub>2</sub>, and oxygen using specially designed adsorption apparatus and a calorimeter. The heat evolved/cc of gas absorbed decreased as more gas was absorbed; the results obtained with charcoal and the different coals were very similar. The values obtained for the heat evolved/cc of gas adsorbed were: CO<sub>2</sub>:0.346-0.255 cal; SO<sub>2</sub>:0.627-0.359 cal; methane: 0.245-0.199 cal; oxygen: 0.19-0.17 cal; nitrogen:0.22-0.17 cal; and CO:0.198-0.188 cal. An equation is given relating the total heat evolved/g of adsorbent with the total volume of gas adsorbed/g of adsorbent. The gases studied were adsorbed more slowly by coal than by charcoal; the differences were most pronounced in the cases of methane and nitrogen.

13666

Nagasawa, Sin

FUNDAMENTAL STUDIES OF ADSORPTION OF GASES AND VAPOURS BY ACTIVE BENTONITE. Tohoku J. Agr. Res., 4(1):75-95, 1953. 6 refs.

Adsorption of gases and vapors by active bentonite which was prepared from commercial bentonite and activated by acid and heat treatments was measured. Isothermal equilibrium was measured and the empirical formulas of Freundlich's type were determined for benzene, sulfur dioxide, ammonia, and water vapor. Each isothermic equilibrium and isobaric equilibrium was calculated, and expressed by empirical formulas. Each desorption equilibrium was measured. The hysteresis-like phenomenon was observed with benzene, water, and sulfur dioxide at several temperatures. Isothermic differential heat of adsorption was calculated. From those values, and from the desorption equilibrium, it was ascertained that capillary condensation might take place at high relative pressures. (Author abstract modified)

13686

Fischer, Hans

COMPARATIVE STUDY OF THE ADSORPTION OF GASES ON CHARCOAL IN SOLUTION. (Vergleichende Untersuchung über die Adsorption an Holzkohlen in Lösung und in Gasen). Text in German. Kolloid-Beih., 42(4-2):125-183, 1935. 17 refs.

The adsorption capacity of eleven types of coals in solution was determined. The amount adsorbed during equilibrium conditions and during a certain period of time, as well as the adsorption

speed, were determined each time. Prior to the tests, the purity of the coals was determined. For the study of adsorption in solution, succinic acid in aqueous solution, iodine in aqueous KI solution, iodine in alcoholic solution, and methylene blue in aqueous solution, and the gases  $\text{SO}_2$ ,  $\text{CO}_2$ , and  $\text{C}_2\text{H}_4$  were used. Dry carbon was mixed with one of the above substances in solution, shaken, and after some time the concentration was determined by titration. With gases, the adsorbed amount was determined by measurement of the pressure difference caused by adsorption. It was found that in solution all types of coals reached the adsorption equilibrium slowly. The adsorption speed depended very much on the grain size of the carbon particles; the larger the particles, the lower the adsorption speed. Porous coal adsorbed rapidly, dense coals slowly. Succinic acid was adsorbed best, methylene blue least. The adsorption capacity of porous coal in solution was higher than that of dense or indistinct coal. The same results were obtained for the adsorption of  $\text{SO}_2$  vapor. With  $\text{C}_2\text{H}_4$  and  $\text{CO}_2$ , however, the dense coals had a higher adsorption capacity than the porous ones. The adsorption speed was higher with gases owing to the higher molecular motion of gases. It was concluded that the various types of coals showed no markedly different adsorption properties. Greater difference existed only between impure, tarry ordinary retort coal and activated tar-free coals.

13766

Graham, J. Ivon

THE ADSORPTION OR SOLUTION OF METHANE AND OTHER GASES IN COAL, CHARCOAL, AND OTHER MATERIALS. Colliery Guardian (London), 132(3168):809-811, Sept. 16, 1921. 7 refs.

The adsorption curve for coal dust and  $\text{CO}_2$ , up to a 50% concentration, was first obtained by making several additions of known quantities of the gas and reading the equilibrium pressure. A definite amount of methane was then added and allowed to set for two days, to ensure equilibrium between the  $\text{CO}_2$  and methane in the gas mixture and that adsorbed by the coal. The points obtained for the adsorption of  $\text{CO}_2$  alone, and mixed with methane lay practically on the same curve when allowance was made for experimental error. There was, however, a marked effect on the adsorption of methane. A much smaller amount was adsorbed by the coal when  $\text{CO}_2$  was present than when only methane was present. It was found that when moisture was added to the coal dust, its adsorptive capacity decreased by 25%, and when 10.5% pyridine was added, the adsorptive capacity was reduced to a lower level. Crushing the coal in the laboratory did not produce an increase in the coal adsorption proportionate to the increase in surface area. It was concluded that the actual surface area of the particle forms only a small proportion of the total surface available for adsorption. Coal dust was examined for use in Army respirators during 1917-1918. It was found that while it was very effective for adsorbing chlorine gas, it was useless for the adsorption of carbon monoxide.

13876

Remy, H. and W. Hene

ADSORPTION OF GASES BY ACTIVE CHARCOAL. (Ueber die Adsorption von Gasen durch aktive Kohle). Text in German. Kolloid - Z. (Germany), 61(3):313-322, Dec. 1932. 12 refs.

The adsorbability of a number of gases by a highly active charcoal was studied. A simple relationship was found to exist between the adsorbabilities at 15 C and the vapor pressures of the liquefied gases at 15 C. The dependence on pressure of adsorption at room temperature (15 C) of the gases H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, N<sub>2</sub>O, CO<sub>2</sub>, SO<sub>2</sub>, and CH<sub>3</sub>Cl was investigated as was the dependence on temperature of the adsorption at atmospheric pressure of the gases H<sub>2</sub>, CO<sub>2</sub>, SO<sub>2</sub>, NH<sub>3</sub>, and CH<sub>4</sub>. An empirical formula was derived which jointly represents the adsorbabilities of the latter gases at those temperatures at which their vapor pressures are equal. A few exploratory experiments were carried out on the adsorption of gas mixtures by charcoal. It was discovered that with any of the several gas mixtures used, the total amount adsorbed was not related simply to the sum of adsorbabilities of its individual components. However, this amount corresponded approximately to the mean value of the adsorbabilities of the individual components of the mixture.

13882

Airey, E. M.

GAS EMISSION FROM BROKEN COAL. AN EXPERIMENTAL AND THEORETICAL INVESTIGATION. Int. J. Rock Mech. Min. Sci., 5(6):475-494, Nov. 1968. 7 refs.

Deep soft seam coal from the Sherwood Colliery ranges in size between 0.5 in. and 200 mesh was brought into equilibrium with methane at pressures of 50, 150, and 300 psi. One empirical formula with only three constants was developed to describe the rate of degassing observed for all the sizes, pressures, and moisture contents tested. Errors in the empirical formula were very small. A theory based on gas flow through a homogeneous solid is shown to give poor agreement with experimental results. A theory incorporating a mathematical model including a crack system is shown to be compatible with the empirical equation.

13931

Seery, Daniel J. and Craig T. Bowman

A SHOCK TUBE STUDY OF METHANE OXIDATION. Preprint, Am. Chem. Soc., Washington, D. C., Div. Fuel Chem., 11(4):82-95, 1967. 11 refs.

An experimental study was made on the oxidation of methane behind reflected shock waves to provide information on the reaction mechanism and chemiluminescence for high temperature oxidation. In this study, pressure, OH, CH, CO, C<sub>2</sub>, and H<sub>2</sub>O emission and

OH absorption were monitored during the reaction. Using a proposed 15 step reaction mechanism, temperature, pressure, and concentration profiles were calculated for the conditions of the experiment. The concentrations of the intermediates increased rapidly during the early stages of the reaction and then maintained a constant value through most of the induction period. Induction time was defined to be the time between the heating of the gas by the reflected shock wave and the rapid increase in pressure or characteristic emission or absorption. Carbon monoxide and H<sub>2</sub>O showed a rapid increase early in the induction period and then increased linearly to their equilibrium concentrations. Carbon dioxide increased linearly from the start and only at the end of the induction period did it increase rapidly. A peaking of CH emission was observed; however, OH emission and OH absorption were found to increase simultaneously during the reaction. From the pressure and OH emission, it was concluded that the reaction passes through two phases - a first phase in which the pressure and OH emission increase slowly, followed by a second phase in which the pressure and OH emission increase rapidly.

13933

Lyublina, E. I.

RELATIONS BETWEEN PHYSICO-CHEMICAL PROPERTIES OF HYDROCARBONS AND THEIR TOXICITY. (O svyazyakh fiziko-khimicheskikh svoystv uglevodorodov s ikh toksichnost'yu). Text in Russian. Gigiena i Sanit., no. 7:20-25, 1969. 4 refs.

A formula is suggested for preliminary calculation of toxicity indices on the basis of a correlation existing between the physicochemical properties of hydrocarbons and their lethal concentrations for mice and that of their maximal permissible concentrations in the air of industrial premises. From the molecular weights and boiling points of volatile hydrocarbons, it is possible to calculate the value of LD<sub>50</sub> and various physicochemical constants of hygienic significance by means of a given nomogram. (Author summary modified)

14145

Bjerklie, John and Stephen Luchter

RANKINE CYCLE WORKING FLUID SELECTION AND SPECIFICATION RATIONALE. Preprint, Society of Automotive Engineers Inc., New York, N. Y., 10p., 1969. 14 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690063.)

Present applications of Rankine cycle turboalternators and turbogenerators cover a power range of 2.5 orders of magnitude and extend from unattended microwave repeater stations to marine and automotive installations. Organic working fluids used include dowtherm, dichlorobenzene, toluene, liquid metals, water, monochlorobenzene, perfluorodecalin, and hexafluorobenzene. As more potential applications for the Rankine turbine and reciprocating systems become apparent, a family of new organic fluids suited to quantity applications must be developed.

Ideally, these fluids will have high thermal efficiency. The best will be those whose vapor pressures extend across temperature fields without going beyond pressure limits. Alternatives will be fluids requiring low superheat and having the widest temperature difference between peak and minimum pressure. Other requirements are high molecular weight, thermal stability, freezing points below minimum temperature, isentropic saturated vapor lines, and a liquid specific heat of 0.4. Fluids must be compatible with common construction materials.

14158

Swinerton, J. W., V. J. Linnenbom, and C. H. Cheek

DISTRIBUTION OF METHANE AND CARBON MONOXIDE BETWEEN THE ATMOSPHERE AND NATURAL WATERS. Environ. Sci. Technol., 3(9):836-838, Sept. 1969. 13 refs.

Methane and carbon monoxide concentrations in the atmosphere and in natural waters were measured from samples collected during an oceanographic cruise between Washington, D. C. and Puerto Rico in June 1968. The purpose of the measurements was to determine to the level of these concentrations and to obtain information on the direction of net transport across the air-water interface. Such information is expected to prove helpful in determining whether these gases are being generated in the water by biological processes and escaping into the atmosphere, or whether as the result of relatively high atmospheric partial pressures, the gases are going into solution in the seawater. The concentration of methane was highest in the upper Potomac River and decreased as the ocean was approached because of pollution in the river and bay waters. Methane was at equilibrium between the atmosphere and the open ocean where its average concentration in the atmosphere was 1.24 plus or minus 0.03 ppm. It is still not clear whether the ocean is acting as a source or a sink for methane under equilibrium conditions. Conversely, carbon monoxide concentrations increased in the open ocean relative to the river and bay waters. Equilibrium was not observed for carbon monoxide, and the net transport of this gas appears to be from the water into the atmosphere for all samples analyzed. Atmospheric carbon monoxide concentrations ranged from 0.075 to 0.44 ppm. Possible natural sources of carbon monoxide in the open ocean are the photochemical decomposition of organic matter near the surface and its production by various algae, green plants, and some species of siphonophores. (Author abstract modified)

14164

Hansen, Andrew C., Jr.

CONVERSION OF SULFUR-CONTAINING HYDROCARBONS. (Universal Oil Products, Co., Inc., Des Plaines, Ill.) U. S. Pat. 3,461,062. 6p., Aug. 12, 1969. 1 ref. (Appl. Sept. 6, 1966, 9 claims).

A principal object of the invention is the production of high octane gas by an economical combination of hydrotreating and catalytic reforming of hydrocarbon mixtures contaminated with sulfur compounds. A related object is the integration of a hydrocarbon conversion process with a hydrocarbon treating

process. One embodiment of the invention involves a combination process for the conversion of sulfur-containing hydrocarbon stock charge. This comprises the steps of (a) contacting a naphtha charge stock and hydrogen with a cobalt-molybdenum hydrogenation/desulfurization catalyst in a fixed bed reactor at conditions selected to convert sulfurous compounds to hydrogen sulfides and hydrocarbons; (b) removing hydrogen sulfide from the hydrorefined effluent; (c) introducing at least a portion of the remaining effluent into a conversion zone where the hydrocarbons are contacted with a catalyst of alumina, platinum, and combined chloride; and (d) recycling at least a portion of the conversion zone effluent to combine with an alkylaromatic hydrocarbon stock charge prior to contacting the latter in the hydrorefining zone, and separating the remaining conversion zone effluent to provide a hydrogen-rich gaseous phase and a normally liquid carbon product. The process produces a substantially debutanized pentane plus product in amounts from 3020 to 3880 b/d. Two changes are instituted in the combination process for catalytically reforming sulfur-containing hydrocarbon charge stock. A portion of the hydrorefined effluent is introduced into a catalytic reforming reaction zone containing a platinum catalyst, and the total reformed effluent is combined with a stock charge of gasoline boiling range hydrocarbons prior to contact in the hydrorefining zone.

14220

Gilbert, Everett E. and E. Paul Jones

SULFONATION AND SULFATION. Ind. Eng. Chem., 53(1):501-507, Jan. 1961. 167 refs.

The literature published in 1960 on the chemistry of sulfonation and sulfation is reviewed. New procedures are reported and the properties and possible uses of new products are summarized. Topic headings include the direct sulfonation of polyethylene film, alpha-sulfonation of pelargonic acid with SO<sub>2</sub>, oxidative sulfonation by aqueous chlorination of trithiane, sulfonation with SO<sub>2</sub> compounds, polymerization and condensation methods, aromatic sulfonation with H<sub>2</sub>SO<sub>4</sub>, the preparation of long-chain alkylated aromatics, the preparation of polystyrene and aromatic resins, benzene and naphthalene derivatives, the direct preparation of aromatic sulfonyl chlorides, sulfation of alkenes, monohydric alcohols, glycol esters and ethers, and the sulfamation of cyclohexylamines and insulin.

14227

Farnsworth, H. E. and R. F. Woodcock

EFFECTS OF RADIATION QUENCHING, ION-BOMBARDMENT, AND ANNEALING ON CATALYTIC ACTIVITY OF PURE NICKEL AND PLATINUM SURFACES. II. HYDROGENATION OF ETHYLENE (CONTINUED). HYDROGEN-DEUTERIUM EXCHANGE. Advan. Catalysis, vol. 9:123-130, 1957. 11 refs.

A method for cleaning a wide variety of solid surfaces in high vacuum permits the separation and individual investigation of factors affecting the chemical properties of catalysts: lattice defects, electronic and geometric factors, and contaminants, including chemisorbed gas. The method consists of high-temperature outgassing, radiation quenching, argon-ion



bombardment, and annealing and is applicable to both single crystals and polycrystalline forms. A mass spectrometer provides continuous or intermittent gas analysis. In experiments involving the hydrogenation of ethylene or nickel and platinum catalysts, catalytic activity after ion bombardment was essentially the same as that after radiation quenching. Activity after these treatments is higher than after subsequent annealing, suggesting that annealing removes surface lattice defects which contribute to high activity. Results also indicate that small amounts of impurities promote catalytic activity, while larger amounts of the same impurity act as a poison. Measurements of hydrogen-deuterium exchange on a nickel surface revealed no appreciable difference in activities of annealed and quenched surfaces, indicating that the rate-controlling factor for the hydrogen-deuterium reaction is not the same as that for the hydrogen-ethylene reaction.

14258

Sherman, Albert and Henry Eyring

QUANTUM MECHANICS OF ACTIVATED ADSORPTION. J. Am. Chem. Soc., 54(6):2661-2675, July 1932. 12 refs.

When binding energies are expressed as 10% of the total for all atom pairs, the quantum mechanical calculations of the activation energies for the hydrogenation of ethylene, acetylene, and the activated adsorption of hydrogen on charcoal at zero K are, respectively, 51.5, 24.4 and 8.8 kg cal. Better agreement with the values obtained by Pease occurs when the coulombic energy is taken as 14% of the total binding. The mechanism for the conversion of ortho-to para-hydrogen on charcoal involves three steps: activated adsorption, collision and reaction of two adjacently adsorbed hydrogen molecules, and desorption. At very low temperatures, the last step, a zero-order evaporation process, is undoubtedly the rate-determining step. As the temperature increases, the rate of desorption increases until finally the collision of two adjacently adsorbed molecules is the slow process. With increasing temperature, the chance of two hydrogen molecules being adsorbed in adjacent positions approaches zero, and simultaneously the conversion of para- to ortho-hydrogen drops to zero. Since the adsorption obtained is the so-called atomic adsorption, the C-H bonds must have strength of 51.8 kg cal in order that the final bonds will have strength of only 2 kg cal more than the initial hydrogen bond. A carbon dioxide distance of 3.6 Å is most favorable for calculating the energy of the bonds at 51.8 kg cal. The mechanism of conversion is assumed to involve the collision of a hydrogen molecule from the gas phase with an adsorbed hydrogen molecule. The problem of spin degeneracy of six electrons is solved, and an equation for the potential binding energy of the six electrons is applied to the calculation of activation energies.

14293

Peatman, W. B., T. B. Borne, and E. W. Schlag

PHOTOIONIZATION RESONANCE SPECTRA. I. NITRIC OXIDE AND BENZENE. Chem. Phys. Letters (Amsterdam), 3(7):492-497, July 1969. 21 refs.

A new method is described for the study of ionized molecules by direct observation of optical resonance in photoionization. This method interposes an electron filter in the system so that a signal is detected in the measuring circuit only at the point where the optical monochromator sweeps through a resonance transition. Photoionization is carried out at the intersection of a well-focused beam of light and a high intensity molecular beam at right angles to the photon beam. Electrons are withdrawn perpendicular to both of these beams. The energy of the photoionization resonance is directly read off the setting of the optical monochromator. Contributions from lower photoionization processes are avoided. Photoionization resonance scans of benzene show the presence of two peaks at 10.385 and 10.471 eV, respectively. It is thought that these peaks are due to a new electronic level of C<sub>6</sub>H<sub>6</sub>(plus) at 10.385 eV and that this level corresponds to the removal of a sigma electron from the benzene molecule. Data obtained for NO(plus) using this method were compared with data previously obtained by other methods. The average ionization potential of five experimental runs was in exact agreement with the spectroscopic value of other investigations.

14313

Lederer, E. L.

VERIFYING ADSORPTION FORMULAS BY MEANS OF ADSORPTION MEASUREMENTS WITH ACTIVATED CHARCOAL. (Pruefung von Adsorptionsformeln an Hand von Adsorptionsmessungen bei einer hochaktiven Kohle). Text in German. Kolloid-Z. (Stuttgart), 61(3):323-328, 1932. 15 refs.

Data reported by Remy on the adsorption of gases and vapors on activated charcoal were used to verify isothermal and isobaric adsorption laws. In the isothermal case, no decision can be made between a logarithmic law and the formula of Langmuir. In the isobaric case, a logarithmic law seems to fit the results best. The isosteric curve of Trouton and Poole and the relationship of Gurwitsch fit the data only moderately well. The relationship between the vapor pressure and the adsorbed volume of various gases indicates that equal amounts of different gases are adsorbed, referred to corresponding states. Gas mixtures are adsorbed proportionally, provided the concentrations are modified by the influence of the mean molecular velocities and the shape of the molecules. The adsorption data for the following gases were used: CO<sub>2</sub>, N<sub>2</sub>O, HCl, H<sub>2</sub>S, NH<sub>3</sub>, Cl<sub>2</sub>, CH<sub>3</sub>Cl, SO<sub>2</sub>, CH<sub>4</sub>, and COC<sub>12</sub>.

14335

Klimisch, Richard L.

OXIDATION OF CO AND HYDROCARBONS OVER SUPPORTED TRANSITION METAL OXIDE CATALYSTS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968. 11 refs.

The reactivities of a series of potentially useful catalysts for the oxidation of carbon monoxide and propylene were examined, singling out the copper oxide-alumina system for more intensive study. Evidence was obtained which indicates that these oxides act as stoichiometric oxidizing agents for carbon monoxide. Mass-transfer limitations were examined in the copper oxide-alumina system for the oxidation of carbon monoxide and hydrocarbons at low concentration levels, showing the importance of this effect. The ease of catalytic oxidation of a series of hydrocarbons could be correlated with the atmospheric nitric oxide photooxidation rates of these hydrocarbons. The extent of the inhibition of these oxidation reactions by water and carbon dioxide at realistic exhaust gas concentration levels was also examined. Other more subtle features of these reactions were also examined, and explanations were offered in terms of simple mechanistic concepts where possible. (Author summary modified)

14379

Lavrov, N. V.

PHYSICOCHEMICAL MECHANISM OF NATURAL GAS COMBUSTION. (Fiziko-khimicheskiy mekhanizm gorennya prirodnogo gaza). Text in Russian. Teoriya i Prakt. Szhiganiya Gaza, Nauchn.-Tekhn. Obshchestvo Energ. Prom., vol. 3:136-150, 1967. 12 refs.

The mechanisms of natural gas combustion are discussed in terms of oxidation and reduction of methane. This theoretical treatment is based on a review of the literature. The following topics are treated: physicochemical regularities in the process of fuel combustion; peculiarities of methane combustion; gasification of methane; methane conversion reactions; chain mechanism of methane combustion; low-temperature oxidation of methane; mechanism of methane combustion at elevated temperatures (proposed by the author together with I. G. Petrenko); intermediate compounds and primary products of methane combustion. The proposed high-temperature combustion mechanism is based on the following assumption: chemical reaction with oxygen involves separate stages of thermal decomposition of methane; formaldehyde is regarded as an intermediate compound in the methane-oxygen reaction analogous to physicochemical complexes formed in carbon-oxygen combustion; methane combustion is subdivided into three stages (incomplete combustion to formaldehyde, decomposition of formaldehyde to CO and H<sub>2</sub>, combustion of CO and H<sub>2</sub>).

14385

Stezhenskiy, A. I., V. S. Luk'yanchikov, and V. B. Protsenko

OXIDATION OF NITROGEN DURING COMBUSTION OF METHANE-NITROGEN-OXYGEN MIXTURES. (Oksileniye azota pri gorenii metano-azoto-kislorodnykh smesey). Text in Russian. Khim. Prom. Ukr. (Ukr. Ed.), no. 1:7-9, 1967. 2 refs.

A methane-nitrogen-oxygen mixture was burned at a rate of 50 cu m/hr. Enriched air with an oxygen content of 40 to 73% was provided in an excess of 1.3 to 2.6. Inlet temperature ranged from 300 to 600 C and maximum NO yield (1.82%) was obtained with an oxygen content of 70% and an air excess of 1.7

(equivalent to equimolar nitrogen-oxygen ratio in combustion products). It is concluded that such a continuously operating arrangement for fixing atmospheric nitrogen has a number of advantages: constant NO concentration, ease of process control and possibility of automatic control, low thermal cycling . assures prolonged and reliable operation of refractory materials made of MgO or ZrO<sub>2</sub>. The combustion chamber used was described in an earlier article.

14388

Antonishin, N. V., V. A. Borodulya, A. M. Gulyuk, S. S. Zabrodskiy, and V. A. Nemkovich

COMBUSTION OF LIQUID AND GASEOUS FUELS IN A FLUIDIZED BED OF FINE-GRAIN MATERIAL AND UTILIZATION OF HEAT FROM THE EXHAUST GASES. (O szhiganii zhidkogo i gazoobraznogo topliva v psevdoozhizhennom sloye melkozernistogo materiala i utilizatsii tepla ukhodyashchikh gazov). Text in Russian. Fiz. Goreniya, Akad. Nauk Ukr. SSR, Respub. Mezhdvedom. Sb., 1966:20-25.

