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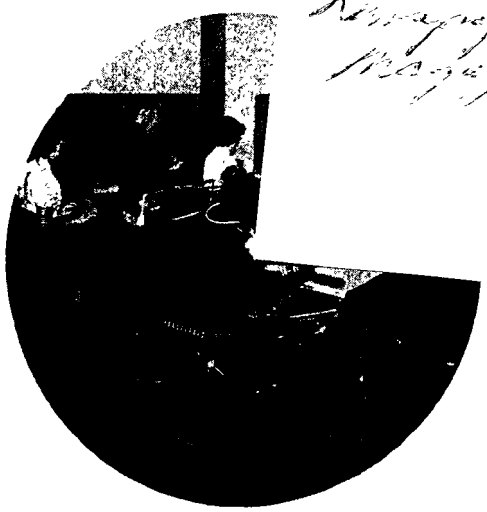
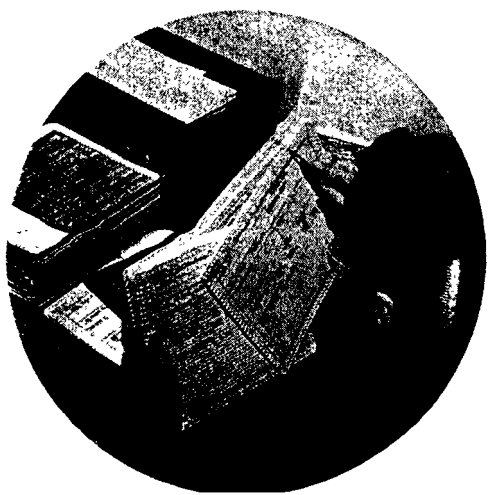
Coding, microfilming and recording pertinent information from death certificates onto master IBM cards, coding records of all chromate workers for statistical study, and making time studies of chromate workers (above) are all part of a cancer survey being conducted by the Ohio State Department.





Studies on environmental CANCER

CANCER, as an industrial or occupational disease, is an historically old but scientifically new field of study. Though the backlog of research covering industrial cancer is relatively small when compared with other fields of cancer research, the significance of the disease has been recognized by the National Cancer Institute of the U. S. Public Health Service which has established a program of investigation and control.

The National Cancer Institute has organized a separate section devoted to the study of this problem, under the direction of Dr. W. C. Hueper, a recognized medical authority and an individual long interested and active in this field of endeavor. An environmental cancer

After obtaining all available information on the chromate workers a personal follow-up interview is made where records are incomplete.

Dr. Thomas F. Mancuso outlines a method of studying the cancer problem both in the actual chromate plant and its immediate vicinity.

research laboratory is also nearing completion at Georgetown University Medical School in Washington, D. C., where experimental work will be performed to determine. through scientific methods, the scope of environmental and industrial cancer and the role it is playing in the lives of both worker and consumer.

The need for considerable investigation is being met by the creation of a Public Health Service grants-in-aid program to assist states in the study of occupational cancer related to various industrial procedures and operations. Grants have already been made to Ohio, New Jersey, New York and Colorado, and additional requests are being evaluated. These grants are primarily used to learn more about the part played by carcinogenic (cancer-producing) agents among the industrially employed, and to further the knowledge concerning the extent to which the carcinogenic factors reach the general population which utilizes the products of industry, or comes in close contact with the wastes or end products of manufacturing.

Man's environment has undoubtedly been ever present as a causative factor in the development of cancer. It has been generally accepted by the medical profession that the rays of the sun influence the development of cancer of the skin in light complexioned people. The incidence of skin cancer among such people is higher in the South and Southwest where occupations tend more toward outdoors than in the North and the East where office buildings enclose and protect their occupants from the harmful effects of overexposure to the sun. Environmental cancer, unfortunately. is not secondary only to the carcinogens of uncontrollable elements but is also closely related to many man-made carcinogenic compounds.

So many new substances have been developed by modern industrial procedures that it has been impossible to afford to each of these products and technical procedures necessary testing to determine whether or not they might be culpable in the cancer problem.

A number of carcinogenic agents act in a slow, insidious. almost imperceptible way so that the end results seem to bear no relation to the original cause. Even the specifically known carcinogens are hard to incriminate, because the development of cancer may not appear for years. There may be agents in current usage which are contributors to the pathological development of cancer, but which are not as yet classified on the "suspicious list." At present there is no accurate information concerning the number of people in contact with elements of high carcinogenic potential without what might be considered as adequate protection. Because of the woeful inadequacy of knowledge in this field, new products are being introduced without determination of their possible carcinogenic qualities and thereby perhaps add to the number of health hazards with which man must already contend.

In recent years industry itself has become increasingly aware of the challenge presented by environmental and occupational cancer, and is also attempting to meet this problem with practical solutions. Only through cooperative efforts of all groups concerned to provide a concerted attack on the issue can industrial employees and the general public be protected.

