

TREASURY DEPARTMENT

OFFICE OF
INDUSTRIAL HYGIENE
AND SANITATION

UNITED STATES
PUBLIC HEALTH SERVICE

WASHINGTON, D. C.

September 12, 1936.

The Surgeon General,
U. S. Public Health Service,
Washington, D. C.

Sir: (Through Division of Scientific Research)

I have the honor to transmit herewith a statement concerning the toxic effects of methanol which you asked to be prepared for Mr. John L. Spivak, 31 East 27th Street, New York City.

Respectfully,

R. R. Sayers
R. R. Sayers,
Medical Officer in Charge.

Gen'l (Sayers)
10/2/36

METHANOL

Methanol is neither a new nor an uncommon chemical compound. It has been marketed under many different chemical and trade names, some of which are methyl alcohol, wood alcohol, wood spirit, methyl hydrate, wood naphtha, Columbia Spirits and Colonial Spirits. Millions of gallons have been used by millions of people during the past thirty years, principally for solvent purposes, for the manufacture of formaldehyde, and for denaturing ethyl alcohol. In 1930 methanol became available in large quantities and at a markedly lower cost than heretofore. This was not due to the expansion or development in the wood distillation industry, but to the development of a synthetic process for making the product. The new process was originally conceived and developed in France and Germany, primarily from the viewpoint of increasing uses of coal and gas and with the particular viewpoint of the developments of future liquid motor fuels. The process readily found adoption in the United States for the utilization of heretofore waste gases in the manufacture of industrial chemicals, resulting in the production of methanol at a markedly reduced cost.

TOXICITY OF METHANOL

The observations and discussions of the poisonous effect of methanol which have been recorded in the literature are in many cases conflicting and confusing. Some have explained the differences

DEC 3 1935

Paul F. L. *ammy*
10/2/36

in results on the basis of individual susceptibility. While this explanation is no doubt valid in part, it is also just as possible that many of the differences arise through the difficulty in obtaining accurate quantitative details, particularly if it involves the possible use of methanol for beverage purposes. In surveying past experience, however, there are certain consistent observations.

It has been shown beyond doubt that methanol is a poison and will produce serious poisoning when sufficient amounts are taken into the body. Also, there is no practical difference between the toxicity of crude and refined methanol or between methanol made by the wood distillation process and that made by the recent synthetic process. Further, it cannot be made nonpoisonous by any known method or process. These facts need emphasis because some persons have held the erroneous opinion that the poisonous action of methanol is due mainly to impurities and that the purified product is relatively less toxic.

The quantity of methanol required to produce poisoning when the product is taken into the stomach is pretty well known. Small amounts have been taken without apparent harm, but on the average one or two ounces (the contents of one to two ordinary whiskey glasses) will cause serious poisoning with the possibility of blindness and death, and twice that amount will frequently cause death.

The effects of inhaling air containing various amounts of methanol vapor are not so well known. Wide experience over many

1001 3 10 35

years has shown that there are conditions of exposure to methanol vapor in the air which cause no apparent harm and also that there are conditions which will produce serious poisoning. Records of cases of severe poisoning by inhaling methanol vapor, however, show the large majority of serious cases to have occurred in the use of methanol principally as a solvent for paints and varnishes in relatively small confined and unventilated places. The use of shellac dissolved in methanol for coating the interior of beer vats has been an important source of trouble of this kind. The potential health hazards from air containing methanol vapor thus depend on the degree of exposure.

Less is known of the dangers to health from absorption of methanol through the skin. A review of the literature gives no conclusive information that serious poisoning has been acquired in this manner. A few cases are described as possibly being due to skin absorption. In these cases the exposure was either so slight that it is rather hard to believe that the trouble was due to absorption of methanol through the skin, or the situation was so complicated by the possibility of high concentrations of vapor in the air breathed. When one considers the large amounts of methanol that have been used and the frequency with which it has undoubtedly come in contact with the skin, in many instances having been used for treatment of wounds and for "rubbing" purposes, it is

produced by the rapid evaporation. A number of persons stated that they had used methanol on wounds and as a liniment for rubbing purposes.