Experimental studies were made of the combustion of liquified propane-butane, and of solar oil in fluidized beds at the Institute of Heat and Mass Exchange of the Belorussian SSR Academy of Sciences. Gas combustion studies were made with quartz sand particles graded at 0.2-0.6 and 1.4-2.0 mm in a 75-mm diameter tube and in a 0.04 sq m chamber. Bed height was 120-200 mm and maximum temperature occurred at a height of 30-70 mm. A bed temperature of 850-1000 C gave sufficiently complete combustion with an air excess of 1.05-1.2. Liquid combustion studies were made with Dinas brick fragments graded at 2-3, 3-5, and 5-7 mm in 75- and 100-mm diameter tubes. An air excess of 1.4 in the 75-mm tube gave 96-97% combustion, and an air excess of 1.15 in the 100-mm tube gave 94.1% combustion. The experimental data are used in proposing a theoretical scheme for recovering heat from exhaust gases by circulating the material of the fluidized bed so as to pass incoming air through it for preheating.

14391

Kiselev, A. V.

NATURE OF HYDROCARBON ADSORPTION ON GRAPHITE, OXIDES, HYDROXIDES, AND CHEMICALLY MODIFIED SURFACES. (Priroda adsorbtsii uglevodorodov na grafite, okisyakh, gidrookisyakh i khimicheskii modifitsirovannykh poverkhnostyakh). Text in Russian. Gaz. Khromatogr., Tr. Pervoi vses. Konf., Akad. Nauk SSSR, Moscow, 1959, p. 45-80. 61 refs.

Considerations necessary for a better theoretical and practical understanding of chromatographic separation of hydrocarbons are presented. Topics examined are: absorption energy of hydrocarbons on graphitized carbon black and magnesium oxide; absorption energy of hydrocarbons on hydroxides; adsorption isotherms for individual hydrocarbons on a uniform surface; effect of chemical modification of absorbent surface on the absorption of hydrocarbons; effect of geometrical modification of absorbents--creation and alteration of surface--on the absorption of hydrocarbons. It is recommended that further

work center on the following items: theory of adsorption forces, calculation of adsorption energy, measurement of heat of adsorption at different temperatures; statistical theory of adsorption equilibria, measurement of heat capacity of adsorption systems; investigation of the state of surface chemical compounds and adsorption complexes using infrared spectra and other new methods; investigation of the geometric structure of adsorbents and structure modification; investigation of the chemical structure of surfaces and their chemical modification; investigation of adsorption equilibria for gas mixtures, especially by the vacuum circulation method using new adsorbents.

14399

Dioszeghy, D.

THEORETICAL AND PRACTICAL DEVELOPMENT OF FLAME RESEARCH.  
(Theoretische und praktische Entwicklung der Flammenforschung).  
Text in German. Freiburger Forschungsh. B, no. 120:183-200,  
1967. 15 refs.

Historical development and fundamentals of flame research are reviewed. With respect to the microstructure of flames, burning velocity and the importance of secondary air in reducing the flame are discussed. Pertinent experiments in Hungary were concentrated on the study of the combustion for natural gas, the main fuel in the steel industry. Formation of scale can be avoided if stoichiometric combustion and uniform flame temperature are maintained. The effect of secondary air was studied by means of a ceramic flame tube. The gases were analyzed by gas chromatography with CO<sub>2</sub> as carrier gas. It was found that the least amount of scale is formed when (CO<sub>2</sub>/CO) plus (H<sub>2</sub>O/H<sub>2</sub>) is less than one. Larger experiments were conducted in a chamber furnace where 14.4 cu m natural gas per hour were burned with 130 cu m air per hour. Heating tests were performed with 30 mm brass blocks. In furnaces with radiative heat transfer, it is important to destroy the boundary layers at the walls. This is done by sucking the flue gases through openings in the walls. Thirty such furnaces were constructed and they now operate in forges throughout the country. The wall temperatures in these furnaces are typically 1080 C without wall channels and 1250 C with wall channels.

13415

Haseba, S., T. Shimose, N. Kubo, and T. Kitagawa

NITRIC OXIDE EXPLOSION. Chem. Eng. Progr., 62(4):92-96, April 1966. 8 refs.

A method was found to analyze low-concentration hydrocarbons assumed to have contributed to an explosion in the second heat exchanger of a nitrogen wash unit. Acetylene, 1,3-butadiene, and allene existed in the crude gas in the order of 2 to 3 ppm, 0.2 to 0.5 ppm, and 0.2 to 0.3 ppm, respectively. Nitric oxide was detected at concentrations in the order of 0.005 to 1 ppm through oxidation with permanganate and sulfuric acid, followed by calorimetric detection with the Griess-Saltzman reagent. Findings showed that more than 90% of NO entered the unit accumulated in the second heat exchanger, most of it oxidized to nitrogen dioxide and nitrous anhydride, which is more reactive with hydrocarbons

than NO. Experiments confirmed the possibility of spontaneous ignition in the second exchanger and the composition of reaction products between nitrogen and conjugated dienes. An adsorption process is now used to remove NO, in which Na<sub>2</sub>CrO<sub>2</sub> or C12 are added to the wash-water circuit.

13713

Durau, F. and V. Schratz

STUDY OF ADSORPTION HEATS OF SO<sub>2</sub> AND C<sub>3</sub>H<sub>8</sub> ON NaCl AND OF C<sub>3</sub>H<sub>8</sub> AND C<sub>2</sub>H<sub>6</sub> ON DECOMPOSED KMnO<sub>4</sub>. (Ueber Adsorptionswaermen von SO<sub>2</sub> und C<sub>3</sub>H<sub>8</sub> am NaCl und von C<sub>3</sub>H<sub>8</sub> und C<sub>2</sub>H<sub>6</sub> am zersetzten KMnO<sub>4</sub>). Text in German. Z. Physik. Chem. Abt. A (Leipzig), 159 (2-3):115-130, 1932. 22 refs.

In an experimental set-up completely isolated from the atmosphere, the adsorption isotherms of SO<sub>2</sub> and propane (C<sub>3</sub>H<sub>8</sub>) on NaCl powder and of C<sub>3</sub>H<sub>8</sub> and ethane (C<sub>2</sub>H<sub>6</sub>) on decomposed KMnO<sub>4</sub> in the temperature range from 0 C to 40 C were determined. To increase the accuracy of the measurement, the experimental set-up was enclosed in a thermostat especially constructed for this purpose. The NaCl powder was obtained by melting cleaned NaCl in a high vacuum and by pulverizing the crystals in a nitrogen atmosphere. The KMnO<sub>4</sub> was prepared by heating under low pressure without contacting any gas other than the oxygen liberated during the process. The adsorption heats were determined and results show that adsorption is caused by van der Waal forces. The experiments also confirmed observations made with coal, namely that the individual surface points develop different energies. Surface points with high adsorption potential cause chemisorption, which was weak between SO<sub>2</sub> and NaCl and more pronounced between C<sub>2</sub>H<sub>6</sub> and C<sub>3</sub>H<sub>8</sub> and decomposed KMnO<sub>4</sub>. The points of high adsorption potential disappear by crystalline transformation due to heating.

14450

Hollax, E., K. Schwabe and K. Wiesener

ELECTROCHEMICAL CLEANING OF INDUSTRIAL WASTE GASES AND DEVELOPMENT OF A NEW TWO LAYER ELECTRODE. (Über die Beseitigung von Industrieabgasen auf elektrochemischem Wege und die Entwicklung einer neuartigen Zweischichtelektrode.) Text in German. Dechema Monograph, 59 (1045-1069):147-157, 1968. 14 refs.

Elimination of gaseous pollutants from industrial waste gases poses many problems, particularly the removal of SO<sub>2</sub>. In an effort to find a satisfactory solution, electrochemical fuel cell experiments were conducted with SO<sub>2</sub> diluted with inert gas to obtain a realistic concentration. Results of galvanostatic tests showed that 90% of the SO<sub>2</sub> could be removed from the waste gas feed to the anode. Measurement of the potentials against a Hg/Hg<sub>2</sub>SO<sub>4</sub> reference electrode in 3.8 M H<sub>2</sub>SO<sub>4</sub> showed that at a fuel dilution of 1:1000 there are theoretical limits with respect to the attainable current density and the cell voltage. Further experiments were concerned with removal of other substances in the waste gas in electrochemical fuel cells. Since oxygen electrodes are 'blubber' electrodes, no difference between pure oxygen and air as reactant was found at the cathode. With methane

and carbon monoxide only, considerably lower current densities could be achieved. For conversion of reaction gases, it is advisable to use tightly-sealed, non-gassing electrodes with high electrochemical activity. These demands are fulfilled by a carbon electrode consisting of a hydrophobic substrate and a less hydrophobic coating. The coating layer is produced by surface decomposition of the binding and hydrophobilizing agent of a hydrophobic carbon body in the presence of a catalyst such as Ag, Pt, etc. Its use as an oxygen electrode is discussed. The effects of operating parameters such as temperature, gas pressure, oxygen partial pressure and KOH concentration on electrochemical power generation and on long-term performance are discussed.

14500

Gottauf, M.

GAS-CHROMATOGRAPHIC DETERMINATION OF ORGANIC COMPOUNDS IN AIR IN PRESENCE OF OZONE. (Gas-chromatographische Bestimmung organischer Verbindungen in Luft bei Anwesenheit von Ozon). Text in German. Anal. Chem., 246(1):31, 1969. 2 refs.

Trace analyses of organic compounds in air can be successfully performed by using a gas chromatographic method. The air sample is passed through a cold trap which causes the organic compounds to condense. The carrier gas then takes them through the chromatographic column. In the presence of ozone, the ozone is also condensed, at least in part, in the cold trap and begins to react with certain organic compounds either immediately or during the heating process. Many organic substances are thus destroyed and cannot be analyzed. This result can be avoided by adding an excess amount of ethylene to remove the ozone. This method was successfully used for measurements of the reaction rate between ozone and various gaseous odorants. It was possible to determine hexanal, 2-hexenal limonenes, allylisothiocyanate, and pyridine in concentrations of 10 to the minus eighth power moles/l at ozone concentrations between 10 to the minus seven and 10 to the minus five moles/l.

14622

Dauba, J. L.

MAXIMUM TEMPERATURES ATTAINABLE BY COMBUSTION OF CARBON AND METHANE IN AIR. (Temperatures maximales accessibles par combustion du carbone et du methane dans l'air). Text in French. Genie Chim., 92(4):102-110, Oct. 1964. 4 refs.

A thermodynamic study made possible the prediction of the effects of preheating of combustibles and supporters of combustion as well as the influence of the combustible/combustion supporter ratio, burning methane and carbon, respectively, in air. A simple approximation to account for calorific losses in the heat exchanger during preheating is possible if it is assumed that heat losses are mainly due to radiation. The combustible/combustion supporter ratio is much more important in the carbon-air system than in the methane-air system.

Dimov, Neno Pentshev

CHROMATOGRAPHY OF THE LIGHT GASES ON METAL-SUBSTITUTED SILICA GELS. (Chromatographie der leichten Gase auf metallersetzbaren Silikagelen). Text in German. Abhandl. Deut. Akad. Wiss. Berlin, Gas-Chromatog. 1965, no. 2:C133-C136, 1966. 16 refs.

On silica gels whose hydroxyl group hydrogens had been replaced by metal ions, the chromatographic separation of a mixture of methane, ethane, ethylene, propane, propylene, and butane were studied. It was expected that on silica gels containing -OAg, -ONa, and -OK groups, polar propylene and polarized ethylene would be retained. However, the alkali metals lead to a reduction of the retained volumes of ethylene and propylene. The alkali earth metals (Ca, Ba) reduced the effect of the hydroxyl groups but not as strongly. Propylene appears between iso-butane and n-butane. Silica gel Cu and silica gel Ag did not pass the olefins at 30 C and with a pressurized carrier gas for 30 min. Silica gel treated with Ag ions was used for analysis of ethane traces in ethylene or of propane and butane traces in propylene. It was found that at 20 C, 20 ml of ethylene can be passed through 4 g of silica gel containing 8 mole % of silver without obtaining any peaks. With larger quantities (50 ml), an ethylene peak is developed in the same time as needed with non-treated silica gel, but this peak is so small that it does not interfere with the quantitative evaluation of the other peaks.

14688

Niedrach, L. W.

ELECTROCATALYSIS AND RELATED PROCESSES AT THE HYDROCARBON ANODE. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 487-524. 33 refs.

Several techniques were used to study oxidation reactions occurring at the hydrocarbon anode of low-temperature fuel cells using aqueous acidic electrolytes. They have provided information about surface species and reaction kinetics. Results indicate two major paths for such oxidations, both deriving the required oxygen from water in the electrolyte. The first, and preferred, path involves fission of carbon-carbon bonds to form Cl radicals. These rapidly react with water to form a partially oxygenated surface intermediate which in turn reacts further at moderate overvoltage to form CO<sub>2</sub>. The second path results in the formation of more refractory multi-carbon alkyl radicals on the surface. They are held to the surface by multipoint attachment and are more difficult to oxidize. Because of the many species present on the electrode surface and changes in coverage and composition with temperature, potential, and time, a study of the anodic oxidation of hydrocarbons requires many transient electrical measurements. Some of the techniques used in measurement may prove useful in connection with air pollution and abatement problems. (Author summary modified)



Zimmermann, F. K.

GENETIC EFFECTS OF POLYNUCLEAR HYDROCARBONS: INDUCTION OF MITOTIC GENE CONVERSION. Z. Krebsforsch., 72 (1):65-71, 1969. 28 refs.

Mitotic gene conversion is a process which causes genetic variegation in somatic cells by the interaction of two different alleles of the same gene due to a presumably localized pairing of homologous chromosomes. Five polynuclear hydrocarbons were tested for their ability to induce mitotic gene conversion in a deploid strain of *Saccharomyces cerevisiae*. To enhance the sensitivity of the test system, the yeast was also made respiratory-deficient. Such a strain, in the absence of a fermentable substrate, was deprived of energy sources and consequently, unable to repair DNA damage. Under these conditions, mitotic gene conversion was induced by 9, 10-dimethylbenzanthracene, but not by pyrene, 3, 4-benzpyrene, 1, 2-benzanthracene, or 1, 2, 5, 6-dibenzanthracene. The inactivity of the latter compounds was ascribed either to their inability to react directly with DNA, or to the lack of activating enzymes in the yeast cells. The results are discussed in the light of a general genetic theory of carcinogenesis including karyotic genetic effects such as mutation, mitotic recombination, and mitotic gene conversion, as well as cytoplasmic mutation. (Author summary modified)

14811

Abel, Nikolaus, Peter Winkler, and Christian Junge

STUDIES OF SIZE DISTRIBUTIONS AND GROWTH WITH HUMIDITY OF NATURAL AEROSOL PARTICLES. PART II. INVESTIGATION OF THE COMPOSITION OF ATMOSPHERIC AEROSOL PARTICLES BY MEASUREMENT OF PARTICLE GROWTH DUE TO ABSORPTION OF WATER VAPOR AND ORGANIC VAPORS. Max-Planck-Institut fuer Chemie, Mainz, West Germany, Otto-Hahn-Institut, Contract AF 61 (052)-965, AFCL-69-0205, p. 41-63, Jan. 1969. 15 refs.

AD 689189

A gravimetric method is described for the determination of the growth of aerosol samples in vapors of water and organic solvents. Results of measurements for samples of natural and artificial aerosols for water vapor demonstrate the possibilities of the method and some special characteristics of these growth curves, such as the smooth form of the curves and the hysteresis effect. Experiments show that the typical smooth form of the growth curves of natural continental aerosols can be explained by the presence of salt mixtures and insoluble material. It is found that both the mutual influence on solubility among the various ions, as well as interaction between dissolved and insoluble material, tends to smooth the shape of these curves. The study of hysteresis indicated that this effect is due partly to the supersaturation of solutions and partly to the existence of pores in the aerosol particles or at least in the aerosol sample. There is evidence that the effect of the pores is enhanced by the interaction between soluble and insoluble material. The study of growth of natural aerosol particles in organic vapors showed that organic material

is present which results in similar growth curves as in the case of water vapor. It became clear, however, that growth in organic vapors will influence the subsequent growth in water vapor, that is, that exposure of the aerosol samples to organic vapors is not reversible. Heating of aerosol samples up to 150 C resulted in mass losses up to 35%. This mass loss is due to both organic and inorganic components. For further systematic study of the organic components in aerosols the so-called 'solution' method was developed. In this method, the mass losses are determined after exposure of the sample to a certain sequence of solvents. (Author abstract modified)

14882

Bridgeman, Oscar C. and Elizabeth W. Aldrich

TABULATION OF GAS SOLUBILITIES IN HYDROCARBON AND OTHER NON-AQUEOUS SOLVENTS. Phillips Petroleum Co., Bartlesville, Oklahoma, Jan. 18, 1955, 31p., 48 refs.  
ASTIA, AD:84791

Tables of the available information of the solubility of a number of gases in hydrocarbons and other non-aqueous solvents are compiled. There are a considerable number of methods for expressing gas solubilities. Frequently, the literature data are incorrectly designated or computed, and an attempt was made to rectify those errors. All gas solubility values summarized are expressed as Ostwald solubility coefficients, namely the volume of the gas at the stated temperature and prevailing partial pressure dissolved in one volume of liquid at the stated temperature. This method was selected for uniformity and also because the value is essentially independent of the gas pressure. For high pressures, a correction is required to account for the departure from the perfect gas laws. In the conversion of the literature values to Ostwald solubility coefficients, for which precise relations exist, the final result was expressed to the same number of figures as the original recorded value. Since the data on air solubility is a mixture of gases, the solubility, value will depend upon the V/L ratio prevailing at the time of measurement because the different components have different solubility coefficients. This is a matter for detailed computation in each individual case. Such computations were made for all literature data on air solubility and the Ostwald coefficients for air in the tabulation refer specifically to a dissolved gas of normal air composition, unless otherwise noted. Theoretical relations between the solubilities of a given gas in a variety of liquids constitute a guide to weighting the accuracy of values by different observers and can be employed to extend the range of knowledge of the solubility of a given gas in a given liquid.

14917

Jonathan, Neville

INFRARED SPECTROSCOPY APPLICATION TO CHEMICAL KINETIC SYSTEMS. Southampton Univ., Southampton, England, Dept. of Chemistry, Contract AF61(052)-886, Proj. 8658-03, AFCL-69-0055, 20p., Oct. 21, 1968. 15 refs.  
CFSTI, DDC: AD 683 772

Work carried out on atom-molecule and atom-atom reactions in the gas phase is reported. A zeolite pump was designed for studying the reactions at fast flow rates and low pressures. Results are given of studies on three light emitting reactions: atomic oxygen plus nitric oxide, atomic nitrogen recombination, and atomic oxygen plus acetylene. The mechanism by which ozone is adsorbed on silica gel was investigated using infrared absorption spectroscopy. Spectra were obtained for ozone, carbonyl sulfide, and sulfur dioxide adsorbed on an Aerosil pressed disc sample. In each case, a new band was detected at a lower frequency than that due to unperturbed hydroxyl groups, and the new band was found to increase in intensity as the latter decreased. Shifts were measured at various temperatures, and the results explained in terms of the formation of a hydrogen bond between the hydroxyl group on the adsorbent surface and the adsorbate molecule. The temperature dependence of the shift is also consistent with the known properties of the hydrogen bond. As the temperature is increased, the hydrogen bond becomes weaker, and the frequency of the hydroxyl band approaches the value for a free hydroxyl group. It is suggested that both ozone and sulfur dioxide are adsorbed on silica gel through their central atoms rather than through their terminal oxygen atoms.

15045

Crosley, David R.

USE OF OPTICAL PUMPING TO DETECT FREE RADICALS DURING A GAS-PHASE PHOTOLYSIS. J. Chem. Phys., 47(4):1361-1368, Aug. 15, 1967. 32 refs.

An optically pumped system of rubidium was used as a probe to measure the concentration of free radicals present during the vacuum-ultraviolet photolysis of five hydrocarbons. The mechanism for this measurement is the reduction of the relaxation time of the oriented rubidium in the presence of radicals, due to the large spin exchange interaction between the two species. Measurements were made at two different pressures each on methane, ethane, propane, butane, and isobutane and both relative and absolute approximate quantum yields for radical production were determined. Separate detection of hydrogen atoms during the photolysis, through spin exchange coupled electron spin resonance is discussed. This method of directly detecting free-radical intermediates appears to be a useful complement to standard experiments in which reaction mechanisms are deduced from analysis of final products of the photolysis. (Author abstract modified)

15046

Herkstroeter, William G. and George S. Hammond

MECHANISMS OF PHOTOCHEMICAL REACTIONS IN SOLUTION. XXXIX. STUDY OF ENERGY TRANSFER BY KINETIC SPECTROPHOTOMETRY. J. Am. Chem. Soc., 88(21):4769-4777, Nov. 4, 1966. 26 refs.

Conventional flash techniques were used to measure the acceleration of the decay of various sensitizer triplets in the

presence of energy acceptors. An extensive study was made of the stilbenes and 1,2-diphenylpropenes as acceptors. The results are correlated with those obtained earlier in studies of the photosensitized cis-trans isomerization of the same substrates. The reactivity in energy transfer remains remarkably high with these substrates even when the triplet excitation energy of the sensitizer is insufficient to produce any known optical transition of the substrates. The result is in good agreement with the hypothesis that flexible molecules can undergo 'non-vertical' transitions to produce twisted geometric forms directly. (Author abstract modified)

15012

Reeds, J. N. and Karl Kammermeyer

ADSORPTION OF MIXED VAPORS. Ind. Eng. Chem., 51(5):707-709, May 1959. 17 refs.

Measurements of the rate of diffusion of components of the system methanol-benzene through porous glass blocks revealed the existence of an adsorption azeotrope in analogy to vapor-liquid azeotropes. At the temperatures studied (15, 25, and 35 C), benzene was preferentially adsorbed from the azeotropic vapor-liquid mixtures. However, when present in very high concentrations, methanol was preferentially adsorbed. Thus a composition must exist in the intermediate region which would absorb unchanged in composition. Since the equilibrium between the composition of the vapor and the composition of the adsorbate is graphically similar to common isothermal vapor-liquid equilibria for minimum boiling mixtures of binary constituents, this crossover composition is called an adsorption azeotrope. The curve for vapor-adsorbate equilibrium is, however, shifted toward the methanol-rich side of the vapor-liquid equilibrium system. This shift is more pronounced at lower temperatures or lower pressures. The existence of adsorption azeotropes, is established in these vapor adsorption studies on the benzene-methanol system, has implications in all separation processes using adsorption methods. (Author conclusions modified)

15019

Porter, G. and J. I. Steinfeld

GIANT-PULSE-LASER FLASH PHOTOLYSIS OF PHTHALOCYANINE VAPOR. J. Chem. Phys., vol. 45:3456-3457, 1966. 6 refs.

Flash photolysis was conducted on phthalocyanine gas to investigate the radiationless processes. Conventional flash photolysis, using a 220-J discharge through flash tubes filled with 3 torr of oxygen, produced a depletion of singlet absorption followed by extremely rapid recovery, faster than could be resolved by the apparatus. When a Q-switched ruby laser flash passed through the vapor, a large, fast depletion of absorbing molecules was observed, followed by a slow recovery. The slow recovery is due to the vaporization of excess solid in the sample tube and subsequent diffusion of the vapor into the absorbing region; thus, the laser flash irreversibly decomposes

a large fraction of the phthalocyanine molecules in its path. If the Q-switch is removed from the laser and the full 40-J pulse is passed through the sample, no decomposition is observed. This strongly suggests that a process involving two photons is responsible for the photodissociation. When a similar experiment is carried out in chloronaphthalene solution at 25 C, the singlet absorption recovers more quickly, and there is apparently no photodissociation. A possible explanation for this, suggested by the observation that the fluorescence yield decreases by a factor of 77 in going from solution at 25 C to vapor at 450 C, is that the second photon is absorbed by a metastable state M1, which could be the lowest triplet or a singlet of different electronic symmetry, producing a state M2, which dissociates. Since the crossing rate has an apparent activation energy of 4.5-7.5 kcal/mole, this process will be favored at high temperatures. An additional effect which might be operative is the rapid relaxation of M1 by solvent. This mechanism is supported by our results for conventional flash photolysis of tetraphenylporphyrin at 310-350 C, which absorbs at 4010 Å.