Medical history, almost in story fashion, relates the development of cancer in certain body locations in association with specific carcinogens. One of the better known stories concerns Sir Percival Pott, a London physician, who in 1775 while writing of the curiously high incidence of cancer of the scrotum among chimney sweeps, suggested a connection between the cancer and the accumulations of soot on the bodies of the unwashed urchins. Subsequent experimental research revealed the coal tar in the soot as being the dangerous factor.

During the next century, paraffin and shale oils, pitch and tar were added to the list of suspected causes of cancer of the skin, through medical research carried on in France, Britain and Germany. Toward the end of the 19th century, the investigation of bladder cancer among workers in the German dye industries disclosed that beta-naphthylamine and benzidine were the causative agents among the aromatic amines.

Many cases of lung disease occurring in miners of radioactive ore, notably in Schneeberg and Joachimsthal, Central Europe, were found to be lung cancers

produced by long term exposure to the radioactive elements in the ore compounds.

In this country, perhaps one of the most dramatic stories concerns the cancer secondary to "radium disease" which appeared in the 1920's among the women who painted luminous dials on instruments in plants located in New Jersey and Connecticut. A large percentage of these factory workers developed cancer of the bone as a direct result of their swallowing small quantities of radium, day after day, as they moistened the point of their painting brush with their lips.

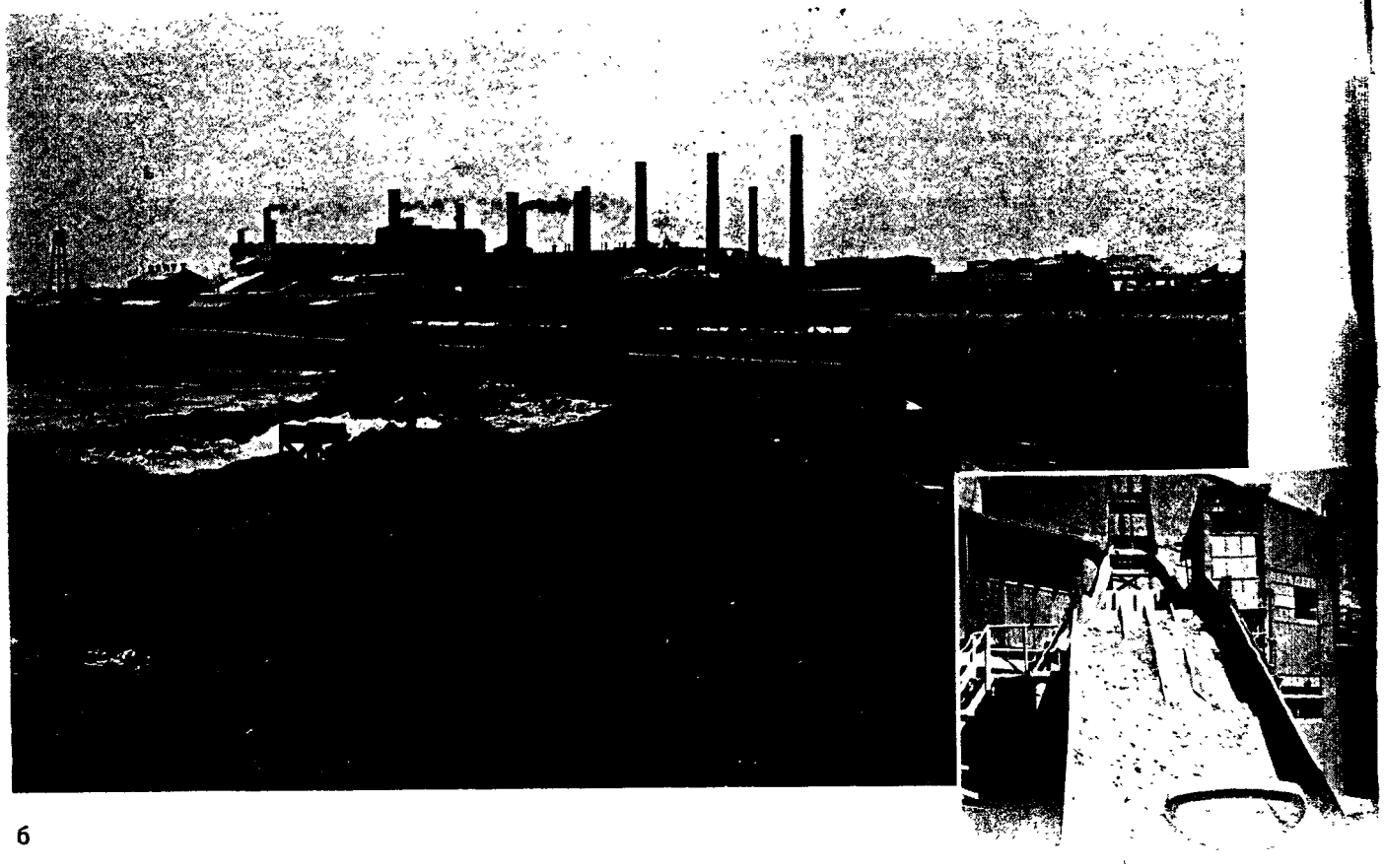
In the past twenty years, research both abroad and in this country has revealed the fact that a number of industrially useful substances can be classified as "dangerous" in respect to their ability to produce cancer. The United States Public Health Service has published a chart of fifty-two agents which attack twenty-seven types of body tissue. The inherent dangers of thirty-three of these agents have been definitely established, while nineteen of them are still receiving further investigation and are classified as "suspected."