15020

Yardley, James T. and C. Bradley Moore

LASER-EXCITED VIBRATIONAL FLUORESCENCE AND ENERGY TRANSFER IN METHANE. J. Chem. Phys., vol. 45:1066-1067, 1966. 10 refs.

The collisional relaxation time for the transfer of vibrational energy from the asymmetric stretch to the bend of methane were measured. Ultrasonic measurements indicate that most polyatomic molecules exchange vibrational energy rapidly among the excited states and lose energy to translation and rotation via the lowest-energy mode. Measurements confirmed this conclusion for methane and yielded stretch to bend rates for comparison to theory.

15032

Sobolev, Igor, J. A. Meyer, Vivian Stannett, and Michael Szwarc

PERMEATION, DIFFUSION, AND SOLUBILITY OF METHYL BROMIDE AND ISOBUTENE IN POLYETHYLENE. Ind. Eng. Chem., 49(3):441-444, March 1957. 20 refs.

Permeability constants, diffusion constants, and solubility coefficients were obtained for methyl bromide and isobutane vapors in polyethylene. The results are presented in the form of permeability isobars and permeability and sorption isotherms. The temperature dependence of the permeability constants for methyl bromide is shown for three different pressures: 100 mm, 300 mm, and 640 mm of mercury. The isobars corresponding to higher pressures depart markedly from the normally observed linear relationship, the permeability constants first decreasing and then increasing as the temperature is progressively lowered. A similar behavior is observed in the permeation of isobutane. The minima of these isobars are shifted toward lower temperatures as the pressure is decreased, and at sufficiently low pressure, e.g., 100 mm, normal linear plots are obtained across the whole temperature range covered. At lower temperature both diffusion constants and solubility coefficients depart from normal linear relations. The

diffusion constants are concentration-dependent and the activation energy required for diffusion decreases with increasing constant relative vapor pressure. The solubilities of constant relative vapor pressure are independent of temperature, indicating that lowering the temperature at constant pressure leads to the same sequence of effects as increasing the pressure at constant temperatures, i.e., in a proper scale the isobar at variable temperature is identical with the isotherm at variable pressure. Hence, the rapid increase in the solubility coefficient at constant pressure and variable temperature reflects the steep slope of the sorption isotherm.

15048

Ruhemann, M. and P. L. Charlesworth

THE THERMODYNAMIC EFFICIENCY OF GAS SEPARATION PLANTS. Brit. Chem. Eng., 11(8):839-842, Aug. 1966. 2 refs.

The sources of inefficiency in gas separation units are analyzed. Variations in column pressure accompanied by other modifications can affect thermodynamic efficiency. However, the principal causes of low thermodynamic efficiency are difficulty of cold recovery and the irreversibility of the distillation columns. This is due to the large temperature differences between the top and bottom ends of columns fractionating the multicomponent mixtures encountered in low temperature hydrocarbon separations. To improve efficiency and reduce the utility consumption of hydrocarbon gas separation plants, a higher degree of cold recovery should be achieved wherever possible. Temperature differences between the ends of the columns should be decreased. The circulation rate of refrigerants should be reduced as far as possible. The amount of the higher boiling refrigerant which must be compressed to a sufficiently high pressure to allow it to be condensed against cooling water should be minimized. The steps to improve thermodynamic efficiency in two of a different design plants, one high pressure, the other low pressure, are described. Although the efficiency of the high pressure plant is considerably greater than that of previous variants, power consumption is still high. This is partly due to the fact that the ethylene product is made available at an elevated pressure and that a portion of it is supplied as liquid. The power consumption of the low pressure plant is considerably lower than the high pressure plant. Other features of the two plant designs will have to be compared from both practical and economic viewpoints before a design preference is made.

15055

Eisenthal, K. B., W. L. Peticolas, and K. E. Rieckhoff

LASER-INDUCED LUMINESCENCE AND DISSOCIATION IN BIPHENYL. J. Chem. Phys., 44(12):4492-4497, June 15, 1966. 16 refs.

The interaction of the radiation field of an unfocused ruby laser with molecules containing a phenyl-phenyl or benzyl-benzyl single bond gave rise to a new luminescence. This luminescence is linearly dependent on the molecular concentration and proportional to either the second or the third power of the laser intensity. Thus it appears that a multiphoton absorption is

occurring. The absorption does not appear to involve the electronic states of the molecules. This luminescence occurs throughout the visible region and bears no resemblance whatever to either the normal fluorescence or phosphorescence. Because of the exceedingly high laser intensities or electric fields necessary for electronic dielectric breakdown it appears that this mechanism is not of importance. It is suggested that multiphoton vibrational excitation to a dissociative state of the molecule may occur which leads to molecular fragmentation. This process is followed by a chemiluminescent emission. A quantitative comparison of the experimental results with a theoretical treatment of multiphoton vibrational dissociation is made. (Author abstract modified)

15063

Beams, J. W. and C. Skarstrom

THE CONCENTRATION OF ISOTOPES BY THE EVAPORATIVE CENTRIFUGE METHOD. Phys. Rev., vol. 56:266-272, Aug. 1, 1939. 19 refs.

The air-driven vacuum-type tubular centrifuge was used for the separation of the isotopes of chlorine by the evaporative centrifuge method. The separations obtained were about the same as predicted by the theory provided that experimental conditions approximately conformed to the assumptions of the theory. With a steel tube 11 in. long and 3 in. inside diameter, containing baffles to prevent remixing, and spinning at 1060 rps, carbon tetrachloride vapor was withdrawn from the axis at the rate of 3.2 grams per minute without decreasing the separation factor. This separation factor for chlorine, which at any instant is the ratio at the periphery, was 1.025 in the above case. It is believed that the method is practical in the case of the heavier elements, but inferior to other centrifuge methods where large concentrations of the isotopes in smaller quantities of material are used. (Author abstract modified)

15074

Li, N. N. and E. J. Henley

PERMEATION OF GASES THROUGH POLYETHYLENE FILMS AT ELEVATED PRESSURES. Am. Inst. Chem. Engrs. J., 10(5):666-670, Sept. 1964. 16 refs.

The permeability of polar and nonpolar gases (methane, ethane, propane, butane, ethylene, Freon-12, carbon dioxide, and nitrous oxide) in polyethylene film was studied at 15 to 40 C and film pressures to 11 atm. The effects of film thickness, temperature, and upstream and downstream pressures on gaseous permeation were determined. Carbon dioxide permeation through polyethylene obeys both Henry and Fick's laws. When upstream and downstream pressures are maintained at 1.57 and 1.0 atm, the permeation constant CO<sub>2</sub> is temperature dependent, obeying the usual Arrhenius type relationship. The permeabilities of methane, ethylene, ethane, propane, butane, NO, and Freon-12 are pressure dependent, and the activation energies of these gases are functions of pressure. The observed correlation between

permeability and increased pressure is further evidence of the strong plasticizing effect exerted by organic and inorganic polar vapors and gases. Both solubility constants and gas diffusivity are shown to be functions of pressure. Tested film thickness of 1, 2, 4, and 10 mil have no effect on the permeation constant. The effect of pressure on permeability is expressible by an exponential equation. The solubility constants of pressure-dependent gases can be correlated by a similar exponential equation, while diffusivity is calculated from permeation and solubility constants.

15078

Mulvihill, J. W., W. P. Haynes, S. Katell, and G. B. Taylor

COST ESTIMATES OF PROCESSES FOR SEPARATING MIXTURES OF METHANE AND HYDROGEN. Bureau of Mines, Washington, D. C., RI 6530, 43p., 1964. 42 refs.

Capital and operating costs were estimated for separating methane and hydrogen in gas-separating plants designed to produce 90 million standard cu ft per day of product gas containing a minimum of 90 percent methane. After a preliminary literature review of various separation techniques, three different processes moving-bed adsorption using active carbon, oil absorption, and liquefaction were chosen for the cost estimates. Three different methane feed gas concentrations, 5, 20, and 50 percent were chosen as representative methane concentrations for the separation estimates. Capital and operating costs were lowest for the moving-bed adsorption process in all three cases investigated. Operating costs (1964) declined from \$0.24 to \$0.06 per 1000 cu ft of product gas, and capital costs declined from \$47,490,800 to \$7,411,200 as the percentage of methane in the feed gas increased from 5 to 50 percent. (Author abstract modified)

15085

Mellen, A. W.

CRYOGENICS IN GAS PROCESSING. Oil Gas J., 63(26):96-100; 102, June 28, 1965.

Recent developments in the cryogenic processing of natural gas are reviewed. Cryogenic technology is distinguished by its insulation techniques, the most widely known of which is the cold box; by its specialized metallurgical requirements, which depend on the use of various modified steels; and by the need for particularly high thermodynamic efficiency. The technical features of the helium recovery process, presently the greatest of cryogenics in natural gas processing, are explained, and a flow diagram of the operation is given. Because helium plant construction is diminishing, interest in the cryogenics of liquefied natural gas (LNG) is increasing rapidly, with emphasis on peak-shaving and ocean transportation operations. In LNG plants, interest has centered on cascade-type systems; such a system using propane, ethylene, and methane as the cascading refrigerants is described. The recently-developed use of an expansion-engine cycle in conjunction with existing pressure-letdown situations to provide refrigeration for natural



gas liquefaction is also considered, with reference to its application in a simple Claude cycle. The economic and technical aspects of using the cold from LNG revaporization in the liquefaction of industrial gases for distribution is currently under study. Another potential application of cryogenics in the gas industry is the reduction of the nitrogen content of natural gas; nitrogen-rejection techniques have been developed in helium recovery plants and may change the status of gas fields that are not considered economic at present because of high nitrogen content.

15088

Korving, J., H. Hulsman, H. F. P. Knaap, and J. J. M. Beenakker

THE INFLUENCE OF A MAGNETIC FIELD ON THE VISCOSITY OF CH<sub>4</sub> AND CF<sub>4</sub> (ROUGH SPHERICAL MOLECULES). Phys. Letters, 17 (1):33-34, June 15, 1965. 11 refs.

An experimental determination of the influence of a magnetic field on the velocity of CH<sub>4</sub> and CF<sub>4</sub> is reported. The classical picture of the phenomenon for nonspherical molecules is that the magnetic field gives rise to a precession of the magnetic moment of the molecule around the field direction. A more fundamental description is given in terms of the distribution function of the velocities and angular momenta of polyatomic molecules. The change in the viscosity of CH<sub>4</sub> and CF<sub>4</sub>, which are regarded as rough spherical molecules was measured, and a change was found for both gases. Results show that viscosity change is a function of the magnetic field/pressure. A theoretical treatment of viscosity and heat conductivity in a gas of rough spherical molecules was undertaken by solving the Boltzmann equation containing a magnetic field term. The rough-spherical model has the advantage over the oveloid model in that the collision process is completely specified.

15104

Michaels, Alan S., Wolf R. Vieth, and James A. Barrie

DIFFUSION OF GASES IN POLYETHYLENE TEREPHTHALATE. J. Appl. Phys., 34 (1):13-20, Jan. 1963. 16 refs.

Diffusion of helium, oxygen, nitrogen, argon, carbon dioxide, and methane in glassy and rubbery polyethylene terephthalate was studied in the range of 25 to 130 C. Despite the abnormal solution behavior of these gases in the glassy polymer, the diffusion process is evidently normal and Fickian. Correlation of solubility constants for oxygen and nitrogen, obtained by the time-lag method, with data obtained by a static sorption method, indicates that glassy crystalline polyethylene terephthalate may be considered an isotropic diffusion medium. Diffusion is impeded purely geometrically by the presence of the crystallites, and the impedance factor is equal to the reciprocal of the amorphous volume fraction. In the rubbery crystalline state of the polymer, diffusion is Fickian and apparent activation energies for diffusion are larger than those in the glassy crystalline polymer. A model for diffusion in the glassy

amorphous and crystalline polymers is proposed, assuming that the driving force for diffusion is the concentration gradient of dissolved molecules which are assumed to be in local equilibrium with molecules in the 'holes.' The model predicts that actual diffusion constants and activation energies are larger than those experimentally measured. Thus, part of the observed difference between values of the activation energy in the glassy and rubbery states may be reconciled. Correlations of diffusion and activation energy with the square of gas molecular diameters are obtained in both the glassy and rubbery states. In the latter plots, the helium data fall above the correlations, showing evidence of partially nonactivated diffusion in both states of the polymer. (Author abstract modified)

15119

Ronn, A. M.

LASER-INDUCED INFRARED FLUORESCENCE. J. Chem. Phys., vol. 48:511-513, 1968. 2 refs.

Fluorescence was detected from ethylene, SF<sub>6</sub>, NH<sub>3</sub>, CH<sub>3</sub>Br, CD<sub>3</sub>I, D<sub>2</sub>S, CH<sub>3</sub>NH<sub>2</sub>, C<sub>3</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>5</sub>Cl at low pressures when irradiated by a 50-W CW CO<sub>2</sub>-N<sub>2</sub>-He laser. The apparatus used consisted of a commercial CO<sub>2</sub> laser as a pumping source and an infrared grating spectrometer for detection. Ethylene absorbed all of the laser lines and promoted a considerable number of molecules to the seventh excited state. Redistribution of the excited molecules to all rotational states in the vibrational band by thermalizing collisions is very rapid at a pressure of 50 mm Hg and is on the order of 0.1-10 microsec. Vibrational relaxation is much slower, approximately 0.1-10 millisecc; hence, emission occurs in most rotational transitions in the band. The only exception appeared in the emission spectrum of NH<sub>3</sub>. The emission spectrum shows some intensity deviations from the absorption spectrum in that all emission lines originating from s states are slightly more intense than those from a states. The overtone transitions are also more intense in the emission spectrum. It may be that the fundamental transition is absorbing the laser's power, thus causing fluorescence from all s and a states at the same time. Although the mechanism of emission is not fully understood, the efficiency of collisional transfer is sufficient to populate a total vibration-rotation band when only a few of its members are strongly saturated.

15125

Gilliland, E. R., R. F. Baddour, and H. H. Engel

FLOW OF GASES THROUGH POROUS SOLIDS UNDER THE INFLUENCE OF TEMPERATURE GRADIENTS. Am. Inst. Chem. Engrs. J., 8(4):530-536, Sept. 1962. 34 refs.

The isothermal and isobaric flow of pure gases and vapors through microporous Vycor glass was investigated under such conditions that the gas-phase flow occurred by Knudsen diffusion. The isothermal flows and the isobaric flow of nonadsorbed gases are

correlated by existing relationships. On the assumption that surface flow is a diffusive process and that equilibrium exists between the vapor and solid throughout the porous media, a correlation for the nonisothermal surface flow is developed. The factors determining the rate of surface flow are the physical properties of the solid, the temperature level and gradient, the enthalpy of adsorption, the surface concentration and spreading pressure of the adsorbed phase, and the activation energy and coefficient of resistance for surface diffusion. The latter two factors can be evaluated from isothermal surface flow measurements; hence no new arbitrary constants are required in the correlation. Agreement between predicted and measured surface flows is good for ethylene and propylene at a mean temperature of 25 C. Both the gas-phase and surface flows are from the cold to hot end of the porous solid. It is suggested that the use of temperature gradients in porous solids and plastic films for separating mixtures of vapors be investigated. (Author abstract)

15131

Barrer, R. M.

SOME PROPERTIES OF DIFFUSION COEFFICIENTS IN POLYMERS. J. Phys. Chem., 61(2):178-188, Feb. 1967. 62 refs.

Recent developments in sorption and diffusion in some polymers are reviewed. The five diffusion coefficients characteristic of any binary mixture can all be obtained in penetrant-polymer mixtures, but past measurements in a variety of systems have probably given erroneous diffusion coefficients (D) because it was only recently realized that the diffusion coefficients are a function of times as well as of concentration. Present methods of interpretation cannot allow for simultaneous time and concentration dependence of D. For this reason the most reliable results refer to elastomer-penetrant systems, where time effects are at a minimum owing to short relaxation times of polymer molecules. For the same reason, in polymers exhibiting less chain mobility and stronger inter-chain bonds, the steady-state methods of measuring diffusion coefficients are preferable to transient state procedures. A classification of penetrant-polymer systems is given, with examples of each category. Factors influencing the concentration dependence of D are discussed, and also the experimental observations leading to the zone theory of the diffusion mechanism and the quantitative formulation of this theory. Relations between viscous resistance and diffusion are indicated, and generalized functional relationships are considered. Selectivity in the transmission of molecules through organic membranes is also considered. (Author abstract modified)

15134

Salama, C. and D. V. Eyre

MULTIPLE REFRIGERANTS IN NATURAL GAS LIQUEFACTION. Chem. Eng. Progr., 63(6):62-67, June 1967.

Three types of cascade cycles for liquefying natural gas in large-

capacity plants are described. A standard cascade cycle which consists of a succession of refrigeration cycles and utilizes propane, ethylene, and methane refrigerants in closed loops, has certain high-cost and complex operational drawbacks. The dual-refrigerant cycle represents a simplification of the standard cycle by combining the ethylene and methane refrigerant cycles into one group. The development of the autorefrigerated cascade (ARC) cycle was a further refinement of the liquefaction process. The principle of this cycle is still one of refrigeration transfer from cooling water to decreasing temperature levels, as with the other cycles, but the refrigerant consists of a single mixture having a composition which allows the partial condensation at any one state to correspond exactly to the refrigeration requirements of the next stage. The partial condensations of the refrigerant take place at one pressure level corresponding to the high pressure of the cycle, while the vaporizations occur at a single low pressure corresponding to the cycle compressor suction pressure. The refrigerant used in the process is a mixture of nitrogen and hydrocarbons. Flowsheets and detailed descriptions of each of the cycles are presented, as well as a discussion of the thermodynamics involved. The advantages of the ARC cycles over the others favor its application whenever multiple-refrigerant cycles are considered for the liquefaction of natural gas. These advantages include low over-all investment, flexibility of operation, efficient use of installed horsepower, ease of maintenance, no requirement for the purchase of costly high-purity refrigerants, and constant availability of the total amount of refrigeration in different sections of the cycle.

15139

Tiffany, W. B.

SELECTIVE PHOTOCHEMISTRY OF BROMINE USING A RUBY LASER. J. Chem. Phys., 48(7):3019-3031, April 1, 1968. 46 refs.

Gas-phase photochemical addition of bromine to olefin molecules was studied by inducing the reaction with monochromatic light near 6940 Å from a pulsed, tunable ruby laser. All previous photochemical reactions of bromine were induced with light at wavelengths shorter than 6800 Å, and were found to proceed by means of free radical chains. The Br atoms initiating these chains are produced by direct dissociation of Br<sub>2</sub> molecules upon absorption of light in the continuum. The present investigation shows that free-radical chains are responsible for the reaction at 6940 Å, also. However, direct dissociation at this wavelength is found to be negligible, and the Br<sub>2</sub> molecules are excited to individual bound levels 500 to 800/cm<sup>-1</sup> below the dissociation energy. Kinetic and isotopic evidence shows that the additional energy is furnished by subsequent collisions, so that about 1% of the excited Br<sub>2</sub> molecules become dissociated and can initiate the reaction. The remaining excited Br<sub>2</sub> molecules relax by collisions to the ground state at a rate somewhat higher than the gas-kinetic-collision rate. It was shown that selective laser excitation provides information about dynamic molecular processes which is not easily obtained using other methods. (Author abstract modified)

Michaels, Alan S. and Harris J. Bixler

SOLUBILITY OF GASES IN POLYETHYLENE. J. Polymer Sci., 50(154): 393-412, 1961. 22 refs.

The solubility constants for thirteen permanent gases were measured from the 5-55 C in a linear and branched polyethylene, hydrogenated polybutadiene, and natural rubber. Equilibrium and time lag solubility determinations were made and were in agreement. The solubility of each gas in polyethylene was proportional to the volume fraction of amorphous material when the polymer was treated as a simple, two-phase mixture of crystalline and amorphous polymer, each with a characteristic specific volume. A solubility constant in completely amorphous polyethylene was determined for each gas which, with the density of an arbitrary sample, enabled calculation of the solubility of each gas in that particular sample. A correlation of the solubility constants in completely amorphous polyethylene was obtained from a thermodynamic model of the dissolution process. The solubility constants in natural rubber, a completely amorphous polymer under the experimental conditions, were approximately 50% higher than those in amorphous polyethylene. Higher intermolecular forces due to the unsaturation in natural rubber may account for this result. The apparent heats of solution of all gases in branched polyethylene were approximately 1.0 kcal/g mole more positive than those in linear polyethylene. This behavior was the result of crystalline melt-out in branched polyethylene. In linear polyethylene the experimental solubility data yielded essentially true heats of solution, since negligible crystalline melt-out occurred between 5 and 55 C. These were correlated by the thermodynamic model for the dissolution process. Available evidence indicates that the crystallites in polyethylene are impenetrable, and are randomly distributed on a macroscopic scale with respect to the diffusion and dissolution processes. The amorphous phase behaves as a homogeneous liquid whose thermodynamic properties are independent of the mode of polymer preparation, thermal history of the sample, and level of crystallinity. (Author summary modified)

Michaels, Alan S., Harris J. Bixler, and Harvey L. Fein

GAS TRANSPORT IN THERMALLY CONDITIONED LINEAR POLYETHYLENE. J. Appl. Physics, 35(11):3165-3178, Nov. 1964. 18 refs.

The sorption and diffusion of helium, argon, and ethane, and their temperature dependencies were measured in a series of linear polyethylene films previously subjected to widely differing conditions of cooling from the melt and to subsequent annealing at elevated temperature. The results indicate unexpected effects of thermal history on crystalline morphology. Rapidly cooled polymer, after annealing at 130 C, exhibited significantly higher permeability to all gases than slowly cooled polymer, suggesting that gas permeability of linear polyethylene is not uniquely determined by level of crystallinity, but depends also on the path by which such crystallinity is developed. Irrespective of thermal history and crystallinity level, solubility

constants and heats of solution of argon and ethane were normal, varying linearly with amorphous volume fraction. Diffusion activation energies for these gases were also independent of thermal history. The solubility constants of helium were anomalously high, and dependent on both thermal history and level of crystallinity. With helium, anomalous temperature variations of diffusion constants were observed with films in which solubility was anomalous. The peculiar sorption and diffusion behavior of helium implies that helium is capable of slow diffusion into, and occupancy of, defects or voids within the crystalline structure from which larger gas molecules are excluded. The 'chain immobilization factors' for argon and ethane are thought to be a size-controlled impedance to diffusion. They arise from the extremely small dimensions of the diffusional paths in highly crystalline polymer.

15167

Carter, J. W.

ADSORPTION PROCESSES. Chem. Process Eng., 47(9):70-77, Sept. 1966. 12 refs.

Adsorptive capacity and, to a lesser extent, the effective diameter of the internal pores of an adsorbent are important variables influencing the choice of adsorbers for particular separation problems. For drying gases or liquids at low temperatures, molecular sieves are advantageous in their higher capacity. This is particularly the case when drying organic liquids or vapor mixtures of hydrocarbons and other organics. Molecular sieves are also suitable for adsorbing organic compounds such as hydrogen sulfide, carbon oxysulfide, and olefins at relative low humidities. At high relative humidities, the ultimate capacity of silica gel and activated aluminum are higher. Empirical or semiempirical methods must be used to estimate the quantity of absorbent necessary and the dimensions of a suitable absorber bed. Flow and pressure drop requirements of the bed and of the regenerating circuit must also be computed. Predicting the performance of fixed-bed adsorbers is difficult because adsorption processes involve a number of interacting mechanisms. Mathematical treatments can give no more than a guide to the best practice. Numerical methods of solution involving high-speed digital computation are required to explain the influence of these mechanisms.

15183

Michaels, Alan S., Wolf R. Vieth, and James A. Barrie

SOLUTION OF GASES IN POLYETHYLENE TEREPHTHALATE. J. Appl. Phys., 34(1):1-12, Jan. 1963. 19 refs.

The solubilities of helium, nitrogen, oxygen, argon, methane, carbon dioxide, and ethane in glassy amorphous and crystalline polyethylene terephthalate were studied by time-lag and/or static sorption methods. Solubilities of all the gases but ethane were also determined in the rubbery crystalline polymer. The only deviations from Henry's law were displayed by ethane at 25 C and carbon dioxide at 25 and 40 C in the glassy polymer.

Correlation of solubility constants for oxygen and nitrogen obtained by the static sorption method with values obtained dynamically indicate that the glassy crystalline polymer is an isotropic diffusion medium. Sorption in the glassy amorphous and crystalline polymers generally takes place by two processes operating concurrently: ordinary dissolution plus 'hole-filling.' Crystallinity reduces gas solubility in the glassy polymer, but not generally in direct proportion to the decrease in amorphous volume. An exception is helium. The glassy state of the partially crystalline polymer extends to about 80-85 C where a transition region is noted on a van't Hoff plot for solubility constants. The other extremity of this region (about 95 C) marks the onset of rubber-like behavior in the polymer. Heats of sorption in the glassy crystalline polymer are more exothermic than in the rubbery crystalline polymer, characteristic of the transition from sorption by dissolution and void-filling processes to dissolution alone. The heat of solution of helium is slightly positive in both the glassy and rubbery states of the crystalline polymer. It appears that the major contribution to helium sorption in either state of the crystalline polymer is ordinary dissolution. In both the glassy and rubbery states, carbon dioxide shows evidence of a polar interaction with the polymer. Solubility constants are correlated with gas force constants in both the glassy amorphous and rubbery crystalline polymers. (Author abstract modified)

15186

Michaels, Alan S., Raymond F. Baddour, Harris J. Bixler, and C. Y. Choo

CONDITIONED POLYETHYLENE AS A PERMSELECTIVE MEMBRANE. Ind. Eng. Chem. Process Design Develop., 1(1):14-25, Jan. 1962. 16 refs.

The purposes of the investigation were (1) to measure the rates of transmission of xylene isomers through conventional polyethylene films under controlled conditions; (2) to condition polyethylene films by heating the polymer in the presence of selected isomers, followed by cooling; and (3) by measuring the isomer transmission characteristics of the conditioned films, to establish whether the conditioning process has any significant effect on either film permeability or permselectivity to the isomers. By swelling polyethylene film in p-xylene and annealing the film at an elevated temperature in the swollen state, it was possible to increase the xylene liquid permeation rate through the film and the permselectivity of the film to p- with respect to m- and o-xylenes. Permeability and permselectivity changes are highly dependent on the degree of swelling, the treatment temperature, polymer crystallinity, and the treating compound. Alteration of the crystalline texture of the polymer is believed responsible for the observed effects. This technique of tailoring a polymeric membrane to render it more effective as a separation barrier appears to open new prospects for the utilization of membrane permeation as a practical mixture separation method.

15187

Kammermeyer, Karl and Darrell D. Wyrick

EFFECT OF ADSORPTION IN BARRIER SEPARATION. Ind. Eng. Chem., 50(9):1309-1310, Sept. 1958. 12 refs.

Separation experiments were carried out with mixtures of propane and carbon dioxide in flow through porous glass as the microporous barrier to determine if porous barriers are affected by the differences in the adsorbability of the components. The experiments show that components of essentially equal molecular weight can be separated on the basis of differences in adsorption on a microporous barrier. Mixtures of propane and carbon dioxide gave appreciable enrichment in propane, the more condensable component, entirely on the basis of adsorbed flow. It is concluded that mixtures can be effectively separated with barriers by utilizing differences in the adsorbed flow of the components by proper adjustment of operating conditions. Studies are under way to establish the degree of adsorption of propane and carbon dioxide on the porous glass barrier under the conditions of the separation experiments.

15198

Baddour, Raymond F., Alan S. Michaels, Harris J. Bixler, Richard P. De Filippi, and James A. Barrie

TRANSPORT OF LIQUIDS IN STRUCTURALLY MODIFIED POLYETHYLENE. J. Appl. Polymer Sci., 8(2):897-933, 1964. 20 refs.

The mechanism responsible for changes in film properties was investigated and the structural aspects of a crystalline polymer that affects liquid sorption and diffusion were determined. Cast linear polyethylene films subjected to dry and solvent annealing display markedly different sorption and diffusion barrier properties than do untreated films. The subsequent sorption of liquid o- and p-xylene and cis- and trans-acetylene dichloride per unit volume of amorphous polymer increases as the annealing temperature and/or treating solvent concentration increases. Integral diffusivities calculated from sorption and steady-state permeation rates show a monotonic increase with sorption per unit volume of amorphous polymer. The concentration dependence, however, is less marked than observed in similar systems at low permeant activity. Apparently the treatment reduces the effective crosslinking imposed by the crystallites on the amorphous polymer chains through disentangling and incorporating some of these chains into crystallites. Thus the polymer is capable of a greater degree of swelling when brought into contact with a compatible liquid in spite of a higher degree of crystallinity. The low concentration dependence of the diffusivities is probably due to heterogeneous distribution of excess permeant in a treated film. If the excess permeant were preferentially sorbed in regions of low polymer concentration, then the above observations could be explained. Long-duration, osmotic stress-induced swelling and recrystallization are cited to account for time-dependent permeation rates in treated and untreated films. (Author summary modified)

15238

Shtern, V. Y.

MECHANISM OF THE VAPOUR-PHASE NITRATION OF ALKANES BY NITROGEN PEROXIDE. Khim. Kinetika, 1966:286-322. 33 refs. Translated from Russian. Ministry of Technology, Orpington, Kent, England,



To determine the optimum conditions for obtaining nitro products by the nitration of alkanes, the kinetics and mechanism of the thermal nitration of methane and propane were studied. A glass vacuum apparatus with a conventional cylindrical reactor was used for the experiments in which slow reactions, cold-flame, and hot-flame reactions were observed. Only nitromethane, carbon oxides, hydrogen, and water were found in the products of the slow reaction of methane nitration. In addition to these products, the cold-flame reaction yielded formaldehyde and ethane. The hot-flame reaction lead to the appearance of ethylene and to an increase in the ethane and hydrogen content. The main products of the slow reaction of propane nitration were nitro-alkanes and carbon oxides. Methane and hydrogen were not present. The main products of the cold-flame reaction were carbon oxides, olefins, formaldehyde, and methane. The hot-flame reaction decreased the yield of alkenes and carbonyl compounds, increased the carbon oxides, and yielded hydrocyanic acid. The mechanism of alkane nitration is a branching chain reaction that can simulate an unbranching chain reaction when chain discontinuity predominates over the branching. Chain formation is linked with the formation of excited alkyl nitrite whose almost instantaneous decomposition, with the formation of the alkoxyl radical RO, makes possible the further development of the chain. Branching is a result of the reaction of aldehyde with NO<sub>2</sub>. Instead of the formation of two or three free valencies, the formation of the active acyl radical, RCO, occurs in the course of branching.

15243

Meijer, R. J.

THE PHILIPS-STIRLING ENGINE. (Der Philips-Stirlingmotor).  
Text in German. Motortech. Z. (Stuttgart), 29(7):284-298, July 1968. 14 refs.

The development of the Philips-Stirling engine is described and its advantages are enumerated. The engine is based on the principle of moving gas back and forth between a hot chamber and a cold chamber by a displacement piston. Development of the Stirling principle began in 1938 in the Philips research laboratories with the construction of small hot-air engines. Through the invention of the double acting engine, the path to larger Stirling engines was opened. Development of the rhombic gear in 1953 permitted operation with a pressureless crankcase. Hydrogen and helium replaced air. The engine efficiency could be raised to 38%, the specific power to 110 hp referred to the piston displacement volume. Better gaskets improved the longevity of the engine. The problems of thermal tension and heat transfer have been solved. Laboratory models of 10, 40, and 90 hp per cylinder have been built and tested while experiments on a model with 400 hp per cylinder are under way. A Stirling engine performs as well as or even better than a diesel engine. If the Stirling engine is driven with a fossil fuel, the exhaust gases are quite clean. They contain no CO or hydrocarbons owing to a steady combustion in a chamber fenced in by hot walls. Concentrations of NO and NO<sub>2</sub> are low. A table comparing the exhaust gas composition of the Stirling engine with a gas turbine indicates this quite clearly. The reason for the reduction in emissions is not fully understood since flame

temperatures in the burner are very high. To study the relationship between the temperature of the preheated air and the NO<sub>x</sub> content, an electrically driven air preheater was installed in a 90 hp one-cylinder engine. It was found that the NO<sub>x</sub> content decreases with decreasing temperature of the preheated air. If part of the exhaust gas is returned to the combustion air, the NO content can be further reduced.

15265

Michaels, Alan S. and Harris J. Bixler

FLOW OF GASES THROUGH POLYETHYLENE. J. Polymer Sci., 50 (154):413-439, 1961. 17 refs.

Diffusion and permeability constants for twelve permanent gases were measured in a linear and a branched polyethylene, hydrogenated polybutadiene, and natural rubber from 5-55 C. The time-lag method was used in the determinations. For all gas-polymer pairs investigated, a linear plot of the logarithm of the diffusion or permeability constants vs the reciprocal absolute temperature exists, indicating the occurrence of activated diffusion. Arguments are presented supporting the hypothesis that natural rubber is a completely amorphous analog of polyethylene with respect to the diffusion process. The reduction in diffusion constants is to quantitatively express in going from natural rubber to hydrogenated polybutadiene (29% crystalline), to the branched polyethylene (43% crystalline), and to the linear polyethylene (77% crystalline). These reductions were strongly dependent on gas molecular size, increasing as the molecular size increases. A geometric impedance factor and a chain immobilization factor are introduced to account for the effect of crystallinity. The former is assumed to be independent of molecular size; it explains the necessity of the diffusing molecule to bypass crystallites which are shown to be impenetrable. The latter size-dependent factor reflects the reduction in amorphous chain segment mobility brought about through the proximity of crystallites. Analysis of the geometric impedance factor supports the existence of thin, highly anisometric sheets of crystalline polymer in polyethylene. The anisometry of the crystallites increases with increasing crystallinity consistent with the chain folding mechanism for crystal growth in polyethylene. Nucleation and growth kinetics also account for the variation in crystal anisometry observed in polymers prepared by different methods of polymerization. The apparent activation energies for diffusion determined in polyethylene include not only the energy required for chain segment separation, but also the effect of thermal expansion and crystalline melting. Correlations are presented which permit the estimation of gas diffusion constants in a wide variety of polyethylenes. (Author summary modified)

15273

Shapiro, Hymin, Earl George De Witt, and Jerome Engel Brown

ENGINE FUELS WITH THE BOILING POINT OF THE GASOLINE CONTAINING A CYCLIC MANGANESE TRICARBONYL COMPOUND. (Motorenreibstoffe

vom Benzinsiedebereich mit einem Gehalt an einer zyklischen Mangantricarbonylverbindung). Text in German. (Ethyl Corp., New York) W. German Pat. 1,231,058. Sp., Dec. 22, 1966. (Appl. Nov. 19, 1959, 2 claims).

An additive for fuels of the boiling point range of gasolines contain as antiknock agent a cyclic manganese tricarbonyl compound of the general formula  $AMn(CO)_2$ . The A stands for a cyclic hydrocarbon residue with 5 to 17 carbon atoms including a C5 group of cyclopentadiene structure. This hydrocarbon residue is bound to manganese with the aid of the carbon cyclopentadiene. The additive is a gasoline soluble compound of an element of the fifth subgroup of the periodic table of elements with the ordinal numbers 15 to 83 at such a quantity that the atom ratio of the added metal to manganese lies between 0.001:1 and 3:1. These additives prevent or at least delay accumulation of large quantities of manganese-containing precipitations between the spark plug electrodes and on the exhaust valves. The concentration of the manganese compounds in engine fuels should preferably range from 0.008 to about 1.585 g/l manganese. To obtain excellent antiknock effects, this concentration should not be exceeded. Antimony is the preferred corrective substance of the fifth subgroup, which contains also phosphorus, arsenic, and bismuth.

15294

Perkin-Elmer Corp., Pomona, Calif.

ANALYTICAL STUDY OF CONTAMINANT AND ATMOSPHERIC SENSOR. PHASE 1. Contract NAS 1-7260, NASA CR-1375, 133p., Sept. 1969.

The Contaminant Atmosphere Sensor is designed to monitor the general condition of spacecraft atmospheres during extended manned spacecraft missions. It is intended to provide information on concentrations of hydrogen, water vapor, helium or nitrogen, oxygen, carbon monoxide, carbon dioxide, methane, and total hydrocarbons. This report presents the results of analyses of the resolutions and sensitivities required to monitor the above compounds in both helium-oxygen and nitrogen-oxygen atmospheres. The basic instrument of the sensor is the Two Gas Analyzer with a ball leak inlet system. This instrument continuously monitors water, nitrogen, oxygen, and carbon dioxide on four fixed collectors. For total hydrocarbon measurement, a collection for m/e 47-120 is added and, for helium oxygen atmospheres, a mass 4 collector is added. Problems encountered in carbon monoxide measurements have been resolved by accumulator cell techniques which permit carbon monoxide to be determined on an intermittent basis. The normal sample gas flow pattern is interrupted to allow the sensor to monitor CO at m/e 28 as it is desorbed from the accumulator cell. The Contaminant Sensor should meet specified performance goals while still having acceptable weight, power, and size.

15305

Dzhamaletdinova, M. K.

SIMULTANEOUS MICRODETERMINATION OF CARBON, HYDROGEN, AND URANIUM. (Odnovremennoye mikroopredeleniye ugleroda, vodoroda i urana). Text in Russian. Zavodsk. Lab. (Moscow), 29(10): 1175-1176, 1964.

The possibility of simultaneously making quantitative determinations of carbon, hydrogen, and uranium in 3-5 mg samples of organic uranium compounds was demonstrated. Gravimetric analysis is used and takes advantage of the fact that above 500 C in an oxygen atmosphere, quantitative formation of stable U3O8 takes place, while at 800 C, uranium does not form either the carbide or the carbonyl. The method described takes 35-40 minutes and shows a relative error of 0.2%.

15329

Dunken, H. and H. Winde

INTERACTIONS OF SULFUR DIOXIDE WITH POLAR COMPOUNDS. EFFECTS OBSERVABLE IN THE UV ABSORPTION SPECTRUM. (Wechselwirkungen des Schwefeldioxids mit polaren Verbindungen. Im UV-Absorptionsspektrum beobachtbare Auswirkungen). Text in German. Z. Physik. Chem. (Leipzig), 56(5/6):303-308, Dec. 1967. 5 refs.

The interactions of the sulfur dioxide molecule with ketones, nitriles, esters, chloroform, and alcohols were studied in the UV range between 330 nm and 250 nm. The ketones were boiled with KMnO4 and dried with sodium sulfate and fractionated in a vacuum; carbon tetrachloride (CCl4) and n-octane were shaken with sulfuric acid, neutralized, dried, and fractionated. The SO2 was taken from a steel container and dried with P2O5. Iodimetry was used for analysis of the sulfur dioxide. Considerably different spectra were obtained for the system SO2/propionitrile and SO2/CCl4 or SO2/aliphatic hydrocarbons, although SO2 concentrations were the same in all cases. From the region of longer wavelength to about 294 nm, the extinction coefficient of the sulfur dioxide in solutions of nitriles, ketones, esters, and alcohols is smaller than that in CCl4 solution. At 294 nm, the situation reverses and the extinction coefficient of sulfur dioxide in solutions of the polar compounds is considerably larger than that in CCl4 solutions.

15405

Lasoski, S. W., Jr. and W. H. Cobbs, Jr.

MOISTURE PERMEABILITY OF POLYMERS. I. ROLE OF CRYSTALLINITY AND ORIENTATION. J. Polymer Sci., 36(130):21-33, 1959. 16 refs.

With the three polymers widely different in polarity, the water vapor permeability of unoriented films was shown to increase as the amorphous fraction increased. For polyethylenes, adherence to this relation is exhibited only with structures having densities above 0.94, a range in which the number of short chain branches is low. Films with densities lower than 0.94 exhibit higher film permeabilities than those calculated on the basis of the permeability of the amorphous areas of linear polyethylene. This results from the increase in the number of short chain branches and an increase in amorphous area permeability of the lower density polyethylenes. The variation of water vapor permeability with the square of the amorphous fraction may be theoretically accounted for by a linear variation of the diffusion and solubility coefficients with the amorphous fraction. With polyethylene terephthalate and nylon

610, the solubility coefficients exhibit this linear relation. The square permeability relation appears to be a limiting case for structures in which crystallization does not impose restraints on the segmental motions important in permeability. Where restraints do occur, as in oriented films, a higher order dependency on the amorphous fraction exists. This was exemplified with biaxially and uniaxially oriented polyethylene terephthalate films, with which it was shown that orientation in oriented crystalline films effects a decrease in permeability in addition to that ascribable to crystallinity. Only those oriented structures in which the orientation is locked-in, as by crystallization, exhibit a decrease in water vapor permeability. The relations of permeability and solubility coefficients to crystallinity have an important utility in that the extent of crystallinity or crystal density may be estimated with the proper data. On the bases of the literature, water vapor permeability data for two high density polyethylenes at three different vapor pressure differentials, the crystal density of polyethylene was estimated to be 0.995, 1.008, and 0.998 or an average of 1.00, in agreement with Bunn's value calculated on the basis of x-ray diffraction studies. (Author summary modified)

15439

Dunken, H. and H. Winde

INTERACTIONS BETWEEN SULFUR DIOXIDE AND POLAR COMPOUNDS. II. THERMODYNAMIC PARAMETERS OF COMPLEX-FORMING REACTIONS. (Wechselwirkungen des Schwefeldioxids mit polaren Verbindungen. II. Thermodynamische Groessen der Komplexbildungsreaktionen). Text in German. Z. F. Physik. Chem. Neue Folge (Frankfurt), 58(5/6):246-256, 1968. 4 refs.

The number and stoichiometry of SO<sub>2</sub> molecule complexes, as well as the thermodynamic parameters of the respective equilibria, were determined. For this purpose, extinction measurements were taken with the VSU 1 (Carl Zeiss) from -40 C to + 20 C. The complex forming constants were determined from the temperature dependence of the extinction differences of sulfur dioxide in solution with polar compounds in nonpolar solvents (CCl<sub>4</sub>; 2,2,4-trimethylpentane; and n-C<sub>8</sub>H<sub>10</sub>. The systems SO<sub>2</sub>/n-butanol/CCl<sub>4</sub>, SO<sub>2</sub>/isopropanol/CCl<sub>4</sub>, SO<sub>2</sub>/2-butanone/n-C<sub>8</sub>H<sub>10</sub>, SO<sub>2</sub>/diethylether/n-C<sub>8</sub>H<sub>10</sub>, SO<sub>2</sub>/n-butanol/2,2,4-trimethylpentane, SO<sub>2</sub>/acetone/CCl<sub>4</sub>, SO<sub>2</sub>/2-pentanone/n-C<sub>8</sub>H<sub>10</sub> were used. The results show that the enthalpies of the SO<sub>2</sub>/alcohol complexes are lower by 1 kcal/mol than those of the SO<sub>2</sub>/ketone complexes. In general, the enthalpies are rather low compared to the enthalpy of a hydrogen bridge. The entropies for the SO<sub>2</sub>/ketone complexes range from -13 to -15 cal/deg mol. Those of the SO<sub>2</sub>/isopropanol and n-butanol complexes are much lower. The entropy of the SO<sub>2</sub>/acetone complex is -12.9 cal/deg mol.

15481

Zimin, E. P. and V. A. Popov

EXPERIMENTAL INVESTIGATION OF ELECTRICAL CONDUCTIVITY OF PRODUCTS OF COMBUSTION, STIMULATED BY SOLID PARTICLES. Eksperimental'noye issledovaniye elektroprovodnosti produktov sgoraniya, stimulirovannoy tsvedymi chastitsami). Source not

given. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 17p., Aug. 23, 1968. 7 refs. FTD-MT-24-183-68

CFSTI: AD 685511

An experimental study was carried out on the electrical conductivity of the products of combustion of methane with oxygen-enriched air in the presence of solid particles of various substances. By artificially introducing solid particles, the electrophysical properties of the working gas was improved. Solid particles transported from the combustion chamber may be present in the duct of an open-cycle MHD generator working with products of coal combustion. In addition, when there are sufficiently large temperature reductions in the rear part of the duct, particles may form through the condensation of combustion product volatile directly into the solid phase. Experiments showed that the introduction of particles stimulates the electrical conductivity of the products of methane combustion which, without particles, are nonconducting. The dependence of temperature, particle size, and the relative mass flow rate was studied. A sharp increase in electrical conductivity was noted in the range of 1800-2100 K. The ash content spectrum of particles from natural fuels was investigated. The maximum conductivity was obtained with the introduction of ash particles, while the smallest value corresponded to carbon particles. However, particles of low-ash coals were only slightly inferior from the viewpoint of stimulating conductivity. The dependence of conductivity on ash content was 18%. With a further increase in ash content, the electrical conductivity drops, and for an ash content of 50% a minimum was observed, after which the conductivity increases to a maximum value corresponding to ash. The maximum ash content at 18% is explained by the release of volatile components from the coal. This conclusion is supported by measurements made on coke particles. The electrical conductivity obtained was close to that for pure carbon and differed greatly from that relating to coal.

15486

Woods, F. J., M. E. Umstead, and J. E. Johnson

VAPOR-PHASE OXIDATION OF HYDROCARBONS. PART 2 - EFFECT OF OXYGEN CONCENTRATION ON PLATINUM-CATALYZED COMBUSTION AND IONIZATION. Naval Research Lab., Washington, D. C., Chemistry Div., Contract NRL Problem C 01-03, Proj. RR 001-06-41-5850, NRL Rept. 6816, 16p., Feb. 7, 1969. 13 refs.

AD 684072

The catalytic combustion of hydrocarbons was studied with particular attention given to the ionization phenomena associated with it. The greater ion yield of highly branched alkanes relative to straight chain alkanes was confirmed. The effect of the concentration of oxygen in the gas mixture on the extent of oxidation and ionization varied with the hydrocarbon used. In general, increase in O<sub>2</sub> content caused considerable enhancement of the ion yield. However, with some hydrocarbons such as 2,2-dimethylpropane and 2,2-dimethylbutane, the fraction oxidized decreased markedly with increased O<sub>2</sub> concentration in the temperature range, 400-700 C. The data seemed consistent with an explanation based on lower temperature oxidation occurring only on the platinum surface, whereas at higher

temperatures the catalytic process extends itself to some degree into the vapor phase. It is also suggested that dissociative adsorption of O<sub>2</sub> at higher temperatures is involved in the ion-producing process. (Author abstract modified)

15491

Novak, J. R. and M. W. Windsor

LASER PHOTOLYSIS AND SPECTROSCOPY IN THE NANOSECOND TIME RANGE: EXCITED SINGLET STATE ABSORPTION IN CORONENE. J. Chem. Phys., 47(8):3075-3076, Oct. 15, 1967. 5 refs.

Laser photolysis apparatus with a spectroscopic source, capable of recording the spectral absorption of transient species in the nanosecond time range, was developed and used to study the first excited singlet state of coronene. Coronene showed a laser line at 347 nm and fluorescence between 410 and 480 nm. Ground state absorption bands of coronene were in the 320-350 nm region. Using both excitation and background pulses, the middle exposure showed heavy bleaching of the ground-state absorption bands and a new absorption in the 500 nm region with a peak at 520 nm. The 520 nm band decayed at the same rate as the fluorescence and was concomitantly replaced by triplet bands growing in at 480 and 390 nm. This was considered unequivocal confirmation that absorption by the S<sub>1</sub> state is responsible for the 520 nm band. This technique is faster by about two orders of magnitude than current flash-spectrographic instrumentation and extends the studies of transient absorption spectra into the nanosecond range. By using calibrated plates or photoelectric recording, kinetic data can be obtained. This technique should have wide application to solid, liquid, and gaseous systems in searching for intermediates of very short life and increasing the understanding of photochemical primary processes.