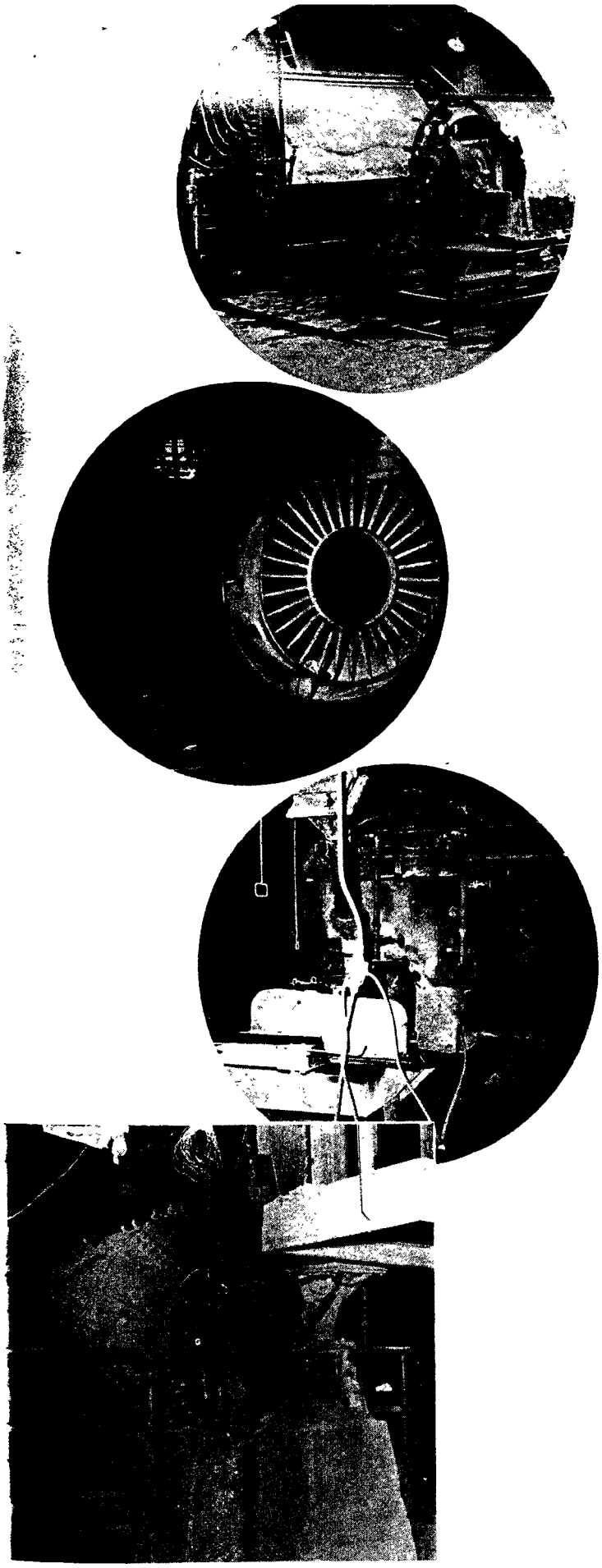
The immense diversification of our modern industrial life has made our environment more complicated and has subjected to a relatively minor role the influences of geology and climate. It is probably surprising, at first consideration, that the materials used for power production, transportation, communications, lighting and heating—factors which we consider as contributing to our safety, comfort and convenience—could also hold dangers for us. It is only during the past twenty years that most research into environmental and occupational cancer has been initiated.

Dr. Hueper, a graduate of the University of Kiel in Germany, while serving as assistant physician in a municipal hospital in Berlin, became interested in the high incidence of lung cancer among his clinic patients. He instituted research which led him to the department of pathology at Chicago's Mercy Hospital in 1923, and then to a four-year stay in the cancer research laboratories of the University of Pennsylvania Medical School. It was here that he made further progress in the study of bladder cancer among the workers in dye industries. There followed fourteen years of research in the DuPont Industries and the William L. Warner Company. Now it is Dr. Hueper's assignment to direct the activities of the Environmental and Occupational Cancer Section of the National Cancer Institute.