15524

Curran, George P. and Everett Gorin

PHASE II: BENCH-SCALE RESEARCH IN CSG PROCESS. LABORATORY PHYSICO-CHEMICAL STUDIES. (Interim Report.) Consolidated Coal Co., Library, Pa., Research Div., OCR Contract 14-01-0001-415, R & D Rept. 16, 58p., 1968. 9 refs. CFSTI: PB 184719

Basic physico-chemical data important to the development of the CO<sub>2</sub> acceptor process are given. Kinetic and integral rate data for lignite char gasification were obtained at 1500 F and 16 atm for two gas inlet compositions. These data show both the strong inhibiting effect of H<sub>2</sub> and the catalytic effect of sodium on the gasification rate. The highest sodium content char was the most reactive, but its reactivity was reduced by water extraction to remove the major fraction of sodium. Differential rate data at 1500 F were obtained with a single lignite char at 11 and 16 atm over a wide range of gas compositions. Rates of formation of carbon oxides and methane were measured. Both rates were inhibited by H<sub>2</sub> as well as CO. The use of the acceptor showed a favorable effect on the rate of both the carbon steam and methane rates, since the acceptor action reduces the partial pressure

of strongly inhibiting CO. The lignite chars showed an unusually high rate of methane formation with pure hydrogen at temperatures of 1400-1500 F which was suppressed by the presence of a small quantity of steam. Phase equilibrium data from the literature were reviewed, and new data were presented in the binary  $\text{Ca(OH)}_2\text{-CaCO}_3$  system. The presence of low-melting eutectics limited practical fluid bed operations to steam partial pressures of 11 atm or below. Agglomerates were formed in the fluid bed above 11 atm, and actual melts were produced above 16 atm. The use of the  $\text{Ca(OH)}_2\text{-CO}_3$  system makes either the preparation of synthetic lime or the reactivation of spent lime or dolomite acceptors possible. The reconstituted acceptors are physically strong and their activity is almost equivalent to fresh limestone. Physical studies pointed out that the major cause of activity loss was the growth in size of  $\text{CaO}$  crystallites. The rapid segregation of the  $\text{CaO}$  and  $\text{MgO}$  phases occurred early in the cycling of dolomite acceptors. Acceptors agglomeration in the regenerator occurred when it was operated without char combustion. Microprobe studies showed that it was due to sintering of an outer shell material enriched by Fe, Si, and Al, and was prevented by the addition of ash. (Author summary modified)

15664

Chaika, P. A.

EXPERIMENTAL UNIT FOR POISONING ANIMALS WITH VISCOUS LIQUID AEROSOLS. (Eksperimental'naya ustanovka dlya zatravki zhivotnykh aerorozem vyazkikh zhidkostey). Text in Russian. Gigiyena Trude i Prof. Zabolevaniya, no. 8:58-61, 1969. 3 refs.

The device described consists of a vacuum chamber measuring 100 by 70 by 40 cm. A vacuum of 10-15 mm H<sub>2</sub>O is produced with a Vikhr' vacuum cleaner attached to the base of the chamber. An incoming air stream passes through a mechanical rotary disintegrator, carrying liquid particles into the path of a second air stream entering at the top of the chamber. Aerosol density and particle size are regulated by varying the depth to which the rotating disks of the disintegrator are submerged, and also by varying the rate of rotation. This arrangement is used to inoculate animals with anthracene oil, producing an aerosol concentration of 0.01 to 1.0 mg per liter.

15744

MacFarlane, Walter and Robert Wright

SOLUBILITY OF VAPOURS IN GASES. J. Chem. Soc., 1934:207-210.

The attraction between methyl alcohol, ether, acetone, or chloroform vapors and carbon dioxide, ammonia, sulfur dioxide, or hydrogen chloride gases was studied at average temperatures and pressures by qualitative and quantitative methods. In the qualitative method, used only for methyl alcohol vapor, equal volumes of a gas and air saturated with vapor were allowed to mix, and after equilibrium had been attained, the change of pressure at constant volume was observed. The results indicate that a considerable attraction exists between hydrogen chloride and



methyl alcohol vapors. In the quantitative experiments, liquid was vaporized in a flask containing mercury and gas, after which pressure readings were taken at 15-min intervals for two and one-half hrs. The results were compared by calculating to the common basis of the pressure exerted by 1 mm of vapor in a volume of 100 cc at the temperature of the experiment. The pressures exerted in air are shown to be slightly greater than the theoretical; the pressures exerted in the presence of any other gas are less. In mixtures of hydrogen chloride with methyl alcohol, ether, or acetone vapors, the pressure decreases are marked, indicating considerable attraction between the two constituents of the mixture.

15784

Michael, Arthur and Nathan Weiner

THE MECHANISM OF THE SULFONATION PROCESS. J. Am. Chem. Soc., vol. 58:294-299, Feb. 1936. 10 refs.

The role of sulfuric anhydride in reactions between ethylene and fuming sulfuric acid was studied, and reaction products determined. When the concentration of sulfuric anhydride did not exceed that necessary to form pyrosulfuric acid, one mole of ethionic acid was formed for each mole of pyrosulfuric acid. When anhydride was in excess, carbyl sulfate was formed from the reaction mixture in the ratio of one mole to two of sulfur trioxide or to one of S<sub>2</sub>O<sub>6</sub>. The results demonstrate that the reaction of fuming sulfuric acid with ethylene does not, as proposed, proceed by addition of H<sub>2</sub>SO<sub>4</sub> to form isethionic acid. Pyrosulfuric acid adds, like other inorganic acid anhydrides, to ethylene by fission between the anhydride oxygen and sulfur to form ethionic acid. Carbyl sulfate is formed in ethylene-fuming sulfuric acid reactions by the addition of the alkene to the S<sub>2</sub>O<sub>6</sub> component of the balanced anhydride system SO<sub>3</sub> in equilibrium with S<sub>2</sub>O<sub>6</sub>. Further experiments showed that the product of reactions between isethionic acid and one mole of 100% sulfuric acid, one mole of 100% sulfuric acid and one mole of anhydride, or one mole of anhydride alone is ethionic acid. The product of isethionic acid and two moles of anhydride is carbyl sulfate, indicating that isethionic acid is converted to carbyl sulfate by the action of two moles of SO<sub>3</sub> or one of S<sub>2</sub>O<sub>6</sub>. It is concluded that all sulfonic acid synthesis with sulfuric acid proceed by pseudo-substitution involving the addition of a hydrogen and carbon of a hydrocarbon group in the organic compound to the unsaturated oxygen and the attached sulfur of a sulfonyl group. Sulfonation with sulfuric anhydride is interpreted as an aldolization reaction.

15805

Gilbert, Everett E.

THE REACTIONS OF SULFUR TRIOXIDE, AND OF ITS ADDUCTS, WITH ORGANIC COMPOUNDS. Chem. Rev., vol. 62:549-589, 1962. 558 refs.

The reactions of sulfur trioxide and its organic complexes are reviewed with respect to organic compounds through 1960. The preparation and properties of the following complexes

are explained: pyridine, dioxane, trimethylamine, triethylamine, dimethylaniline, thioxane, bis(2-chloroethyl)ether, 2-methylpyridine, quinoline, and dimethylformamide. Reactions with aliphatic and alicyclic compounds are described as with either saturated compounds (hydrocarbons, halogenated hydrocarbons, carboxylic acids, esters, nitriles, ketones aldehydes, alcohols, sterols, glycols, polyether glycols, polyether alcohols, carbohydrates, nitrogenous polysaccharides, ethers, amines, amides, amino acids, proteins, oximes, and hydroxylamines) or with unsaturated compounds (alkyl and aryl ethylenes, cycloalkenes, halogenated ethylenes, vinyl ethers and esters, ketones and aldehydes, alkenoic acids, alkadienes, cycloalkadienes, alkynes, alkenols, and alkynols). Reactions with aromatic compounds are grouped as benzene derivatives (benzene, toluene the xylenes, petroleum oils, polystyrene, halogenated benzenes and alkylbenzenes, amines and anilides, phenolic compounds, aminophenols, mono- and dicarboxylic acids and related compounds, sulfonic acids, nitro compounds, and halosulfonation reactions); naphthalene derivatives (hydrocarbons, naphthylamines, naphthols, and aminonaphthols); and reactions with heterocyclic compounds (furan derivatives, thiophene derivatives, pyrrole and indole derivatives, pyridine, and alkyl pyridines).

15816

Christian, Sherril D. and Just Grundnes

CHARGE-TRANSFER COMPLEX BETWEEN SULPHUR DIOXIDE AND TRIMETHYLAMINE IN THE GAS PHASE AND IN HEPTANE. *Nature*, vol.214:1111-1112, June 10, 1967. 7 refs.

Spectral and thermodynamic parameters were obtained for a trimethylamine-sulfur dioxide complex in the gas phase at 15-60 C and in heptane at 13-40 C. In sixteen gas-cell experiments at 39.7 C with amine concentrations from 0.0004 to 0.0049 moles/l and sulfur dioxide concentrations from 0.000023 to 0.000059 moles/l, the peak absorbancy of the complex varied from 0.10-0.60 cm. Ultraviolet spectra of the complex were very similar in both phases; Spectral parameters and the variation of spectral and thermodynamic constants with temperature were almost identical. Apparently, the mechanisms responsible for the effect of the medium on the spectral characteristics of weaker complexes are not important in this system. The increase in the complex formation constant ( $K_c$ ) and minus  $\Delta H$  (enthalpy at the standard state) which occurs as the medium is changed from gas to heptane, suggests that this highly polar complex is more strongly solvated than the sum of its uncombined components. Preliminary results indicate that both  $K_c$  and minus  $\Delta H$  become even larger in polar solvents.

15848

Hooker, George W., Lewis R. Drake, and Stephen C. Stowe

REACTION OF SULPHUR DIOXIDE WITH DIOLEFINS AND SEPARATION OF LATTER FROM HYDROCARBON MIXTURES. (Dow Chemical Co., Midland, Mich.) U. S. Pat. 2,395,050. 7p., Feb. 19, 1946. (Appl. May 14, 1940, 12 claims).

A method for reacting sulfur dioxide with conjugated diolefins to produce crystalline sulfones that are readily decomposed by heat specifically concerns the separation of butadiene-1.3 from mixtures with a butylene or butane. The sulfur dioxide and diolefin material, which should contain at least 0.75 part by weight of sulfur dioxide per part of hydrocarbon, is charged in an autoclave or bomb under pressures sufficient to cause partial liquefaction. In its early stages, the reaction takes place between 100-150 C; these temperatures are lowered to about 70 C during the reaction. Heating is continued until the reaction approaches equilibrium between the sulfone product and the sulfur dioxide and diolefin reactants. At 70 C, almost complete conversion of butadiene to the sulfone is achieved. Although the reaction produces an adequate yield of crystalline sulphones without the use of inhibitors, polyhydric phenols can be added to prevent formation of amorphous sulphones. These inhibitors also counteract the tendency of diolefins to undergo partial polymerization at high temperatures. Only a few hours are required to produce the crystalline sulfones. Hydrocarbons are vaporized from the sulfones releasing the pressure and sulfur dioxide by mild heating. The sulfone can be dissociated into the diolefin and sulfur dioxide by more vigorous heating at 120 C or above.

15851

Morton, Frank, P. J. King, and A. McLaughlin

HELICAL-COIL DISTILLATION COLUMNS. PART I: EFFICIENCY STUDIES. PART II: LIQUID FILM RESISTANCE. Trans. Inst. Chem. Engrs. (London), 42(8):T285-T304, 1964. 33 refs.

The operation of helical-coil distillation columns was studied at atmospheric and reduced pressures. A correlation is given for efficiency at atmospheric pressure based on the gas film. The importance of liquid-film resistance is stressed for low pressures; its effect is correlated by an extension of the Higbie equation to flow in helical coils. Operation of the 1.1 cm diameter column at partial reflux under an absolute pressure of 20 mm Hg is discussed. Performances of a number of high-efficiency distillation columns are compared. It is shown that the helical-coil design is particularly useful for low-pressure fractionation of heat-sensitive hydrocarbons and that the efficiency of the column at reduced pressures is not satisfactorily explained solely in terms of the vapor-phase resistance. At atmospheric pressure the helical-coil column does not offer a reasonable alternative to more efficient packings, though its performance is comparable to that of spinning-band and open-tube columns. The liquid film resistance was measured by a carbon dioxide absorption technique and the liquid film coefficients in helical-coils were found to be in general agreement with values predicted for inclined tubes. However, a reason correlation with the experimental resistance data was obtained only when its overall coefficient was calculated on the basis of substantial wetting of the whole surface of the tube. These results imply that the film coefficient is independent of the size of the tube.

Reed, Cortes F.

METHOD OF REACTING AROMATIC HYDROCARBONS. (Charles L. Horn, Minneapolis, Minn.) U. S. Pat. 2,174,111. 2p., Sept. 26, 1939. (Appl. May 25, 1936, 6 claims).

A method of forming benzene derivatives directly in the presence of an oxide of sulfur, tellurium, and selenium, while controlling the temperature of the reaction to prevent polymerization, is described. The method also provides a means of preparing chlorobenzene substitution products, particularly chlorobenzenes which give a high yield and require a minimum number of steps in its preparation. The method consists of reacting an aromatic hydrocarbon with a vapor mixture of chlorine and an oxide of sulfur, selenium, or tellurium at room temperature. The temperature of the reaction is limited to 70 C. The passage of the mixture into the reaction medium is continued until crystalline products are precipitated.

15872

Latchum, John W. Jr. and James S. Connors

REGENERATION OF ABSORBENT. (Phillips Petroleum Co., Bartlesville, Okla.) U. S. Pat. 2,404,854. 6p., July 30, 1946. (Appl. Dec. 18, 1944, 15 claims).

A method is described for stripping acidic gases, such as sulfur dioxide, from absorbent amine solutions in a dry or moisture-free condition suitable for marketing as dry gases or even for use in cyclic processes requiring dry reagents. The process is especially valuable used in conjunction with solvent extraction processes for removing nitrogen gas from hydrocarbon gases. Acidic gas is separated from the body of the gas mixture by reaction with a diethanolamine or xylydine absorbent. The gas mixture is removed from the absorbent free of the acidic gas. The absorbent is passed through a stripping zone which has an inlet and outlet for the absorbent flow. A vaporous, paraffinic hydrocarbon is passed through the outlet. The hydrocarbon has a boiling point well below the boiling point of diethanolamine. Acidic gas and hydrocarbon is removed from the inlet of the stripping zone. The stripped absorbent is removed through the outlet and recycled into the original contacting step. Acidic gas is removed from the vaporous hydrocarbon as the second product of the process and the hydrocarbon is recycled back to the stripping zone.

15874

McKinnis, Art C.

SOLVENT EXTRACTION. (Union Oil Co. of Calif., Los Angeles) U. S. Pat. 3,350,470. 7p., Oct. 31, 1967. 9 refs. (Appl. Dec. 1, 1961, 8 claims).

A solvent extraction method is described for separating diaromatic hydrocarbons from monoaromatic hydrocarbons of petroleum origin. The method comprises a liquid-liquid extration

technique, employing liquid sulfur dioxide and lower alkane solvents, preferably normal alkanes having 5 to 10 carbon length chains. Monomethylnaphthalene is separated from similar boiling monoaromatic and nonaromatic hydrocarbons by contacting the mixture continuously with liquid sulfur dioxide at -20 to 0 C and concurrently with a saturated aliphatic hydrocarbon liquid boiling in the temperature range 95-350 F. A rich extract phase of liquid sulfur dioxide is formed containing part of the hydrocarbon mixture enriched in monomethylnaphthalene. Also formed is a raffinate phase containing the remaining hydrocarbon mixture, the saturated aliphatic hydrocarbon liquid and a small amount of sulfur dioxide. Sulfur dioxide is evaporated from the extract to form a sulfur dioxide overhead product and a hydrocarbon bottom product enriched with monomethylnaphthalene. The sulfur dioxide overhead product is liquified to form liquid sulfur dioxide and recycled. The extraction of 2-methylnaphthalene from a like-boiling hydrocarbon mixture is accomplished in the same way. The method has general application for the preparation of feedstocks for thermal and catalytic dealkylation processes.

15911

Yamate, Noboru

PHOTOCHEMICAL STUDIES OF AIR POLLUTION. II. STUDIES ON PHOTOCHEMICAL PRODUCTS OF AUTO EXHAUST. (Taiki osen no kokagaku kenkyu (dai 2 ho) jidosha haiki gasu no koshosha seiseibutsu ni tsuite). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 15(4):248-252, 1969. 5 refs.

Automobile exhaust was irradiated with xenon or solar light under static conditions, and the concentration changes of hydrocarbons, nitrogen oxides, formaldehyde, and irradiation products were analyzed. Hydrocarbon concentrations were determined by hydrogen-flame ionization gas chromatography; nitrogen oxides and formaldehyde concentrations, by colorimetry; and irradiation products, by electron-capture gas chromatography. Irradiation decreased the concentrations of hydrocarbons and nitrogen oxides but increased formaldehyde concentrations. The irradiation products were methyl nitrite, ethyl nitrite, methyl nitrate, ethyl nitrate, n-propyl nitrate, isobutyl nitrate, biacetyl, and peroxyacetyl nitrate. These photochemical reactions of auto exhaust presumably occur in the atmosphere.

15914

Kokurin, A. D.

MECHANISM OF COKE AND CARBON BLACK FORMATION DURING THERMAL PYROLYSIS AND DIFFUSION COMBUSTION. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 42(7):1498-1501, July 1969. 11 refs.

The mechanism of soot formation was studied by pyrolyzing various hydrocarbons and their mixtures at 1000-1500 C. At the relatively low temperatures and low heating rates, and with considerable contact time, mainly polycyclic liquid (tarry) products were formed. They were converted to coke by further condensation. Carbon black formed at the higher temperatures as the result of the condensation of C<sub>2</sub>H and C<sub>2</sub> radicals, which are incapable of

forming liquid tarry products. Therefore, the quality of carbon black, i.e., its structure and dispersity, is determined by process conditions and the composition of the raw material. The higher the temperature and heating rate, the greater is the amount of raw material converted to carbon black and the less the amount converted to coke. The quality of carbon black differs in accordance with the degree of participation of radicals and macromolecular liquid products in its formation, the degree of coking, and the contents of impurities, liquid particles, and cokes in the carbon black.

15970

Ryden, L. L. and C. S. Marvel

POLYSULFONES FROM ACETYLENES AND SULFUR DIOXIDE. J. Am. Chem. Soc., Vol. 58:2047-2050, Oct. 1936. 7 refs.

In investigations of the reaction of sulfur dioxide with a variety of substituted acetylenes, monosubstituted acetylenic hydrocarbons were found to combine with sulfur dioxide to give polymeric products. Both monoalkylacetylenes with an alkyl group containing one to five carbon atoms and phenylacetylene combined readily with sulfur dioxide in the presence of alcohol and peroxide-containing paraldehydes. Disubstituted acetylenes did not give this addition reaction. The products of the addition of sulfur dioxide to the monosubstituted acetylenes are presumably polysulfones containing one double bond for each hydrocarbon residue in the polymer. The addition of sulfur dioxide is to the acetylene and not an allene. The polymers are readily hydrolyzed. Among the phenylacetylenepolysulfone derivatives are benzylmethylsulfone, acetophenone, benzoic acid, and sodium sulfite. Hydrolysis of 1-pentynepolysulfone gave a trace of methyl n-propyl ketone. About 40-50% of the sulfur was removed as sulfur dioxide. The only other hydrolysis product isolated was  $C_{10}H_{16}SO_2$ . Pyrolysis in boiling dioxane removed half the sulfur from 1-heptenepolysulfone as sulfur dioxide. Phenylacetylenepolysulfone was insoluble in dioxane, but 62-73% of the sulfur was liberated as sulfur dioxide after heating the polymer. Though evidence is still too meager to ascribe definite formulas to acetylene-sulfur dioxide polymers, there is apparently considerable difference between alkyl substituted and aryl substituted products.

15988

Porter, George

THE MECHANISM OF CARBON FORMATION. In: Combustion Researches and Reviews 1955. London, Butterworth, 1955, Chapt. 10, p. 108-123. 26 refs. (Presented at the 6th and 7th AGARD Combustion Panel Meetings, Scheveningen, The Netherlands, May 1954 and Paris, Nov. 1954, AGARDograph no. 9.)

CFSTI, DDC: AD 688925

Chemical processes leading to carbon formation in five systems are reviewed and experiments in flash pyrolysis of ketone, acetone, and diacetyl are summarized. The five systems considered are pyrolysis of pure hydrocarbons, pyrolysis of acetylene, diffusion flames, explosion in closed vessels, and pre-mixed flames. It is contended that previous theories of mechanisms of

carbon formation are incorrect, since they require the intermediate formation of polymeric hydrocarbons. When the time for half reaction is one second or less, the pyrolysis of hydrocarbons results in decomposition, and not polymerization; decomposition leads to the formation of acetylene and hydrogen before carbon formation. These hypotheses are supported by the flash pyrolysis experiments which showed that acetone and diacetyl formed ethylene and acetylene and ketone formed acetylene. Absorption spectra of the reactions occurring during flash pyrolysis of acetylene show the formation of carbon and hydrogen without intermediate hydrocarbon polymers. It is concluded that solid carbon is formed from acetylene by simultaneous combustion and dehydrogenation. Carbon formation in explosions of hydrocarbons with oxygen occurs by pyrolysis of the hydrocarbon in the same way as in the absence of oxygen. The relative rate of this mechanism compared with the oxidation of the hydrocarbon and carbon determines the amount of carbon finally formed. Carbon formation in a diffusion flame occurs by the same pyrolytic mechanism unless the fuel is near to, but less than, 1000 C. Homogeneous explosions are chemically similar to carbon formation in pre-mixed flames. The fact that carbon particles formed during combustion and homogeneous gas-phase pyrolysis are very similar in shape and diameter supports the view that the same mechanism is common to all processes.

15990

Fox, Arthur L., Clyde O. Henke, and Cortes F. Reed

PURIFICATION OF HYDROCARBON-SULPHUR DIOXIDE-CHLORINE REACTION PRODUCTS. (Charles L. Horn, Minneapolis, Minn. and DuPont De Nemours (E.I.) and Co., Wilmington, Del.) U. S. Pat. 2,228, 598. 6p., Jan. 14, 1941. (Appl. June 30, 1938, 15 claims).

A process is described for purifying surface-active compounds formed by reacting hydrocarbons, sulfur dioxide, and chlorine and hydrolyzing the resulting product. The invention provides a method of removing water-insoluble oils from the emulsion obtained when hydrocarbons are treated with a gaseous mixture of sulfur dioxide and chlorine and the resulting product is hydrolyzed with a hot caustic alkali. The method is exemplified by the treatment of a hydrocarbon oil with a gaseous mixture of sulfur dioxide and chlorine in the presence of light until the oil gains a certain weight. This produce is hydrolyzed and neutralized with a caustic alkali solution. The crude product that is obtained is an aqueous emulsion of hydrocarbon sulfonates, unreacted hydrocarbon, chlorinated hydrocarbon, and salts. This material is purified by diluting with water or a water-soluble organic solvent and removing the water immiscible layer. Purification can also be accomplished by centrifuging without dilution, by extracting the water insoluble portions with a water insoluble organic solvent, by steam distillation, or by a combination of these processes. Many of the products prepared according to the invention have excellent foaming and cleansing properties. These products can serve as intermediates for preparing derivatives useful as plasticizers for paint, varnishes, corrosion inhibitors, gum solvents, extractants for the refining of gasolines and oils, insecticides, detergents, wetting agents, and rewetters. They may also be used to improve flotation processes of ores, pigments, coals, etc. and to break petroleum emulsions. Other uses include fungicides, mildew preventives, penetrating agents, and dust collecting agents.

Mascitti, Vincent R.

A SIMPLIFIED EQUILIBRIUM HYDROCARBON-AIR COMBUSTION GAS MODEL FOR CONVENIENT USE IN AIR-BREATHING ENGINE CYCLE COMPUTER PROGRAMS. Virginia Univ., Charlottesville, Dept. of Aerospace Engineering, Thesis (M. Aerospace Eng.), 1967(?), 44p. 11 refs.  
N69-19694

A simplified hydrocarbon-air combustion gas model was developed for use in engine cycle computer programs. The generalized model reduces to the hydrogen-air system as well as dissociating air. The exclusion of chemical species containing atomic nitrogen allows a considerable simplification of the composition equations. The thermodynamic properties of stoichiometric combustion of the kerosene-air and hydrogen-air systems are computed with the simplified model and are compared with more comprehensive gas models. In addition, the effect of the neglected chemicals species on the performance of an idealized subsonic combustion ramjet is presented. The simplified gas model was used to define the limiting conditions for solid carbon and ammonia formation for rich gas mixtures. A computer program listing of the simplified gas model calculation procedure is presented. (Author abstract modified)

Blakeway, John Murray and Philip Marshall

SULPHONATION OF ORGANIC COMPOUNDS. (Colgate Palmolive Co., New York) U. S. Pat. 3,346,505. 4p., Oct. 10, 1967.  
(Appl. March 15, 1963, 5 claims).

An invention describes the co-sulfonation of sulfonatable organic compounds of different volatilities with sulfur trioxide diluted with an inert gas. Problems arise if the organic compounds are of substantially different volatilities, for such as those which when sulfonated and neutralized are useful as active ingredients in detergent compositions. A high molecular weight alkyl benzene and the diluted sulfur trioxide are introduced in the reaction zone. The more volatile component, a low molecular weight alkyl benzene, and additional diluted sulfur trioxide are added to the reaction zone only after sulfonation of the less volatile component is substantially completed. The point at which the more volatile component is added is not critical. But the earlier this is begun, the greater the risk of losing the more volatile component with the inert gas. The more volatile component is usually introduced when 50% of the less volatile component is sulfonated. The extent of sulfonation is calculated from the amounts of the low molecular weight alkyl benzene and the sulfur trioxide. This invention can be applied to any suitable sulfonating process in which the sulfonating agent is diluted with sulfur trioxide.



Seyer, W. F. and Eric Todd

CRITICAL SOLUTION TEMPERATURES OF SYSTEMS OF SULFUR DIOXIDE AND NORMAL PARAFFINS. Ind. Eng. Chem., vol. 23:325-327, March 1931. 7 refs.

The conditions under which paraffin hydrocarbons (butane, hexane, octane, decane, tetradecane, dodecane, and dotriacontane) are insoluble in liquid sulfur dioxide were investigated. The temperatures defining the limits of miscibility were plotted against both the number of grams of sulfur dioxide in 100 grams of mixture and against the mols of sulfur dioxide in 100 mols of mixture. The curves obtained by plotting miscible temperature against the mol fraction times 100 of the sulfur dioxide were distorted to the right, since the molecular weight of the hydrocarbons were higher than that of sulfur dioxide. Symmetrical curves were obtained when the miscible temperatures were plotted against percent by weight of the sulfur dioxide. The similarity of curves with only one consolute temperature was unwarranted: surface tension measurements indicated that the association is nil or negligible in both hydrocarbons and sulfur dioxide. However, the curves indicate that below the critical solution temperature the solubility of sulfur dioxide in the hydrocarbon is greater at the same temperature than the solubility of the hydrocarbon in the sulfur dioxide. The curve of molecular weight of hydrocarbons vs critical solution temperature indicates that molecular weight is a factor in determining the critical solution temperature point; it must be considered in any attempt to deduce a general equation defining miscibility limits in a binary system. It is also shown that the amount of hydrocarbon soluble in sulfur dioxide at its boiling point is comparatively small.

16052

Locket, George Hazlewood

MOLECULAR ASSOCIATION OF AROMATIC HYDROCARBONS WITH THIONYL CHLORIDE, SULPHURYL CHLORIDE, AND SULPHUR DIOXIDE. J. Chem. Soc., 1932:1501-1512, 1932. 30 refs.

The viscosities, densities and heats of mixing for mixtures of thionyl and sulfuryl chlorides and sulfur dioxide with aromatic hydrocarbons were determined at 25 degrees. Comparative determinations were made with cyclohexane, stannic chloride, ether, and ethyl acetate. In contrast to cyclohexane, the aromatic hydrocarbons associated with thionyl and sulfuryl chlorides and sulfur dioxide and behaved like polar liquids which is in contrast to cyclohexane. The hydrocarbons may be electron donors, but it is probable that they can acquire an induced dipole moment from the inorganic molecule. This effect will only be apparent with molecules which are highly unsymmetrical or in which a large electronic shift is localized. Release of the electrons to the nucleus of the hydrocarbon by methylation increases the induction effect and the association. This view explains complex formation with other unionized inorganic molecules. Polarization of the hydrocarbons is a probable explanation of their activity in the Friedel-Crafts reaction, but in view of the complexity of the reaction, it cannot be determined whether the free halides or more complex molecules produce polarization.

16054

Seyer, W. F., K. Martin, and L. Hodnett

SYSTEMS OF SULFUR DIOXIDE AND THE ISOMERIC XYLENES. J. Am. Chem. Soc., vol. 59:362-363, 1937. 1 ref.

A series of freezing-point measurements were taken on systems of sulfur dioxide and ortho-xylene, sulfur dioxide and para-xylene, and sulfur dioxide and meta-xylene. The bulb method was used to determine the freezing points. The freezing-point curves of the three systems were constructed from the data. Each system has only one eutectic; apparently, there is no compound formation. The latent heats of fusion were calculated and compared with experimental values. Of the systems studied, only the o-xylene and sulfur dioxide solution behaved very nearly as ideal solution. The p-xylene system deviated positively and the m-xylene system deviated negatively from the ideal solution.

16082

Suter, C. M., P. B. Evans, and James M. Kiefer

DIOXANE SULFOTRIOXIDE, A NEW SULFATING AND SULFONATING AGENT. J. Am. Chem. Soc., vol. 60:538-540, March 1938. 12 refs.

The behavior of dioxane toward the addition of sulfur trioxide to form dioxane sulfotrioxide and disulfotrioxide was examined. Under anhydrous conditions both compounds are stable at room temperature, but on heating to 75 deg in carbon tetrachloride, decomposition ensues with formation of water soluble products. Both compounds react with water instantly to give sulfuric acid and regenerate dioxane. Either of the addition compounds serves as a reagent for sulfonation of benzene, m-xylene, anisole, naphthalene, phenol, and aniline. In the case of aniline, phenol and benzoic acid, the reaction occurs with the substituents rather than the benzene nucleus. Primary alcohols are converted into alkyl hydrogen sulfates. Since the higher members of this series are valuable detergents, this reaction has practical significance. Olefins are converted into compounds of the carbyl sulfate type without undesirable side reactions. A study of the structure of the addition product indicates that the carbon-sulfur bond is formed at the end carbon. Hydrolysis of the primary addition product yields hydroxysulfonates. The alkali hydroxysulfonates obtained from olefins containing ten or more carbon atoms have marked detergent properties. Further investigation of these compounds is in progress.

16083

Ryden, L. L. and C. S. Marvel

THE REACTION BETWEEN SULFUR DIOXIDE AND OLEFINS. III. HIGHER OLEFINS AND SOME LIMITATIONS OF THE REACTION. J. Am. Chem. Soc., vol. 57:2311-2314, Nov. 1935. 18 refs.

The formation of polysulfones from sulfur dioxide and a variety of unsaturated compounds was studied. Polysulfones were obtained by the combination of sulfur dioxide and methylpropene, 1-pentene,

2-pentene, 1-nonene, 3-cyclohexylpropene, and 3-methylcyclohexane. No reaction was obtained between sulfur dioxide and trimethylethylene, tetramethylethylene, pinene, or 1,4-dihydronaphthalene. The failure of these olefins to react with sulfur dioxide indicate that increasing the number of hydrocarbon substituents on the carbon atoms that are attached by a double union will tend to block the addition reaction. Sulfur dioxide was also treated with 1-chloropropene, trichloroethylene, allyl cyanide, 2-allyl-p-cresol, undecylenic acid, sodium undecylenate, ethyl undecylenate, ethyl erucate, crotonaldehyde, oleyl alcohol, and undecylenyl alcohol. Only undecylenyl alcohol gave a polysulfone. This conforms the observation that an alcoholic hydroxyl group in the olefin molecule does not interfere with the formation of a polysulfone. The failure of oleyl alcohol to combine with sulfur dioxide must be due to the fact that the double bond is in the middle of a long chain. The polysulfones described are probably of the alcohol type, as none of them were alkali soluble, and those which were treated with an acid chloride gave acyl derivatives. It was probable that the polysulfones derived from olefins of the type RCH double bond CH<sub>2</sub> are closely related to propylene polysulfone in structure.

16169

Baume, Georges

FREEZING POINT OF GASEOUS MIXTURES AT VERY LOW TEMPERATURES. (Sur le point de congelation des melanges gazeux a de tres basses temperatures). Text in French. *Compt. Rend.* 148:1322-24, 1909. 6 refs.

The gas mixtures studied were (CH<sub>3</sub>)<sub>2</sub>O-HCl, (CH<sub>3</sub>)<sub>2</sub>O-SO<sub>2</sub> and (CH<sub>3</sub>)<sub>2</sub>O-CH<sub>3</sub>Cl. The freezing point curve of the first and 2 maxima, one at -94 C, the other at -102, corresponding to a mixture of one ether and 4 HCl. Solid ether + SO<sub>2</sub> was obtained; temperatures were not given.

16207

Schiemann G., F. Fetting, G. Prauser, and F. Steinbach

HETEROGENEOUS REACTIONS IN A FREE FALL REACTOR. (Heterogene Reaktionen in einem Rieselwolkenreaktor). Text in German. *Inst. Chem. Engrs. Symp. Ser.*, no. 27:153-160, 1968. 12 refs.

The reaction mechanism in a free fall reactor was studied and compared with the ideal flow tube and the ideal agitator vessel. The hydrogenation of ethylene and the oxidation of carbon monoxide on grained Pd-containing catalysts were used as model reactions. The kinetic data of these reactions were determined in a fixed-bed reactor connected in parallel to the free fall reactor. The speed of the hydrogenation process was determined by the substance transport, that of oxidation by the chemical reaction speed. To interpret measurements of the amount of substance converted, mixing processes were studied using a dispersion model. The Bodenstein numbers obtained from the measured mixing coefficients were used to calculate the quantity converted. The measured values agreed well with the calculated values.

Buff, H. and A. W. Hofmann

DISSOCIATION OF GASEOUS COMPOUNDS BY ELECTRICALLY INDUCED GLOWING. (Zerlegung gasfoermiger Verbindungen durch electrisches Gluehen). Text in German. Ann. Chem. Pharm., 113(2):129-150, 1860. 4 refs.

Gases and vapors of liquids with low boiling points were exposed to powerful sparking as produced by the Ruhmkoff induction coil, to glowing platinum and iron wires, and to the high temperature of the flame arc, and the dissociation was observed. The induction coil is best suited for dissociation of ammonia; all the other methods take too long. Dissociation of  $C_2H_5N$  begins immediately, but it is never complete. Dissociation of  $C_6H_9N$  and of  $C_4H_7N$  is slow and incomplete. Iron wires dissociated  $C_2N$  completely but slowly; the flame arc is much faster. The induction coil is least suitable. Nitric oxide is dissociated rapidly by a glowing iron spiral and by the flame arc, and slowly by the induction coil. The dissociation is not complete. Similar results are obtained with  $NO_2$ . None of the methods work with dry  $CO$ . Reduction of  $CO_2$  is slow with both the flame arc and the induction coil. The dissociation of  $CS_2$ ,  $C_2H_4$ ,  $C_4H_4$ ,  $SO_2$ ,  $HS$ ,  $PH_3$ ,  $ClH$  and  $SiF_2$  was observed in like manner, and the efficiency of each method was stated.

Ludwig, Barbara E. and G. R. McMillan

DISPROPORTIONATION AND COMBINATION REACTIONS OF ISOPROPOXY RADICALS WITH NITRIC OXIDE. J. Phys. Chem., 71(3):762-764, Feb. 1967. 5 refs.

Because the disproportionation:combination ratio of ethoxy radicals with nitric oxide is important in the photochemistry of alkyl nitrites, nitrates, and nitro compounds, isopropoxy-nitric oxide reactions were studied by pyrolyzing diisopropyl and nitric oxide mixtures at 25 to 180 deg. As determined by gas chromatography, the main reaction products were isopropyl nitrite, acetone, and isopropyl alcohol. Traces of acetaldehyde and methyl nitrate were also present. Over the ranges indicated, the following variables had no effect on the acetone: isopropyl nitrite ratio: diisopropyl peroxide pressure, 2.7-14.6 mm; nitric oxide pressure, 2.8-46.9 mm; nitric oxide pressure: peroxide pressure, 0.35-8.58 mm; percent peroxide decomposition, 2.0-12.1%; reaction time, 0.7-14440 min; and added nitrogen, 200 mm. Below 150 deg, product ratios were temperature dependent due to surface reactions. Above 160 deg, the isopropyl nitrite ratio is temperature independent. This constancy together with independence of the ratio of the other variables suggests that the disproportionation:combination ratio is 0.17 at 26 to 180 deg. Like alkyl-alkyl reactions, isopropoxy-nitric oxide reactions show appreciable difference in activation energies for disproportionation and combination processes.

16257

Mathias, L. E. S., A. Crocker, and M. S. Wills

LASER OSCILLATIONS AT SUBMILLIMETRE WAVELENGTHS FROM PULSED GAS DISCHARGES IN COMPOUNDS OF HYDROGEN, CARBON AND NITROGEN. Electron. Letters, 1(2):45-46, April 1965. 8 refs.

Oscillations at a number of wavelengths between 126 and 373 microns were obtained with a pulsed discharge through dimethylamine at low pressure. The stronger lines in this stimulated emission spectrum were obtained with many other volatile compounds containing hydrogen, carbon, and nitrogen, and with mixtures of hydrogen and bromine cyanide, and methane and ammonia. A new spectrum (four lines between 181 and 205 microns) was obtained with a mixture of deuterium and bromine cyanide. Oscillations at fourteen new wavelengths between 126 and 373 microns were obtained in these experiments. Seven of the wavelengths lie in the region of 200 microns, where no stimulated emission sources were previously available. The radiation was tentatively attributed to  $\text{HnCN}$  with  $n$  greater than one.

16348

Zikanova, A., M. M. Dubinin, and I. O. Kadlets

INVESTIGATION OF THE DYNAMICS OF THE ADSORPTION OF BENZENE BY ACTIVATED CHARCOALS WITH VARIOUS POROUS STRUCTURES AND GRAIN SIZES. COMMUNICATION 3. ANALYSIS OF THE KINETIC FACTORS IN CONNECTION WITH THE POROUS STRUCTURE ACTIVATED CHARCOALS. Bull. Acad. Sci. USSR, Chem. Ser. (English translation from Russian of: Izv. Akad. Nauk SSSR, Ser. Khim.), no. 6:1120-1126, June 1969. 7 refs.

The change in the coefficient of internal diffusion of benzene in grains of activated charcoal was evaluated as a function of the filling of the volume of the adsorption space in kinetic experiments conducted successively a four initial concentrations:  $\text{CO}_1$  equals 1.1,  $\text{CO}_2$  equals 3.84,  $\text{CO}_3$  equals 11.7 and  $\text{CO}_4$  equals 23.4 mg/l. First the kinetic curve was determined at an initial concentration,  $\text{CO}_1$ , and after the equilibrium state was reached, the experiment was continued with an abrupt change of the initial concentration to  $\text{CO}_2$ . The time of change of the concentration was considered for the second experiment, etc., in calculating the effective diffusion coefficient. The curves show that the coefficients increased regularly with increasing volume and specific surface of the transport pores (transitional and macropores). An evaluation of the role of various kinetic factors in the general mass exchange is given. Under the conditions studied, longitudinal transport and internal diffusion of the substance being adsorbed are deciding factors for the dynamics of adsorption.

16439

Wilde, M. P. v.

MIXED INFORMATIONS. (Vermischte Mittheilungen). Text in German. Chem. Ber., 19(1):352-357, Jan. - June 1874. 2 refs.

The production of acetylene by passing acetylene chloride through a red glowing porcelain tube can be increased by filling the tube with pieces of quicklime or soda lime. Experiments with acetylene showed that 2 volumes of acetylene ( $C_2H_2$ ) mixed with 4 volumes of hydrogen yields 2 volumes of  $C_2H_6$ . Ethylene ( $C_2H_4$ ) mixed with the same volume of hydrogen yields  $C_2H_6$ . In further experiments, the influence of electric current on a mixture of  $SO_2$  and oxygen as well as on ethylene and on acetylene was studied. The volume of the  $SO_2/O_2$  mixture was reduced slowly in the first case. It took 5 to 6 hours to reduce 50 ccm of the gas. The two gases reacted directly with each other and  $SO_2$  was formed. Ethylene and acetylene condensed very rapidly under formation of polymers in the first case; in the latter case, an oily liquid condensed which solidified after several hours. This substance is brown and amorphous as well as insoluble. Further studies of this substance will be performed.

16463

Kashtanov, L. I. and V. P. Ryzhov

INVESTIGATION OF THE OXIDATION KINETICS OF GASEOUS SULFUR DIOXIDE IN WATER SOLUTIONS AND THE PROCESSES OF CONTAMINATION OF MANGANESE SULFATE WITH PHENOL. (Izucheniye kinetiki okisleniya gazoobrasnogo sernistogo angidrida v vodnykh rastvorakh i protsessov otravleniya sernokislogo margantsa fenolom). Text in Russian. Izv. Teplotekhn. Inst., 1939:37-40. 7 refs.

Oxidation of  $SO_2$  in water solutions was studied experimentally to determine the effect of phenol both with and without  $MnSO_4$  catalyst. The following conclusions were reached. Oxidation processes taking place during absorption of  $SO_2$  by a solution are analogous to those for oxidation of solutions of sulfuric acid. The percent of oxidation decreases as the total quantity of gas passing through the adsorbing liquid is increased. The percent of desorption increases as the total gas flow rate through the absorber increases. The percent desorption increases as  $SO_2$  concentration of the solution increases. Manganese sulfate salts increase oxidation rate twofold. The presence of phenol in the solution retards autooxidation of  $SO_2$ , the percent oxidation decreasing with increased phenol concentration. Phenol in amounts of 0.1% completely eliminates catalytic action. Trace amounts of phenol sharply decrease the rate of autooxidation both with and without catalyst. Increasing the phenol concentration above 0.1% has practically no further effect. Oxidation of  $SO_2$  takes place not only in solution, but also at the surface of the solvent.

16485

Young, Russell A.

LIQUID METHANE...A CHEAPER MEANS OF PEAK SHAVING? Oil Gas J., 57(13):75-82, March 23, 1959.

Current progress and development in methane gas liquefaction and storage are reviewed. Either the expander cycle or the cascade type are preferred among the numerous liquefaction processes. The expander cycle is a simple straight methane-refrigeration cycle and is more economical in small plants. The cascade cycle is similar, but in large plants refrigerants such as propane or

ethane are substituted. The economics of peak load shaving are discussed. Tabular presentations of the comparative economics of peak load shaving include investment costs, fixed and direct costs, and operating cost per day sendout.

16599

Mousseron, Max

ON DIVERS ALICYCLIC COMPOUNDS CONTAINING SULFUR. (Sur divers composés alicycliques sulfures). Text in French. Compt. Rend., vol. 216:812-814, June 16, 1943. 7 refs.

In the course of a study of some S-bearing alicyclic compounds, several series of compounds were examined. A brief description of the method of their preparation, the temperatures of their melting and boiling points, their specific gravity at 25 C, and their index of refraction at 25 C are given. A list of these compounds is as follows: cyclohexylthiohydroxy-2 cyclopentane, cyclohexylthiohydroxy cyclohexane, cyclohexylthiohydroxy-2 cyclohexane, ethyl ether and ethyl diether of bis-hydroxycyclohexyl sulfide, bis-hydroxy-2 cyclopentyl disulfide, bis-hydroxycyclohexyl, cyclohexylthioamino-2 cyclohexane, bis-amino-2 cyclohexyl disulfide, epithiomethene cyclohexane, thiodicyclohexylmethylol-1, cis-methyl-3 cyclohexylsulfonic acid, trans-methyl-3 cyclohexylsulfonic acid, as well as the K-salts of the latter two.

16605

Asinger, Friedrich

THE PRODUCTS OF THE COMMON INFLUENCE OF SULFUR DIOXIDE AND CHLORINE ON ALIPHATIC HYDROCARBONS IN ULTRAVIOLET LIGHT. IV PART: THE PRODUCTS OF THE COMMON INFLUENCE OF SULFUR DIOXIDE AND CHLORINE ON N-DODECANE. (Zur Kenntnis der Produkte der gemeinsamen Einwirkung von Schwefeldioxyd und Chlor auf aliphatische Kohlenwasserstoffe im ultravioletten Licht, IV. Mitt.: Die Produkte der gemeinsamen Einwirkung von Schwefeldioxyd und Chlor auf n-Dodecan). Text in German. Chem. Ber., 77-79(3-4):191-194, 1944. 13 refs.

In a study of the reactions of high molecular straight-chained paraffines hydrocarbons to sulfochlorination, n-dodecane was subjected to a partial sulfochlorination to avoid excessive di and polysulfochloride formation. The sulfochlorides were liberated from the unconverted hydrocarbon through selective extraction with liquid SO<sub>2</sub>. Di and polysulfochlorides were precipitated from mixtures with monosulfochlorides with pentane. The mixture of monosulfochlorides was then desulfurized, leaving a mixture of dodecyl chlorides in which the chlorine assumed the same position as previously held by the sulfochloride group. The dodecyl chloride mixture was converted into dodecylenes with silver stearate. From 100 g of dodecylene mixture 87g water-insoluble fatty acids were obtained. The composition of the individual acids in mol percent was: C<sub>6</sub> 17.2, C<sub>7</sub> 18.6, C<sub>8</sub> 16.6, C<sub>9</sub> 19.2, C<sub>10</sub> 18.1 and C<sub>11</sub> 10.3.

John, G. S., M. J. Den Herder, R. J. Mikovsky, and R. F. Waters

PHYSICOCHEMICAL STUDIES OF MOLYBDENA RE-FORMING CATALYSTS. In: *Advances in Catalysts*. Adalbert Faricas (ed.), vol. 9, New York, Academic Press, 1957, Chapt. 27, p. 252-267. 22 refs.

In reforming a virgin naptha over molybdena on alumina, best performance is attained with a cogelled catalyst containing about 10% molybdena. To understand the fundamental aspects of this performance, several physicochemical properties of cogelled catalysts were investigated. Hydrogen-deuterium studies, in addition to showing a minimum in exchange ability, reaffirmed that the effectiveness of the molybdena depends on the method of catalyst preparation. Estimates based on naptha conversion indicate that only 70-75% of the molybdena is dispersed on the external surface of the catalyst. A stable nonstoichiometric molybdous oxide is postulated as the catalytically active component. Abrupt, reproducible discontinuities in the kinetic constants of nitrous oxide from decomposition studies are interpreted as indicative of either electronic or structural changes in the active component of the catalyst. The stabilizing influence of alumina was evidence of a delicate balance of bonding forces and was seen in the conductive properties and heats of solution near 10 wt% MoO<sub>3</sub>. The studies also revealed that water has a stabilizing effect upon the nonstoichiometric oxide. Thermodynamic information shows that MoO<sub>3</sub> is the stable phase in water vapor, while molybdenum is the stable phase in the presence of hydrogen. The variance of experimental observation from the thermodynamic calculations is attributed to an interaction between the alumina and molybdena and the stabilizing influence of water. In commercial reforming, the chemistry of the catalyst is further complicated by the presence of sulfur compounds. Sulfur dioxide absorption studies show that dispersing a monolayer of molybdena over the alumina surface will prevent adsorption of SO<sub>2</sub>. It is concluded that in the preparation and use of reforming catalysts, attention should be centered on the conditions which produce and stabilize the active intermediate oxide. Best performance is attained with a catalyst combining a high surface area with a high degree of dispersion and availability of the molybdena. These factors must be balanced against operational conditions that influence the degree of reduction of the molybdena and the accumulation of sulfur.

16611

Mousseron Max and Robert Granger

RESEARCH ON THE ALICYCLIC SERIES. STUDY OF THE ORGANO-MAGNESIUM COMPOUNDS (6TH REPORT). (*Recherches en serie alicyclique. Etude des organo-magnesiens (6e memoire)*). Text in French. Bull. Soc. Chim. France, vol. 13:251-6, 1946. 27 refs.

In the course of carbonation of magnesium derivatives of the methyl-chlorocyclohexanes, a small yield was obtained in acid, particularly for compounds of two of the hydrocarbon chains with MgBr. These secondary reactions are essentially intermediate



reactions in a series of reactions; they are the consequence of the reducing property of the deoxidation of cyclic magnesium derivatives. These reactions, which are quite comparable, are described in a study of the action of organo-magnesium compounds on acids and their salts, halogen derivatives of acids, esters, ketones, and aldehydes, that is, a series of compounds having a carbonyl group. The reduction of sulfinic acids formed in the course of fixation of sulfur dioxide on chlorocyclohexylmagnesium is also studied.