The interest of industry itself in occupational hazards is manifested by its attack on environmental cancers through Memorial Hospital's Sloan-Kettering Institute in New York City. Under the direction of Dr. William Smith, a graduate of Johns Hopkins Medical School and a man who has been involved in cancer

A general view of the chromate plant with ore storage piles in the foreground. Picture in lower right hand corner shows the ore being carried on skip hoist from the storage pile to crusher.





research for ten years. the laboratories of the Institute service some of our largest chemical industries. New materials are tested for carcinogenic properties before they are put into large scale production. With the help of an advisory committee which includes engineers and industrialists, practical methods for controlling dangerous agents are devised.

It is true that the known percentage of occupational cancer accounts for less than 1% of the cancers in the country's overall population. But to Dr. Hueper this is an important 1%! Cancer is not generally believed to be a disease of spontaneous occurrence without some underlying causative factor. One of the reasons that has made cancer a major problem is based on the mystery surrounding the possible reasons for its development. It is not known, for example, whether or not the causes are indigenous (natural to man or already existing in the body system) or exogenous (externally controlled factors such as the air we breathe, the food we eat, etc.). A popular theory expounds the idea that the growth of cancer is influenced by both inherent and external elements.

But for the most part, these inherent and external agents are little known. In the study of cancer in man, most research is devoted to watching the effect of these factors. The study of occupational cancer is therefore unique in that the external factors are known and their effect on the human body may be studied and followed in small groups of industrial workers. Thus it may be possible to isolate information concerning certain types of human cancer which will yield further leads for the various individuals doing basic research.

The prospect of an individual having cancer is one of the calculated risks of our civilization, but the danger of cancer from occupational sources is an added risk from which the individual can and should be protected. These protections may take different forms. In some cases when the latent period between exposure to a carcinogenic chemical and the time when a cancer will develop has been determined, it may be possible to regulate the worker's exposure so that the latent period would extend well beyond the worker's normal life span. Sometimes a rotation of workers through a manufacturing process will prevent any one of the workers from receiving undue exposure.

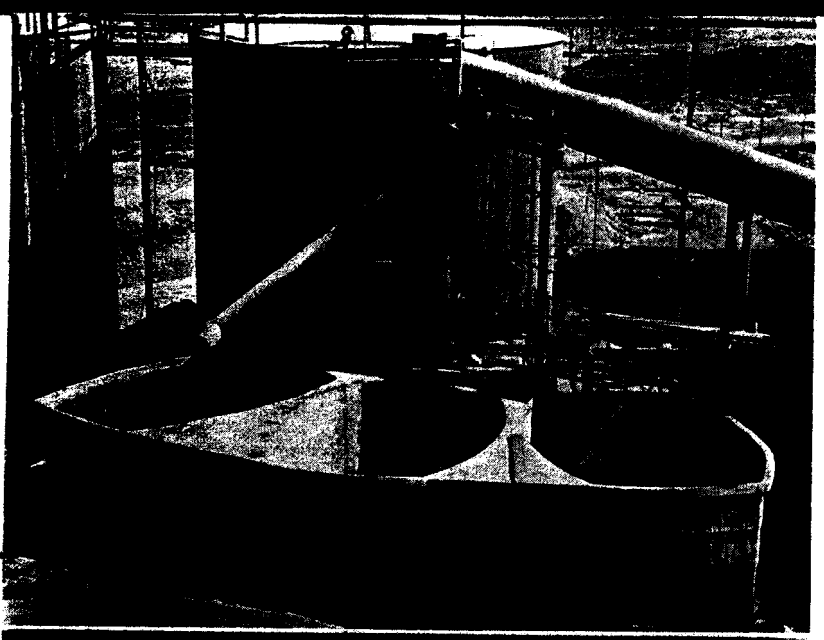
Adequate precautions must be taken in the construction of new plants, in the improvement of existing

Reading from bottom to top, the mix is pulverized into a fine powder.

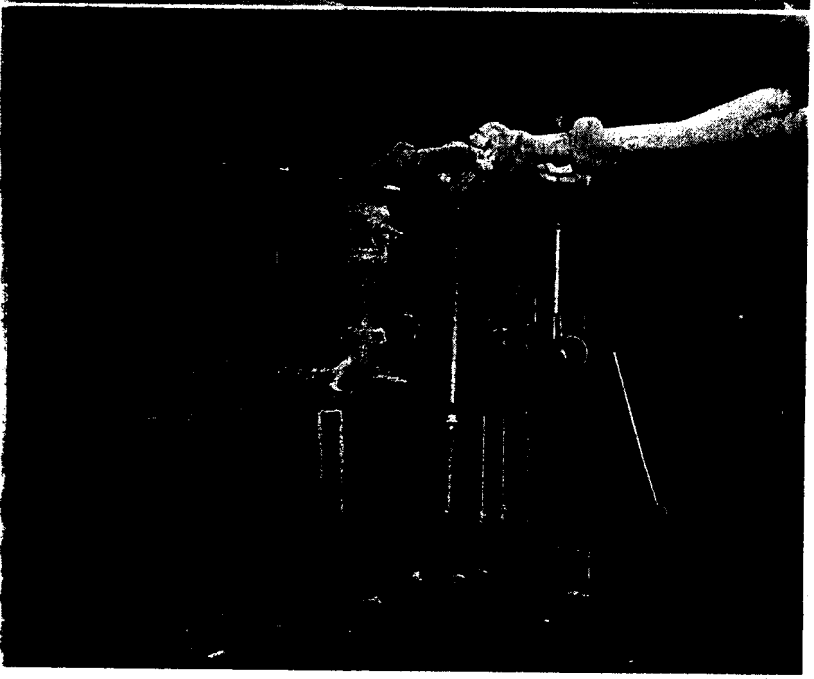
In heavy rotary kiln the mix travels to firing end where it is roasted.