16626

Backer, H. J. and J. Strating

CYCLIC SULFONES DERIVED FROM BUTADIENES. (Sulfones cycliques, derivees de butadienes). Text in French. Rec. Trav. Chim., vol. 53:525-543, 1934. 21 refs.

Addition of sulfur dioxide to butadienes gives rise to cyclic sulfones which possess a double bond which, in most cases, fixes Cl or Br atoms. On the other hand, sulfones whose double bond carries one or two groups of tert.butyl or two groups of phenyl resist the Br addition (steric hindrance). 2,3-dimethylbutadiene sulfone forms a dibromide, which yields a diol (trans) on hydrolysis. Direct oxidation of this sulfone by permanganate gives rise to the stereomer diol (cis). The dibromide, losing two molecules of hydrobromic acid leaves a weakly stable thiophenesulfone. An acetic solution of Cl reacting with dimethylbutadienesulfone fixes in it acetyl hypochlorite. The same type of addition-reaction could be carried out with the ethylene. The homologs of isoprenesulfone isomerize on exposure to ultraviolet radiation. The method of preparation and of some properties are presented, such as temperature of melting and/or boiling point, color, crystal habit, and, in the case of trans- and cis- isomers of 3,4-dihydroxy-3,4-dimethyl-thiacyclopentane-1.1-dioxide only, the crystal structure. The 37-odd organic compounds studied by the authors are identified by their chemical designation and, in 25 cases, by their structural formulas as well and are ordered according to the 8 specific butadienes from which they were derived.

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 Glasson, W. A.  
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   \*06235-C   \*05479-B  
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 Grant, E. P. \*02055-K  
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 Grant, R. J. \*06056-M  
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 Griffin, G. W. 00356-M  
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 Grigorenko, A. I. 04254-D  
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 Jacumin, W. J.  
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Jennelle, L. F. 11632-F  
Jensen, D. A. \*01623-E  
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Jewell, R. G. 04922-B  
Joachim, E. U.  
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Jodeck, P. \*15966-E  
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John, B. 09197-M  
John, G. S. \*16608-M  
Johns, R. H. \*04470-E  
Johnson, A. J.  
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Johnson, F. A.  
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Johnson, J. E. 03969-M  
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Johnson, K. J. \*05720-F  
Johnson, W. R. 13668-B  
Johnston, A. E. 07061-D  
Johnston, H. S. \*02534-M  
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Jonathan, N. \*14917-M  
Jones, C. 01550-E  
Jones, E. P. 14220-M  
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Jones, J. L. \*06052-D  
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Jones, M. H. 00177-C  
Jones, R. C. 08295-F  
Jones, W. M. \*04871-E  
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Just, J. \*10320-K  
Juvet, R. S., Jr.  
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Kachmar, E. G.  
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Kagawa, J. \*08305-F  
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Kalasky, J. D. \*01544-B  
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Kashtanov, L. I.  
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Khan, A. U. \*07257-C  
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 Nau, C. A. 04895-D  
     10767-D 04701-F  
     \*04702-F \*04703-F  
 Naumann, P. \*08337-M  
 Neal, J. 04701-F  
     04702-F 04703-F  
     \*04705-F \*04706-F  
     04709-F 04710-F  
     04711-F 04712-F  
     04713-F 04714-F  
 Nebel, G. J. 05850-B  
     \*07637-B  
 Nedogibchenko, M. K.  
     \*08165-B  
 Neerman, J. C. \*07626-B  
 Neiburger, M. \*00510-C  
     \*03381-C \*06043-C  
 Neiman, I. M. \*04708-F  
 Neligan, R. E. \*05097-B  
 Nelson, E. E. \*14463-E  
 Nelson, S. S. 09734-D  
 Nemeth, A. \*10045-M  
 Neronskii, O. G.  
     \*03937-D  
 Netzley, A. B.  
     \*09825-B \*09830-B  
 Nevens, T. D. \*01838-B  
 Newbury, B. C. 04880-D  
 Newell, H. A. 16277-D  
 Newhall, H. K. 01375-B  
     \*02335-B 13951-B  
     13544-M  
 Newman, D. J. \*15765-E  
 Newton, J. M. \*00231-M  
 Nichols, C. W. 05342-G  
 Nicksic, S. W. 03103-D

\*04960-D \*03978-F  
 \*05611-M  
 Niedrach, L. W.  
 \*14688-M  
 Nielsen, B. J.  
 11299-F 00664-F  
 Niemeyer, L. E.  
 \*04933-C  
 Niepoth, G. W. \*01132-B  
 Niewenhuis, R. \*07068-F  
 Nikberg, I. I. 07300-B  
 Ninomiya, J. S. 13034-M  
 Nippoldt, B. W. 06065-D  
 Nishida, K. 14487-B  
 Nissen, W. E. 02055-K  
 Nobe, K. 00097-E  
 05147-E 00101-M  
 01241-M 04617-M  
 \*05250-E  
 Noble, W. M. 05485-G  
 03584-B  
 Noe, J. L. 02089-D  
 02798-D 02799-D  
 Nolan, M. \*01202-J  
 Nomiya, K. \*03900-F  
 14494-F  
 Noro, L. 01794-F  
 Norris, C. H. 02323-D  
 Norris, L. A. \*07988-M  
 Norris, R. M. \*08109-F  
 Novack, R. L. 08082-E  
 Novak, J. 07432-D  
 Novak, J. R. 11188-M  
 \*15491-M  
 Nouikov, Yu. V.  
 \*07306-F  
 Nowak, K. 10320-K  
 Nowakowski, P. \*11615-B  
 Noyes, C. M. \*16398-D  
 Nozaki, S. \*06793-E  
  
 Oberdorfer, P. E.  
 \*09341-B  
 Oblander, K. \*13989-D  
 Odaira, T. \*15610-J  
 Ogata, M. \*03652-F  
 Ohrn, Y. \*04409-M  
 Ojakaar, L. 01636-F  
 O'Keefe, A. E. \*11270-D  
 Okrent, E. H. 09148-B  
 Oldershaw, G. A.  
 \*02258-M  
 Olesov, N. A. 15614-E  
 Oliver, F. W. 00235-G  
 Oliver, J. \*05471-E  
 Olsen, C. R. 04829-F  
 Olson, D. R. 03266-E  
 10135-B  
  
 O'Neill, W. E. 15484-D  
 Ongun, A. \*07446-G  
 Ordin, L. \*06498-G  
 \*06499-G  
 Ordoveza, F. E.  
 \*00492-D  
 Orning, A. A. \*05011-B  
 \*05012-B  
 Orr, C. Jr. \*00069-M  
 Ortman, G. C. 01828-C  
 \*01823-D \*00623-D  
 Ossicini, L. 13499-M  
 Ostrovskii, M. N.  
 \*02571-F  
 Otto, H. W. \*16357-G  
 Ottoboni, F. 01358-M  
 Ourusoff, L. \*05746-B  
 Ozerskiy, A. S. 10926-E  
 Ozerskii, Yu. G.  
 14767-B  
 Ozolins, C. \*00336-K  
 11224-J 09737-B  
 01890-B  
  
 Padovani, C. \*03128-B  
 Padrta, F. G. 14607-D  
 Pagnotto, L. D. \*06702-D  
 Pahnke, A. J. \*09355-B  
 \*14033-B  
 Pailer, M. H. \*15248-J  
 Painton, R. E. 04839-D  
 Palmes, E. D. 07027-F  
 Pan, C. H. \*05294-F  
 00658-F  
 Papa, L. J. \*09342-D  
 Parker, A. \*07845-A  
 \*07945-B  
 Parker, C. A. \*02336-D  
 Parker, D. R. \*09316-F  
 Parkin, N. R. 00469-D  
 Parmelee, W. H. 05155-E  
 Parson, D. \*08394-B  
 Partsef, D. P. \*04252-F  
 Patterson, G. C.  
 \*06159-E  
 Pattison, J. N. \*03264-B  
 03267-D  
 Patton, H. W. \*05578-D  
 Paul, D. G. 05404-D  
 Paulus, A. O. 03613-G  
 Paulus, H. J. 14609-E  
 Paulus, J. 01991-D  
 Payne, J. Q. \*04993-B  
 Payne, W. W. \*05298-F  
 \*01762-F  
 Pearsall, H. W. \*09343-D  
 05170-D  
 Peatman, W. B. \*14293-M  
  
 Padwa, A. \*00353-M  
 \*00355-M  
 Prejack, E. R. \*09172-M  
 Pentti, L. \*15343-E  
 Perga, M. W. 14608-E  
 Perkins, R. W. 00173-C  
 Pesterfield, C. H.  
 \*01626-B  
 Peters, J. M. \*12955-F  
 Peters, K. H. 07366-J  
 Petcolas, W. L.  
 15055-M  
 Petri, H. \*02969-F  
 Petrova, M. S. \*11486-D  
 Pfaff, J. 00146-D  
 00386-D \*00766-D  
 00868-D  
 Phillips, D. \*02337-M  
 Phillips, W. F. 05092-D  
 Piatt, V. R. \*16159-E  
 Pierre, J. St. 01080-F  
 Piette, L. H. \*07097-D  
 Pigalev, S. A. \*03930-J  
 Ping, A. Y. \*01333-D  
 Pinigina, I. A. 02548-B  
 \*02544-D \*06903-D  
 Piper, R. \*00746-B  
 Pires, E. G. 06546-G  
 Pirkle, C. I. 01051-F  
 Pirila, V. \*01794-F  
 Pitts, J. N., Jr.  
 \*00602-C 00618-C  
 \*00789-C \*00935-C  
 07257-C 00608-M  
 00917-M \*01210-M  
 02489-M \*02496-M  
 \*05100-M 08877-M  
 10512-M 10519-M  
 \*12169-M  
 Plata, R. L. 11307-F  
 Platt, T. S. 06078-G  
 Pless, L. G. 04663-B  
 Plust, H. G. \*07853-B  
 Poglazova, M. N.  
 \*07188-M  
 Pohorecki, R. \*07495-M  
 Poirier, A. R.  
 \*04233-B  
 Poletaev, M. I.  
 \*04099-D  
 Poletayev, M. I. \*08132-D  
 Popov, V. A. \*07830-D  
 15481-M  
 Porter, G. \*15019-M  
 Potter, A. E., Jr.  
 04483-M  
 Powers, J. W. 03064-C  
 Poziomek, E. J. \*04285-M  
 Prager, M. J. \*01451-D

## HYDROCARBONS AND AIR POLLUTION

Salooja, K. C. *16484-E	07878-D 09597-D	Schumm, D. E. 09024-F
*03985-M *04926-M	*11091-D *00518-F	Schuttmann, W. *07956-F
*12058-M	*00870-F *00111-J	Schwabe, K. 14450-M
Salyamon, G. S.	*00625-J 01471-J	Schwartz, C. H. 05011-B
*04086-D	*02225-J *02944-J	05012-B
Saltzman, B. E.	Sawyer, R. F. 06433-D	Schwartz, R. D. *07395-M
*01650-C *03544-D	06435-D 10045-M	Scotfield, F. *15352-B
Samedov, I. G. *03934-F	Scassellati-Storzoilini, G.	Scott, M. K. 07898-D
Samoilovich, L. N.	*06808-B	Scott, W. E. 05818-C
*11914-J	Schaad, R. *16336-J	02786-D *05572-D
Samoilovich, L. N.	Schadt, C. F. 13040-J	02785-D *05627-J
*11914-J	Schaffer, L. J. 01089-J	00251-J
Sanders, W. N. *09574-D	Schalddenbrand, H.	Scully, D. B. 03986-M
Sanderson, D. E.	*07638-B	Seery, D. J. *13931-M
01318-M	Scharf, P. B. *07451-B	Seidman, G. *02537-G
Sandomirsky, A. G.	Scheel, L. 07068-F	Seinfeld, J. H. 15310-B
*00257-E	Scheer, M. D.	Seizinger, D. E. 00241-J
Saruta, N. *16542-F	07498-M *07509-M	Seleznev, B. E. *02559-D
Sato, S. *04142-F	Scherber, F. I.	Selucky, M. *07432-D
Saunders, R. A.	*16170-D	Senderkhina, D. F.
*03829-D *06624-D	Schiele, G. *10568-E	*08136-D
Sauvageau, P. 09030-M	Schiemann, G. *02973-E	Senderikhina, D. P.
Sawicki, E. *00011-D	*16207-M	*07156-D
*00114-D *00146-D	Schleff, H. I. 03184-M	Serat, W. F. *04635-D
*00203-D 00230-D	Schlechter, M. M.	Serzhantova, N. N.
*00386-D *00440-D	01632-M	04085-D
*00479-D *00624-D	Schlesinger, M. D.	Setser, D. W. 05051-M
*00765-D 00766-D	*08391-B	Setzer, H. *06479-E
*00767-D 00768-D	Schlipkoeter, H. W.	Severs, R. K. 03965-D
*00867-D *00868-D	*02963-D *08274-F	03966-D
00911-D 00912-D	*16219-F	Seyer, W. F. *16040-M
*00926-D *00927-D	Schmertzing, H.	*16054-M
*00928-D *00931-D	*09751-B	Shabad, L. M. *10099-G
*00934-D *00998-D	Schmidt, C. E. 06017-F	*05304-F *06268-F
*01232-D 01696-D	Schmidt, F. H. *11004-C	*07301-F *14422-F
*01729-D *01735-D	Schneider, R. A.	*03935-B *07400-D
*01781-D *01795-D	*06017-F *07510-M	Shabaker, R. H.
*01817-D *01922-D	Schoff, E. P. 08331-F	09106-B
*01973-D *01944-D	Schonauer, G. *02657-D	Shaffer, N. R. 03462-J
*01995-D *01997-D	Schultz, V. 13713-M	06031-B
*01999-D *02077-D	Schuck, E. A. *03883-B	Shafner, H. 13886-F
*02078-D *02079-D	*00618-C *01602-C	Shapiro, D. D. *04109-F
*02080-D *02081-D	06052-D 01596-F	Shapiro, H. *15273-M
*02083-D *02084-D	*01603-F *05819-F	Sharkey, A. G., Jr.
*02085-D *02086-D	02496-M	*14173-D
*02087-D *02088-D	Schueneman, J. J.	Sharma, R. K. *04667-D
*02089-D *02090-D	*00599-A 03404-J	Sharp, J. H. 07097-D
*02091-D *02092-D	03458-J *09209-J	Sharpe, L. M. *09759-B
*02094-D *02095-D	Schuette, F. J.	Shaw, R. *05425-M
*02096-D *02097-D	*02806-B *01876-D	09700-M 07457-M
*02226-D *02227-D	08270-D	Sheehy, J. P. *00220-B
*02795-D *02796-D	Schuetze, M. *13865-E	Shen, L. *05954-F
*02797-D *02798-D	Schulte, J. *00538-E	Shepherd, M. *00224-D
*02799-D *02801-D	Schulz, E. J. 04049-D	Sherman, A. *14258-M
*02803-D *02805-D	Schulz, H. 10539-E	Sherrell, F. G. *02460-D
*02843-D *03080-D	Schulz, K. R. 16356-F	Sherwood, P. W. *08476-E
*03081-D *03253-D	Schumacher, R. 02796-D	Shevkun, O. N. 11486-D
*03523-D *04029-D	Schumann, C. E.	Shimose, T. 13415-M
*04328-D 05319-D	*05336-J	Shinagawa, K. 07375-D



Shively, J. F. 00730-J	Smith, G. V. 00293-D	00203-D	00399-D
*06430-J	Smith, I. D. *05649-B	00479-D	00624-D
Shizuo, Y. *14353-E	Smith, I. G. 12085-B	00867-D	00927-D
Shoji, H. *08493-B	Smith, J. E. 02812-M	00934-D	00998-D
*14487-B	03732-D	01232-D	01729-D
Shook, W. C. 09370-K	Smith, M. 07783-F	01735-D	01787-D
Shtern, V. Y. *15238-M	Smith, M. E. 11010-G	01795-D	01826-D
Shubik, P. 06004-F	Smith, R. 01413-B	01979-D	01995-D
07785-F	04630-B 07885-D	01997-D	*01998-D
Shulman, H. L. *02374-M	*02378-D *04596-D	02078-D	02080-D
Shultz, J. F. 00015-E	00336-K	02085-D	02087-D
Shultz, J. L. 14173-D	Smith, R. P. *04723-F	02091-D	02092-D
Shvarts, Y. I. *08163-J	04927-F	02094-D	02096-D
Sidorina, I. Yu. 07518-C	Smith, S. B. *03425-D	02795-D	02801-D
Siegel, J. *03822-F	Smith, S. H., Jr.	*04329-D	*06200-D
Sigsby, J. E., Jr.	00103-E	*11093-D	*11218-D
*05135-D 01926-D	Smith, T. *09002-F	15337-D	00770-M
*04796-D 00122-D	Smith, W. D. 01461-D	00869-M	02082-M
00542-D *02375-B	*08519-D 05057-J	Starkman, E. S.	
00271-B	Smith, W. E. 01440-F	*01375-B	*01565-B
Sigworth, H. W.	Smith, W. S. *00030-B	02527-B	*05411-B
04993-B	Sobolev, I. *15032-M	*10044-B	*13544-M
Simmers, M. H. *08015-F	Soda, R. 04206-D	Starshov, I. M. *14773-D	
*02276-F	10946-D *12949-M	Statsek, N. K. *07574-F	
Simonaitis, R. 00935-C	Sokoloskii, M. S.	Staudhammer, P. 05966-E	
*10512-M	*03363-J	Steadman, B. L. 06196-F	
Simonsen, R. N. 03872-E	Solomin, G. I.	Stebar, R. F. *05339-D	
Singer, J. M.	*02566-F *03933-F	Steel, C. 02528-M	
*04653-M	*05949-F	Stefanescu, A. *08321-D	
Singh, T. *06443-D	Somazzi, S. *07204-A	Steger, E. *14470-D	
Sipple, H. E. 07187-B	Sonley, J. M. 09365-D	Steigerwald, B. J.	
Skala, H. *14607-D	Sorenson, S. C.	*03543-B 00783-C	
Skanavi, M. D. 05184-B	*13951-B	Stein, K. C. *03796-E	
Skarstrom, C. 15063-M	Soultages, N. L.	*03797-E *07607-M	
Skeel, R. T. 07089-B	*01230-D	Steinbach, W.	
Skunca, I. 14074-B	Sourirajan, S.	08373-B	
Skvortsov, A. N. *06305-E	*08207-E	Steinfeld, J. I. 15019-M	
Skvortsova, N. N.	Spencer, C. F. 02204-M	Stemmer, K. L. 09435-F	
*10631-B	Spencer, E. F., Jr.	Stenburg, R. L.	
Slater, D. H. *07512-M	*03762-E	*02232-B *06086-B	
11239-M *11248-M	Spencer, J. N.	*02233-D	
Slater, W. L. *04668-M	*06219-F	Stephens, E. R.	
Sleva, S. F. 03727-D	Sperling, F.	03264-B *02476-C	
02161-D 02162-D	*07332-F	*05817-C *05818-C	
Slutsky, S. *13580-M	Spindt, R. S. *00277-D	*01208-D *03112-D	
Small, M. 01302-D	Springer, K. J.	05572-D 03595-G	
02169-J 01025-F	*06039-B *11254-B	*03618-G 05627-J	
Smelyanskii, Z. B.	*01867-E *04888-E	*00238-M *02851-M	
07289-L	Squire, E. C. 09355-B	*11050-M	
Smirnova, V. G.	Squires, A. M.	Sterba, M. J. *03289-I	
06893-D	*06488-B	Stern, A. *03085-A	
Smith, C. G. *10767-D	Stahman, R. C. 03562-B	*01654-B *02951-B	
Smith, C. W. *09085-M	03989-B 00936-E	*05822-E	
Smith, D. S. *02527-B	*01411-E 02244-E	*07893-E	
*06435-D	Stanescu, L. 08321-D	Sternberg, H. W. *10039-M	
Smith, E. I., Jr.	Stanilewicz, W.	Sternlicht, B. 14202-E	
*04440-D	*06021-D	Stevens, R. K. *04839-D	
Smith, G. F. *06820-F	Stanley, T. W.	Stevenson, H. J. R.	
Smith, G. T. *06163-F	00011-D 00114-D	*01318-M	

Steward, R. C. 03547-A  
 Stewart, R. D. \*00747-D  
 \*04124-F \*05561-D  
 Stezhenskiy, A. I.  
 \*14385-M  
 Stickel, R. 06127-E  
 Stock, P. \*03886-F  
 Stockman, R. L.  
 01949-J  
 Stocks, P. \*03086-F  
 \*03526-J \*04051-F  
 Stockton, E. J.  
 09370-K  
 Stoeve, W. 06235-C  
 Stokinger, H. E.  
 \*04544-G  
 Stone, R. K. \*14127-B  
 Stopps, G. J. \*05418-F  
 Story, P. R. \*00565-M  
 Stoudenmire, J. H.  
 16170-D  
 Stout, B. M., Jr.  
 \*11259-F \*11260-F  
 \*11261-F  
 Strating, J. 16626-M  
 Strong, A. A. \*01495-D  
 Struck, J. H. 07638-B  
 Struck, R. T. 04022-M  
 Stuart, R. A. \*05056-D  
 Sturgis, B. M. \*07627-D  
 Styles, H. E. \*07596-B  
 \*16024-B  
 Sugiyama, K. 03652-F  
 Sukharevskaya, T. M.  
 08526-F  
 Sullivan, J. H. \*03354-D  
 Sullivan, J. L. 05675-J  
 Sullivan, R. E. \*09329-E  
 Sumegi, I. 05729-F  
 Sunderman, D. N. \*06682-D  
 Suppan, P. \*09082-M  
 Susan, S. \*11239-M  
 Suter, C. M. \*16082-M  
 Suter, H. R. \*07620-E  
 Suzuki, T. \*06744-A  
 Suzuki, Y. \*05461-D  
 14125-D  
 Swann, H. E., Jr.  
 \*00779-F \*02277-F  
 Swann, M. H. 03991-D  
 Swartz, D. J. \*06104-B  
 Sweeney, M. P. \*00155-D  
 \*03267-D  
 Sweeney, W. J. \*02428-B  
 \*03887-B  
 Swinnerton, J. W.  
 \*14158-M  
 Syczewska, K. \*07403-D  
 Tabor, E. C. \*00388-B  
 \*00293-D \*03426-J  
 Tada, O. \*06112-D  
 \*13154-D  
 Taeuber, K. E. 03486-E  
 Talbot, R. B. 00176-F  
 Tamagno, J. 13580-M  
 Tanimura, H. \*07335-D  
 \*11015-J \*14679-J  
 Tanner, R. L. 08105-M  
 Tarkhova, L. P. \*06892-F  
 Taylor, F. R. 03542-D  
 Taylor, J. R. 05575-C  
 Taylor, O. C. \*00009-G  
 Taylor, R. E. \*14036-E  
 Tebbens, B. D. \*01798-D  
 \*01358-M \*02203-M  
 02495-M  
 Teeter, R. M. \*02204-M  
 Teichner, W. H. 11241-F  
 Tendron, G. \*03116-G  
 Termeulen, M. A.  
 \*02017-B  
 Teske, W. \*11058-E  
 Tessier, K. C. \*11234-E  
 Theisz, E. 04539-F  
 Theones, H. W. \*11061-D  
 Thom, N. G. 07165-F  
 Thomas, A. A. 00096-F  
 \*00429-F \*04738-F  
 \*10613-F \*11593-F  
 Thomas, G. \*09803-B  
 Thomas, J. F. 01902-B  
 08359-B 01798-D  
 08354-D 04551-F  
 02203-M  
 Thomas, J. W. \*02205-D  
 Thomas, M. D. \*03395-G  
 Thomas, R. S. 07427-D  
 Thomas, T. F. \*0528-M  
 Thomas, W. J. \*09197-M  
 Thompson, C. J.  
 \*08118-M \*13779-D  
 Thompson, R. N. \*04895-D  
 Thompson, W. B. \*01133-B  
 Thornton, D. P., Jr.  
 \*04558-E  
 Thorton, M. 04706-F  
 Tiffany, W. B. \*15139-M  
 Tighe, J. \*04631-D  
 Tillman, J. H. 03505-J  
 Tilson, S. \*00984-A  
 Timmins, G. W. 06471-D  
 Tinkham, L. 10662-B  
 Tipson, R. S. \*03234-D  
 \*00058-M \*09200-M  
 Tkach, N. Z. \*07573-F  
 Tkachev, P. G. 05959-D  
 Todd, E. 16040-M  
 Todd, G. W. \*03627-G  
 \*03629-G \*03630-G  
 \*05777-G \*05778-G  
 Toliver, W. H., Sr.  
 \*00447-J  
 Tomingas, R. 01714-D  
 02648-E 02689-F  
 08339-F 09713-F  
 11572-J 11571-M  
 Tomioka, T. \*02142-E  
 Tomita, K. 02061-J  
 Tope, O. \*07952-F  
 Tompkins, E. E. 05345-M  
 Tosihide, O. \*15772-E  
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03264-B 04315-B	08681-D 09342-D	09752-B
05007-B 05844-B	09348-D 09574-D	
07844-B 09393-B	10242-D 11237-D	Beckman Fission Reactions
11457-B 14045-B	11554-D 14525-D	07898-D
16017-B 16263-B	15763-D 15904-D	
05742-E 01830-J	15909-D 16132-D	Behavior 07306-F
02239-J 04938-J	03266-E 10539-E	
08300-J 09281-K	00195-F 00473-F	
See also: Automotive	00870-F 01603-F	
Exhausts	01987-F 01988-F	Bentonite 13666-M
	02332-F 03076-F	
<b>Automotive Exhausts</b>	03214-F 03270-F	
00020-B 00324-B	03583-F 03823-F	Benzamides 02210-J
01132-B 01133-B	04252-F 04553-F	
01228-B 01375-B	06099-F 07613-F	Benzanthracenes
01381-B 01382-B	07842-F 07952-F	02607-D 11218-D
01383-B 01384-B	08801-F 11632-F	15337-D 01628-M
01413-B 01673-B	03596-C 00115-M	See also: Anthracenes
01815-B 01837-B	00058-M 05611-M	
01958-B 02244-B	05849-M 06698-M	7H-Benz(de)anthracen-7-one.
02806-B 03352-B	10129-M 15911-M	11218-D 15337-D
03584-B 03883-B		See also: Benzanthracenes
03989-B 04028-B	Autoxidation 03164-B	
04460-B 04630-B		Benzene Hexachloride (BHC),
04993-B 04994-B	Autorefrigerated Cascade	Gamma 16526-B
05097-B 05109-B	Cycle 15134-M	See also: Benzene
05113-B 05292-B	Azines 01581-D 03929-D	Compounds
05411-B 05850-B		
06350-B 07623-B	1, 1' Azoisobutane	Benzene Compounds
07626-B 07629-B	07512-M 11248-M	16526-B 00177-C
07635-B 08165-B	11239-M	01825-C 01984-C
08633-B 09341-B		00203-D 00293-D
09355-B 09389-B	Azulenes 02085-D 02091-D	00768-D 00911-D
09405-B 10662-B	02092-D 07878-D	01997-D 02803-D
10734-B 11254-B		03081-D 03929-D
11562-B 13562-B		04060-D 04143-D
00036-D 00068-D		04206-D 04219-D
00108-D 00122-D	Background Stations	04742-D 05092-D
00142-D 00146-D	11004-C	05376-D 05952-D
00155-D 00277-D		05959-D 06021-D
00469-D 00584-D	Bacteria 04635-D	06661-D 06702-D
00620-D 00772-D	07400-D 00992-F	07061-D 07153-D
00898-D 00911-D	04551-F 04650-F	07432-D 07578-D
01225-D 01269-D	05294-F 00231-M	10772-D 11558-D
01495-D 01560-D	07188-M 07463-M	11559-D 15749-D
01720-D 01831-D	See also: Microorganisms	04871-E 04874-E
01926-D 02130-D		02566-F 03821-F
02358-D 02378-D	Bacteriophage 07782-F	03900-F 03933-F
02785-D 02848-D		04142-F 04148-F
03112-D 03267-D		04701-F 04703-F
03977-D 04318-D		