It is finally dropped into rotary cooler and is then ready for leaching.

After leaching, the large neutralizing tanks prepare mix for the filters.



The leaching process is carried on in three large open leach boxes which are located out of doors.



A general view of filter, also of open box design, which further prepares mix for the finishing tanks.

methods of production and of the disposal of wastes, and by the testing of the substances manufactured for carcinogenic properties.

The following are some of the measures and procedures which have been outlined for effective and rational control of occupational cancer: (1) Use of carcinogenic agents in industry should either be eliminated or reduced to the technically feasible minimum. (2) Technical measures such as the use of buildings and machinery which will prevent the escape of dust, fumes, mists and vapors, and efficient exhaust ventilation should be introduced. Good housekeeping is a necessity, including the safe disposal of carcinogenic waste products or, if needed, the isolation of the potentially harmful operation from the rest of the plant. (3) There should be greater provision of periodic and extensive medical supervision of all workers exposed to carcinogenic agents. It is imperative that these examinations be continued at regular intervals even after the worker is no longer in contact with his original occupation. (4) The adoption of a system of regular inspection of all plants using, handling or producing carcinogenic agents by governmental factory inspectors. (5) Mechanical devices and chemical compounds capable of producing cancer should be given proper warning labels. (6) Registration with the Departments of Public Health and Labor of all factories and laboratories using carcinogens.

The research that is required to unravel the mysteries of environmental cancer presents a formidable challenge. A few tasks which confront the research

Engineering groups test amount of chromate dust in various parts of plant with particle accumulator and particle size analyzer (left). A device is used at right which filters the air.

scientist are the study of thousands of case histories of cancer patients (both past and present), the devising of means to collect such histories to provide more background detail than is available in most case histories today, and the problem of adding precancerous and cancerous lesions to the list of legally reportable diseases to give earlier leads into the danger areas in our industrial economy.

Inspection of a list of cancer producing agents with which humans come in contact reveals marked variation in basic nature, but the list does allow classification. A few of these agents are well defined chemical or physical entities such as arsenic, beta-naphthylamine, benzidine, roentgen rays and rays from radioactive material. Others represent indefinite and varying mixtures of numerous chemicals, which, depending on the source of origin and on the subsequent type of processing, may or may not contain varying amounts and types of carcinogenic substances. In this group are tar, pitch, asphalt, soot, lampblack, crude mineral oil, shale oil, crude paraffin oil, anthracene oil, creosote, lubricating and fuel oils and greases prepared by cracking mineral oil and distilling coal. A third group of industrial carcinogenic agents are more closely connected with the handling of and exposure to certain inorganic, mainly metallic compounds, such as chromates, nickel carbonyl and asbestos. As a possible fourth group are several tropical worm infections sustained by workers during their occupational activity and later resulting in the development of cancers of internal organs, such as infections with *Schistosomum hematobia* and *Clonorchis sinensis*.

It is generally agreed that occupational cancers will appear at those locations in the human body where there is either greatest concentration or most prolonged contact. Therefore, ultraviolet rays, x-rays or rays from radioactive substances, through an external action upon the skin, will produce cancer of the exposed portions of the body. Those chemicals which enter the body and concentrate in one particular body organ or system will initiate the development of cancer at that site. For example, the ingestion of radioactive matter (as in the case of the luminous dial painters) which locates itself in the bony skeleton may lead to the appearance of bone sarcomas or leukemia starting in the bone marrow. The carcinogenic agents which are excreted via the urinary tract (e.g. tar) and have prolonged contact in the urinary bladder are responsible for the production of carcinomas of the bladder. The inhalation of fumes (chromate dusts) over extended periods of time may result in the appearance of cancers of the nasal sinuses and lungs.

With full understanding of the relationship between the development of cancer and the contact with certain chemical substances, how shall the problem be approached? In 1947 the management of one of the large producers of chromates became concerned with the incidence of lung cancer among its employees. A

The roller particle size analyzer measures size of dust particles collected throughout the plant.

brief survey of the situation revealed the need for more extensive investigation to prove, disprove or accurately assess the importance of the association between lung and higher respiratory tract cancer and the chromates used in manufacturing. The amount of effort required for such a project is almost beyond realization. What is the mechanism of a survey of this kind?