<b>Benzene Compounds (contd.)</b>	<b>Benzophenones 07097-D</b>	<b>Benzyl Chloride</b>
06663-F 06892-F	11218-D 00916-M	15749-D
06905-F 07306-F	01210-M 05100-M	
07308-F 07368-F	10039-M 11218-M	<b>Bioassay 01453-B</b>
07475-F 08431-F	See Ketones	00728-D 00966-D
08526-F 12276-F		01302-D 01025-F
06788-J 00034-M	<b>Benzotrichloride</b>	04551-F 02169-J
00120-M 01026-M	04104-F	
01978-M 02493-M		<b>Biological In-</b>
08827-M 09700-M	<b>Benz(a)pyrene 03686-F</b>	<b>dicators 00728-D</b>
14293-M 15491-M	04710-F 04711-F	00966-D 05836-D
15869-M 16027-M	05650-F 08274-F	
16348-M	03925-J 04091-J	<b>Biological Tissues</b>
<b>Benzene Soluble Compounds</b>	See also: Benzo(a)pyrene	01049-F
11260-F	3,4-Benzpyrene Benzopyrenes	
See also: Benzene	Pyrenes: Carcinogens	<b>Bioluminescence</b>
Compounds		04635-D
<b>Benzene-Soluble Organic</b>	<b>Benzopyrenes 13668-B</b>	
<b>Matter 00728-D</b>	00114-D 00451-D	<b>Biomedical Techniques</b>
00293-D 00728-D	01356-D 01395-D	& Measurement
00638-F 06383-F	01714-D 01729-D	01469-F
02169-J 03426-J	01735-D 01781-D	
	01999-D 02048-D	<b>Biosphere 14019-C</b>
	02226-D 02233-D	
<b>Benzhydrols 01210-M</b>	02336-D 02581-D	<b>Biosynthesis</b>
	02786-D 02797-D	10116-G
	02805-D 03542-D	
<b>Benzo(a)pyrene 00621-B</b>	03940-D 04085-D	<b>Birds 06266-F</b>
00835-B 03935-B	04248-D 04329-D	04709-F 04711-F
04098-B 04108-B	05605-D 06200-D	04713-F
05005-B 10734-B	06380-D 06634-D	
10964-D 11091-D	06662-D 07298-D	<b>Blast Furnaces</b>
11093-D 00518-F	07400-D 07743-D	14399-M
00663-F 00664-F	08643-D 08644-D	
00750-F 00754-F	14125-D 14658-D	<b>Blood Cells 07308-F</b>
00842-F 00870-F	15763-D 03678-F	08526-F
01025-F 01029-F	08598-F 14422-F	
01440-F 02600-F	14679-J 02203-M	<b>Blood Chemistry 01426-F</b>
04177-F 04551-F	02495-M 02853-M	03898-F 03934-F
04705-F 04709-F	07188-M 07463-M	04142-F 04148-F
04712-F 04713-F	11571-M	04723-F
04714-F 05298-F		
05372-F 07291-F	<b>3,4 Benzpyrene 07299-B</b>	<b>Blood Coagulation System</b>
07301-F 07340-F	07300-B 07570-B	08526-F
07785-F 08210-F	08200-B 02596-F	
08339-F 08598-F	02689-F 03086-F	<b>Blowby 03264-B 03562-B</b>
09060-F 09713-F	04702-F 06268-F	04993-B 05596-B
11299-F 10099-G	07302-F 07783-F	01560-D
02061-J 02225-J	09055-F 14711-F	
03685-J 04938-J	16219-F 16542-F	<b>Blowby Emissions</b>
06789-J 08485-J	03925-J 06760-J	02375-B
11015-J 11572-J	06788-J 07292-J	
15248-J	07366-J 11914-J	<b>Body Fluids 05561-D</b>
See also: Benz(a)pyrene	16336-J	
3,4-Benzpyrene	See also: Benzo-	<b>Bosch Reduction Reactor</b>
Benzopyrene Pyrenes:	pyrenes Benz(a)pyrene	04273-M
Carcinogens	Benzo(a)pyrene	
	Pyrenes: Carcinogens	<b>Brassica oleracea</b>
<b>Benzoles 04581-E</b>		10116-G

Breathing 00747-D 01310-D 12949-M	Cancer 01038-B 01453-B 02573-B 06108-B 01029-F 01030-F 01062-F 01469-F 01692-F 02288-F 03886-F 07159-F 08241-F	01998-D 02084-D 08270-D 04926-M 07510-M
Bromocoulometric Analytical Method 02162-D 04960-D 12002-D See also: Coulometry	Carbazoles 00230-D 00912-D 02078-D 02090-D 09200-M	Carburetion 02130-D 01854-E 01873-E 09337-E 15257-E
Bronchial Cancer 06003-F	Carbohydrates 07878-D See also: Sugars	Carburetor Evaporation Losses 07632-B
Bronchitis 03086-F 08415-F	Carbon Black 03986-M 04668-M 15914-M 15988-M 09224-B 06701-F 04702-F 04703-F 04706-F 04711-F	Carcinogens 00621-B 00835-B 01008-B 01362-B 01404-B 01453-B 01788-B 01803-B 02023-B 02549-B 02573-B 03543-B 03935-B 04098-B 04108-B 05005-B 05109-B 06108-B 06808-B 07299-B 07570-B 08200-B 09405-B 10631-B 10741-B 13668-B 14124-B 14619-B 16024-B 16125-B 00114-D 00451-D 00479-D 00624-D 00728-D 00931-D 00966-D 03156-D 01714-D 01729-D 01735-D 01781-D 01999-D 02048-D 02226-D 02233-D 02336-D 02581-D 02795-D 02805-D 03080-D 03542-D 03940-D 04014-D 04085-D 04210-D 04329-D 05084-D 05502-D 05605-D 06135-D 06200-D 06380-D 06634-D 06662-D 07298-D 07400-D 07743-D 08296-D 08321-D 08589-D 08643-D 08644-D 10767-D 10946-D 10964-D 11091-D 11093-D 11554-D 11567-D 14658-D 15708-D 15763-D 15977-D 02600-E 01851-E 06674-E 10637-E 00195-F 00518-F 00630-F 00663-F 00664-F 00750-F 00842-F
Butadienes 01981-J 07458-M 07791-M 15848-M 16626-M See also: Olefins	Carbon Dioxide 00141-D 00277-D 00469-D 03965-D 07150-D 07627-D 08226-D 03184-M 04273-M 04288-M 04289-M 13766-M 15524-M	
Butanes 00139-C 01587-C 01419-D 06017-D 16427-D 04650-F 01648-M See also: Aliphatic Hydrocarbons	Carbon Dioxide Acceptor Process 15524-M	
Butenes 02854-D 04635-D 06301-D 00356-M 02258-M 07498-M 09079-M 09080-M 13034-M See also: Olefins	Carbon Monoxide 04098-B 00141-D 00277-D 00469-D 02130-D 03965-D 07150-D 07564-D 07627-D 08838-D 08488-E 08221-F 07366-J 02253-M 02286-M 02467-M 02472-M 03184-M 04653-M 08877-M 10292-M 14158-M	
Butyl Halides 05613-M	Carbon Tetra Chloride 03820-F 03821-F 08026-F 08028-F 08295-F 11539-F	
By-Product Recovery 08359-B 06170-E 08365-E 14505-E 15995-E 04668-M 15874-M	Carbonyl Compounds 01649-C	
Caffeine 00492-D	Carbonyl Oxide 00565-M	
Calcium Compounds 13278-M	Carbonyls 00464-B 00146-D 00934-D 01581-D 01720-D	
Calibration Methods 02323-D 02354-D 08083-D 08357-D 09888-D 10960-D 15909-D 11543-M		
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# Carcinogens (contd.)

00915-F 01015-F  
01020-F 01025-F  
01029-F 01030-F  
01062-F 01081-F  
01286-F 01440-F  
01469-F 01629-F  
01636-F 01668-F  
01692-F 01762-F  
01813-F 01844-F  
01971-F 02288-F  
02596-F 02689-F  
03480-F 03678-F  
03686-F 03702-F  
03886-F 04539-F  
04551-F 04589-F  
04590-F 04701-F  
04702-F 04703-F  
04705-F 04706-F  
04708-F 04708-F  
04709-F 04710-F  
04711-F 04712-F  
04713-F 04714-F  
05231-F 05238-F  
05284-F 05298-F  
05304-F 05372-F  
05650-F 06002-F  
06004-F 06266-F  
06268-F 06383-F  
06947-F 07291-F  
07301-F 07302-F  
07340-F 07782-F  
07785-F 07952-F  
08210-F 08241-F  
08243-F 08244-F  
08274-F 08339-F  
08511-F 08598-F  
09024-F 09055-F  
09435-F 09713-F  
13860-F 11489-F  
14422-F 14711-F  
14724-F 00111-J  
00625-J 00689-J  
00727-J 02061-J  
02169-J 02225-J  
02587-J 02944-J  
03526-J 03685-J  
03925-J 04091-J  
04651-J 04938-J  
05675-J 05839-J  
06384-J 06760-J  
06788-J 06789-J  
07292-J 08315-J  
08485-J 09766-J  
09936-J 10099-J  
11015-J 11572-J  
11575-J 11914-J  
14679-J 15248-J  
16336-J 00925-M

01630-M 01631-M  
01634-M 01635-M  
02203-M 02495-M  
02853-M 05325-M  
07188-M 07463-M  
09200-M 10520-M  
11571-M 14709-M

Carcinomas 11275-F

Carrier Gases 01771-M

Cascade Samples 02323-D

Catalysis 13033-E  
13554-E 00097-E

Catalysts 04272-B  
09838-B 13543-D  
14525-D 00015-E  
02737-E 03796-E  
03797-E 08082-E  
13865-E 14326-E  
14333-E 00101-M  
01680-M 03343-M  
04022-M 04288-M  
07607-M 12172-M  
13391-M 13465-M  
14227-M 14335-M  
16608-M

Catalyst Support  
08536-E

Catalytic Activity  
05214-E 07362-E  
14459-E 00231-M  
01241-M 09179-M  
14227-M 14258-M

Catalytic Afterburners  
07637-B 07638-B  
00269-E 02373-E  
14341-E 14604-E  
14608-E

See also: Afterburners

Catalytic Combustion  
04839-D 14525-D  
15200-D 02112-E  
08207-E 03969-M  
04617-M 15486-M

Catalytic Converters  
14604-E

Catalytic Muffler  
13036-E

Catalytic Oxidation  
00060-D 03966-D  
01497-E 02648-E  
02725-E 03797-E  
04470-E 04558-E  
04610-E 04771-E  
05147-E 05250-E  
05415-E 05471-E  
05929-E 06285-E  
06512-E 07362-E  
07620-E 08082-E  
08536-E 12998-E  
13144-E 15765-E  
16184-E 01241-M  
02286-M 05208-M  
14335-M

Cattle 05421-G

Cell Growth 05294-F  
06847-F 06498-G

Cell Metabolism  
04575-E 09024-F  
09055-F

Cells 01062-F 06384-J

Centrifuge, Evaporative  
15063-M

Ceresin Aerosols  
07156-D

Charcoal 01392-D  
01419-D 03185-D  
04648-D 15541-D  
04871-E 04874-E  
13686-M 13876-M  
14313-M 14622-M  
16348-M

Charcoal Grilling  
14124-B

Chassis Dynamometer  
03547-A

Chemical Analytical  
Methods 00122-D  
00845-D 02439-D  
03080-D 04796-D  
07146-D 07156-D  
07373-D 07375-D  
10242-D 14428-D  
15171-D 15355-D  
16211-D 01049-F  
07342-F 13453-M

## Chemical Bonds 01603-F

### Chemical Composition

02362-B 02375-B  
02610-B 03264-B  
07629-B 01714-D  
02685-D 04262-D  
06435-D 06624-D  
13779-D 06534-E  
14119-F 05627-J  
13040-J 13788-J  
14776-J 15575-J  
05849-M 06102-M  
13415-M 14500-M

### Chemical Compounds

15712-C 00868-D  
02415-D 07972-F  
05342-G 03525-M  
09764-M

### Chemical Industry

03129-B

### Chemical Plants

11914-J

### Chemical Processes

02234-B 02236-B  
14767-B 15392-B  
02439-D 03940-D  
14430-D 00587-E  
11058-E 13554-E  
00883-F 02571-F  
04256-G 13415-M  
15848-M 15990-M  
Chemical Reactions  
06722-A 00302-C  
04988-C 06994-C  
01683-D 06682-D  
07884-E 14264-E  
00608-M 04288-M  
04289-M 07498-M  
07509-M 11050-M  
15805-M 16082-M  
16439-M 16599-M  
16626-M

### Chemical Synthesis

01635-M

### Chemiluminescence

00426-D 02188-D  
11097-M

### Children 04037-F

06869-F 10987-F  
11272-F

## Chlorella pyrenoidosa 10119-M

### Chlorine 16605-M

### Chlorine Dioxide Treatment 03983-E

### Chlorophenols

05092-D

### P-Chlorophenyl Isocyanate

04258-F

### Chloroplasts

07446-G

### Chloroprene 02121-D

11272-F 02592-J

### Chlortetracycline

02559-D

### Chromatograph Back

Flush Gas

05057-J

### Chromatography 00060-D

00108-D 00141-D  
00230-D 00264-D  
00469-D 01696-D  
02785-D 02786-D  
07153-D 07878-D  
11068-D 14391-M

### Chromatography, Column

00542-D 00624-D  
00926-D 00934-D  
01979-D 02227-D  
02581-D 04930-D  
06380-D 07435-D  
11574-D 12668-D  
14662-D 02812-M  
06980-M 07395-M

### Chromatography, Gas

01382-B 01558-B  
04731-B 05337-B  
07214-B 16494-B  
00935-C 01761-C  
00036-D 00479-D  
00542-D 00610-D  
00772-D 00911-D  
00942-D 01278-D  
01289-D 01310-D  
01392-D 01430-D  
01503-D 01784-D  
01926-D 01979-D

02159-D 02460-D

02500-D 02875-D

03112-D 03430-D

03732-D 03949-D

03967-D 03977-D

03991-D 04143-D

04206-D 04484-D

04648-D 04667-D

04895-D 05056-D

05135-D 05263-D

05404-D 05578-D

05848-D 05863-D

05981-D 06112-D

06328-D 06699-D

07061-D 07140-D

07335-D 07432-D

07628-D 07749-D

07850-D 07887-D

08285-D 08354-D

08357-D 08519-D

08848-D 09342-D

09365-D 09388-D

09574-D 10238-D

10946-D 11164-D

11554-D 11558-D

11559-D 12001-D

12663-D 12668-D

13779-D 13974-D

14430-D 14839-D

15529-D 15541-D

15802-D 15904-D

16620-D 01980-J

02160-M 02204-M

02812-M 07395-M

08118-M 13062-M

14500-M 14648-M

### Chromatography, Paper

00440-D 00766-D  
00868-D 00911-D  
01720-D 01991-D  
06903-D 11068-D  
11485-D 02210-J  
02495-M

### Chromatography, Thin-Layer 00011-D

00114-D 00399-D  
00479-D 00624-D  
00766-D 00767-D  
00868-D 00912-D  
00926-D 00931-D  
00934-D 00998-D  
01232-D 01581-D  
01735-D 01781-D  
01795-D 01826-D  
02795-D 04328-D  
04329-D 05092-D

Chromatography, Thin-Layer (contd.) 05461-D 06955-D	Cocklebur ( <u>Xanthium</u> <u>pensylvanicum</u> <u>Walln.</u> ) 07167-G	Combustion, Oscillatory 03588-M See also: Perturbations
07743-D 08589-D	Coffee 03354-D	Combustion Products
09223-D 09597-D	Coke 15914-M	09780-A 00027-B
10767-D 11068-D	Coke Ovens 16125-B	01744-B 01788-B
11091-D 11093-D	Colloids 10041-M	02001-B 02335-B
11218-D 11574-D	Colorimetric Analysis	04995-B 05011-B
14662-D 15337-D	04245-C 00845-D	05012-B 07451-B
00869-M 01034-M	00867-D 01802-D	10475-B 10741-B
Chromotropic Acid 03680-D	01973-D 01995-D	00275-D 01289-D
Cigarette Smoke 03839-F	01997-D 01998-D	01748-D 05605-D
Ciliary Activity 02248-D	01999-D 02077-D	06328-D 04279-E
Citrus Crops 03611-G	02079-D 02083-D	08080-E 08476-E
Clean Rooms 04139-E	02084-D 02085-D	05440-M 09172-M
Cleaner Air Package. 00154-B	02086-D 02087-D	Combustion Stability 03588-M
Cleavage 01628-M	02088-D 02089-D	Combustion Temperatures 05043-M
Closed Ecological Systems 08025-B	02090-D 02091-D	Commercial Firms 01073-A 02234-B
Coal 01482-B 05067-B	02092-D 02094-D	Compact Cars 04028-B
10429-B 01395-D	02095-D 02096-D	Computer Programs 11225-C 00277-D
07783-F 10292-M	02097-D 02121-D	16023-M
13636-M	02135-D 02161-D	Concentrations
Coal Briquets 02600-E	02544-D 02595-D	01673-B 01958-B
Coal Characteristics	02785-D 02798-D	02610-B 03255-B
13494-A 06636-E	02801-D 02803-D	07635-B 03059-D
13766-M 13882-M	02803-D 02854-D	03369-D 03520-D
15481-M	03096-D 03523-D	04049-D 07838-D
Coal Preparation Pro- cesses 10047-E	03537-D 03679-D	01980-J 05110-J
10039-M	03680-D 03684-D	Condensation 08162-E
Coal Tar Dye Plant. 01038-B	03929-D 03937-D	07495-M
Coal Tar Pitch	04029-D 04086-D	Condensation Nuclei Counters 06231-D
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Hydrocarbon-Ozone  
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Hydrocarbons, Aromatic

13494-A 01815-B

01902-B 01958-B

10775-B 12084-B

00773-C 01194-C

00011-D 00108-D

00155-D 00386-D

00399-D 00440-D

00747-D 00766-D

00867-D 00868-D

00911-D 00927-D

00928-D 00931-D

00934-D 01178-D

01461-D 01499-D

01581-D 01997-D

02085-D 02095-D

02096-D 02159-D

02226-D 02227-D

02595-D 02875-D

03234-D 03991-D

04254-D 04484-D

04930-D 05042-D

05257-D 05959-D

06661-D 07061-D

10089-D 10772-D

11164-D 11476-D

11559-D 12086-D

14607-D 15977-D

16701-D 00103-E

06674-E 10637-E

00622-F 00803-F

01029-F 01636-F

03933-F 05949-F

06004-F 06196-F

08415-F 09766-J

00119-M 00770-M

00916-M 01034-M

01833-M 01978-M

02160-M 02493-M

02495-M 03986-M

04617-M 05325-M

07395-M 08827-M

09197-M 09200-M

10129-M 13553-M

14145-M 14220-M

15186-M 15874-M

16052-M 16599-M

Hydrocarbons, Aromatic  
Polycyclic

01008-B 01059-B

01453-B 03543-B

05011-B 05109-B

09389-B 10741-B

16352-B 00750-F

01762-F 09024-F

04651-J 05675-J

08315-J 09936-J

15600-J 11147-M

15600-M

Hydrocarbons, Aliphatic

01902-B 09385-B

01649-C 01825-C

00584-D 00747-D

00845-D 00927-D

00931-D 01178-D

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05210-D 06008-D

06858-D 06876-D

07146-D 07375-D

08077-D 08136-D

08294-D 08446-D

08471-D 11164-D

11476-D 14773-D

15355-D 15529-D

06285-E 00883-F

00887-F 03820-F

03821-F 08028-F

08026-F 08151-F

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00120-M 01677-M

01875-M 02337-M

02517-M 02812-M

03488-M 03969-M

04228-M 04583-M

09116-M 11097-M

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05005-B 00386-D

00399-D 00440-D

00479-D 00624-D

00728-D 00766-D

00767-D 00912-D

00926-D 00931-D

00934-D 01238-D

01302-D 01395-D

01683-D 01696-D

01729-D 01795-D

01826-D 01998-D

01999-D 02077-D

02081-D 02083-D

02085-D 02087-D

02090-D 02091-D

02092-D 02226-D

02607-D 02685-D

02805-D 03080-D

03234-D 03523-D

03542-D 03592-D

03955-D 04014-D

04085-D 04210-D

04328-D 04930-D

05084-D 05461-D

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