Dr. Thomas F. Mancuso, the Director of the Division of Industrial Hygiene of the Ohio State Department of Health is approaching environmental cancer in industry on a two-fold basis: (1) A broad epidemiological survey of deaths due to cancer of the lung and bladder among all of Ohio's population. This aspect is mainly one of statistical research and analysis and (2) A specific study of workers in a chromate plant in the state located at Painesville.

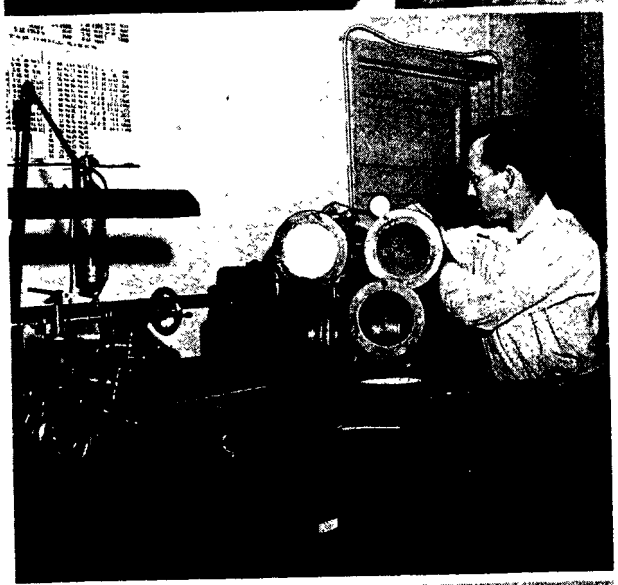
Part 1 involves the collection of all death certificates which have diagnoses of respiratory or bladder cancer. Then through the cooperation of the Bureau of Old Age and Survivors Insurance the exact dates of employment of deceased cancer patients are learned. The employment records are coded according to classification of the U. S. Bureau of Census. Previous employment is investigated as to contact with chemical substances and similarly worked into the pattern of the project. A field investigation is then to be carried out by qualified engineers for the actual identification of the toxic chemicals and materials which are inherent in the manufacturing processes. A statistical evaluation is then made of all the above data in order to correlate the type of cancer death by industry, manufacturing process, length of exposure, etc. This represents the epidemiological approach.

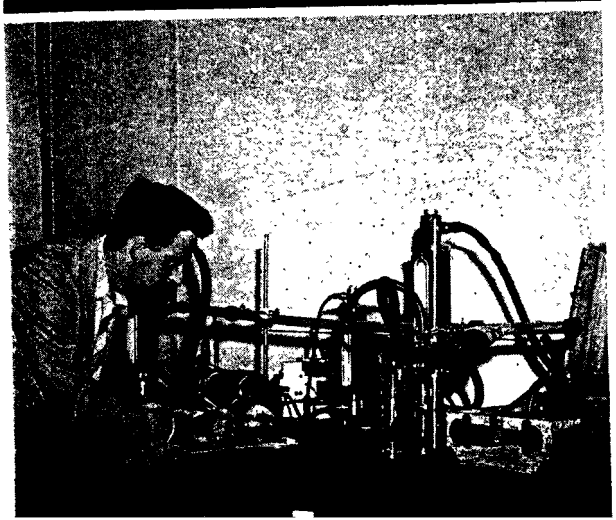
Part 2 consists of a plan for the study of a specific industry. In the case of Ohio it is the chromate industry. The plan is divided into three main sections:

Further analyzation of the accurate size of the dust particles is done with the use of the microscope.

Special apparatus was designed and mounted in station wagon to test air pollution in vicinity of plant.

A piece of chromic acid mist generating equipment is used for testing the efficiency of filter paper.





Cremation of organic matter in furnace results in the ash residue necessary for laboratory testing.

Medical, Engineering and Chemical. The Medical Section includes a mortality study of the City of Painesville, where the specific industry under study is located. Death certificates covering a 21-year period are coded via an international statistical classification and correlated with the location of employment. The Medical Section is also involved in the examination of employees currently working in the industries. The Engineering Section is primarily concerned with raw material sources, uses of chromium, the manufacturing process, contamination of the atmosphere, the measurement of the size of airborne dust particles and measures available for control. The Chemical Section will investigate production steps, analytical procedures to detect the presence of chromate, and sampling of dusts to determine the quantity of chromate present.

This, in simplified form, represents the task that lies ahead for the Ohio State Department of Health. The complexity of the entire project points out the many ramifications of the study of environmental cancer and approaches the problem through a wholly scientific point of view. It is only from studies similar to the one being supervised by Dr. Mancuso that the significance of external agents in the causation of cancer can be determined. These efforts usually lay the ground work for numerous subsequent investigations which continue to reveal more and more to the research scientist who in turn makes possible the application of safety measures for the protection of the factory worker and the general population. Without the careful and studied caution used in such a planned program, innocent factors might receive undue importance and harmful agents might be totally overlooked if their action required many years of prolonged exposure to produce the end result of cancer. It becomes readily apparent that only by use of the cooperative forces of the chemist, engineer, physician, statistician, industrialist and many others who play prominent

parts can a satisfactory solution eventually be reached.

The problem of occupational cancer becomes even more acute, since there is a strong possibility of an increase in the incidence of the disease. As happened under similar conditions after the First World War, the character of some of the industrial activities of recent years makes it likely that there will be an increase in the exposure of man to more and varied types of agents which have a high carcinogenic potential. During the war, plants were necessarily built hurriedly and staffed by men unfamiliar with the occupational hazards. These hazards, in the main, were probably greatly avoided in the laboratories handling radioactive substances, but it may require another 10 to 20 years before statistical evaluation will reveal our mistakes of today. Due credit must be given today, however, to the elaborate precautions taken by many industrial corporations as compared to the days following World War I. Nevertheless, with the expected increase in occupational cancer, the urgency of the situation imposes itself on the scientific talent of the world and encourages immediate action.

Of all the end results of our two generation industrial change, perhaps the newest and most foreboding is environmental cancer. Although its scope at present has no full explanation, because it is so new and because the facts are difficult to gather, enough is known to make environmental cancer an urgent and pressing matter in public health. The entire problem will continue to grow more ominously as industry expands and adds more products to the world market. The individual in a mining town in South Africa becomes as deeply involved as the worker in the newly rehabilitated factories in occupied Europe or the average consumer in America. The diversification of modern industry makes each of us a component part of this far-reaching problem. Through the use of surveys dealing with the occurrence, incidence and types of occupational cancers developing in individual states and under different environmental conditions, a stimulus is provided which leads to a fuller understanding and appreciation of the entailed hazards. The scientific approach must be applied for effective and speedy results. Cooperation becomes the key word in providing a solution. The joint action of health departments, voluntary health agencies, departments of labor, compensation boards and legislation bodies along with industrial management, insurance corporations and the medical profession will determine the outcome of the challenge.

Industrial cancer is not some imaginary thing designed to cause fear and worry. It is ever present and real, and is accepted by the cancer-conscious public as a health hazard. Because of its somewhat nebulous nature it poses a puzzle more difficult to cope with than most others. Though it will take considerable effort and time before satisfactory analysis is finally achieved, we can feel assured that nothing will be left undone.

Methods of determining chemical content of ash residue are by use of polarograph and x-ray analysis.

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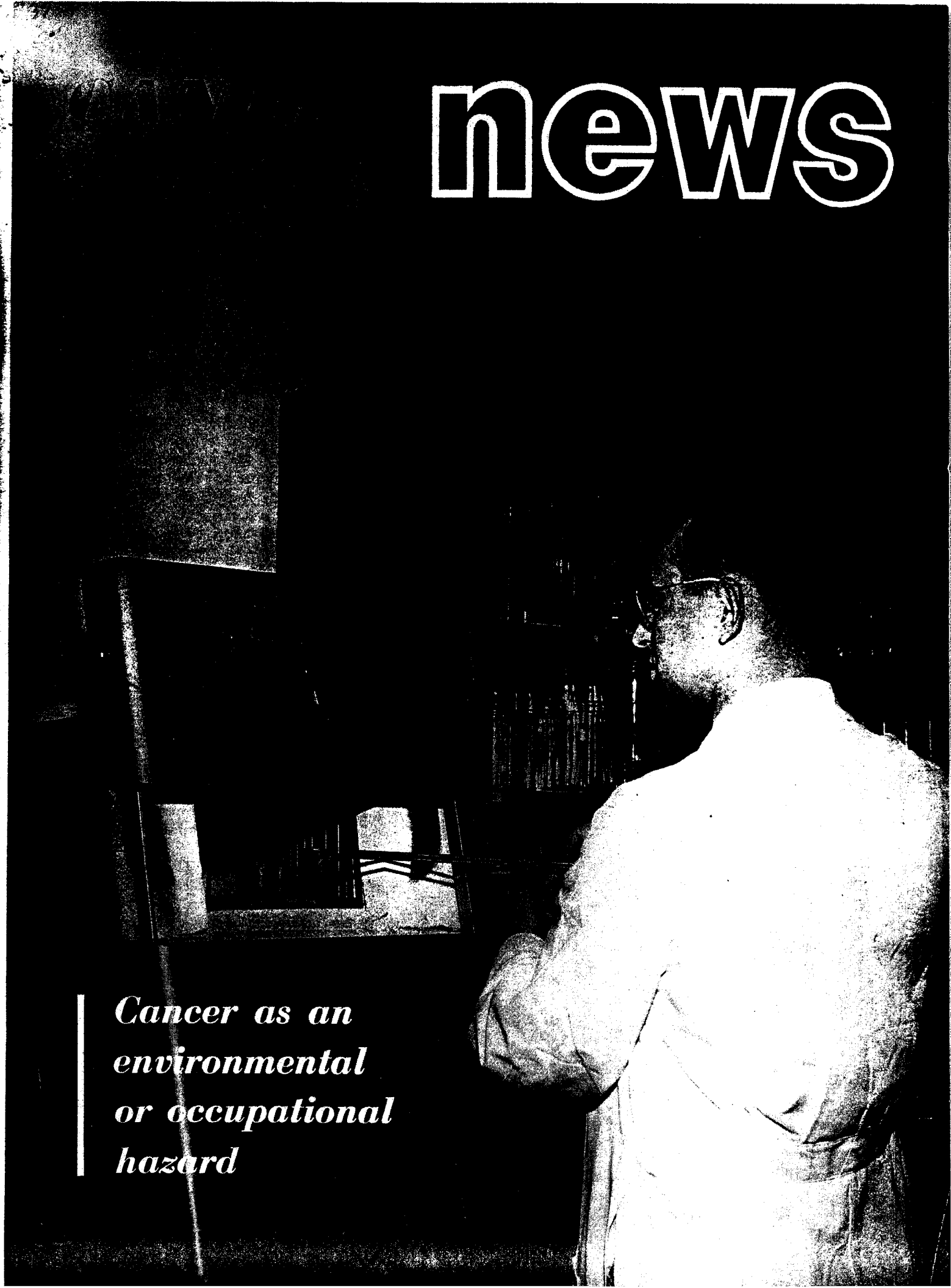
news



Cancer as an environmental or occupational hazard

Our Position

THE AMERICAN CANCER SOCIETY *takes the only position on federated fund raising which will assure its continued service to the American public: a complete refusal to yield or abdicate one or both of its functions of program and finance in joint, united or other general community fund raising efforts.*

The National Board of Directors, at a meeting on June 10, 1949, directed the appointment of a Board committee to meet and prepare a statement of fund raising policy and the application of such policy to specific circumstances and conditions, together with historical background and other explanatory material for issuance to the public. Selected for this committee were seven members, representing each of the Society's seven Regions. Those persons chosen were: Mr. Emerson Foote, New York City, Region 1, chairman; Mr. Richard M. Bourne, Cleveland, Region 2; Mr. Rutherford B. Ellis, Atlanta, Region 3; Dr. Harry M. Nelson, Detroit, Region 4; Mr. William G. Preston, Great Falls, Montana, Region 5; Dr. David A. Wood, San Francisco, Region 6; and Dr. C. C. Nesselrode, Kansas City, Kansas, Region 7. This committee met in New York City on July 30 and, following that meeting, reported to the Executive Committee on August 18. Their statement of policy was unanimously approved and reads as follows:

This statement on federated fund raising is made in behalf of the 22 million Americans who are now doomed to die of cancer—unless this disease can be conquered.

Representing the present and future sufferers from cancer in America, the American Cancer Society is opposed to federated fund raising as a source of revenue in the war against cancer. Neither the American Cancer Society nor any of its regional, state or local units can or will participate in federated fund raising.

There has recently been widespread promotion of and agitation for the principle of federated, combined or united fund raising. This is being carried on in many parts of the country and also at a national level. The federated movement has attracted to it many business and professional leaders of the highest standing. These leaders have been principally attracted by the great convenience and simplicity of the federated idea, though doubtless many of them sincerely believe that the federated method will also be more effective in raising money for worthy causes.

The American Cancer Society wishes to make it explicitly clear that it is only concerned with the matter of federated fund raising as applied to cancer. That federated fund raising would be an unsound and dangerous practice in combating cancer, the Society feels is scarcely debatable. Whether federation should be applied to other causes in the health or welfare field is a matter which does not concern the Society and on which it would not presume to express an opinion.

Here are some of the reasons why the Society cannot entertain the federated principle as applied to the cancer problem:

In the first place, cancer represents a national problem of such great proportions that to believe it can adequately be handled merely as one of 50 or 100 other matters is a hopeless fallacy. The cancer problem is too serious—affecting too large a segment of America—to be diluted with a number of other projects, however worthy.

Consider again: it is an actuarial fact that not less than 22 million Americans now living will *die* of cancer—unless current cancer death rates are reduced.

The CANCER NEWS

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Credits

Material for the article on environmental cancer was obtained from Dr. W. C. Hueper, National Cancer Institute, Bethesda; and from Dr. T. F. Mancuso, Industrial Hygiene Division of the Ohio State Department of Health. Pictures were obtained from the Hygiene Division, the Ohio Bureau of Vital Statistics and a chromate plant located in Painesville, Ohio. Cover photo depicts muffle furnace in which ash residue is collected for laboratory testing to determine chemical content of dust particles. Pictures other than those of the chromate plant were taken by William Shupe of Columbus.

Artwork and layouts by Mahlon A. Cline.