None of these men expressed fear of exposure to the vapors or by skin contact, for the reason that they had never experienced ill health from it, nor did they know of serious effects having occurred to workers in the industry from this manner of exposure. There is, on the other hand, universal knowledge that methanol is poisonous and cannot be taken into the stomach. The results of the physical examination of these men revealed no acute or chronic illnesses and no defective vision or eye pathology attributable to methanol. There was also no indication of deleterious action revealed by blood and urine analysis. In a considerable number of cases of comparatively severe exposure, methanol was found in both the blood and urine when the specimens were taken after several hours' work. This confirms actual exposure and acquiring methanol, but, on the other hand, substantiates experience that certain amounts of methanol can be acquired without apparent harm. Specimens taken the following morning from several of these persons showed methanol to be practically absent in most cases, and markedly reduced in the others. In all cases the amounts in the blood and urine were far below those which had been found in the laboratory part of the study to be harmful to dogs.

It was concluded that the evidence that methanol poisoning has been caused by absorption through the skin is rare and inconclusive. Also that practically continuous exposure to low concentrations and

short intermittent exposure to high concentrations of methanol caused no apparent harm; but, on the other hand, continued exposure to high concentrations will cause serious poisoning.

All methanol, whether made by wood distillation methods or synthetic methods or whether it is crude, refined or highly purified, is poisonous when taken internally. It will cause serious poisoning, blindness or possibly death, when as little as two ounces is taken into the stomach. The greatest danger is that someone might drink methanol, in view of its other names, wood alcohol and methyl alcohol.

On behalf of the state and territorial health officers, the Public Health Service has been instrumental in bringing about agreements with the chemical industry beneficial to the health of those working in the industry and also to those using its products. The agreements cover such poisonous materials as tetraethyl lead, methanol, liquid chlorinated hydrocarbons, carbon tetrachloride, carbon disulphide, and anilin oil. A copy of the Agreement by the United States Public Health Service with the Manufacturers of Methanol, Methyl Alcohol, or Wood Alcohol, is attached hereto. So far as is known to the Public Health Service this agreement has formed a satisfactory basis for the protection of users and handlers of Methanol.

apparent that no appreciable hazard exists from this manner of exposure to methanol when it is used in automobile radiators as antifreeze.

A survey of the conditions of exposure prevailing in four plants engaged in the manufacture of methanol and physical examinations of the limited number of men who were exposed from a period of a few months to ten to fifteen years has been completed. This survey consisted in making general observations of duties and exposure of the workmen, quantitative chemical determinations of the amount of methanol to which the workmen were exposed and a physical examination of the workmen. The physical examination included an occupational history, a health history and a complete physical examination with special attention to vision, pupil reflex and eye pathology as revealed by ophthalmoscopic examination. Urine specimens were examined for albumen, sugar, specific gravity, reaction to litmus and methanol content; and blood specimens for methanol, hemoglobin content, number of red and white cells and differential cell counts.

These persons were engaged in all the operations of manufacturing methanol wherein there was exposure to air containing the vapor and exposure by contact with the skin. In nearly all cases both types of exposure were present. The manner of exposure to vapor ranged from working over drums being filled with methanol, inserting bungs in filled drums the exterior of which was usually wet with drippings,

623016

working over an open drain pan continuously wet with methanol, taking samples of methanol from drums and still-house lock-boxes, making hydrometer tests and general exposure resulting from leaks and spillage in the working places.

Contact with the skin was a common finding, occurring many times daily with some persons. In one operation a man wet the palm and fingers of one hand two hundred to three hundred times daily, and in addition to this, was continuously working over drums being filled with antifreeze methanol. In a similar operation another person wore gloves, the palms and fingers of which were wet almost constantly. Other operations required almost constant contact of the fingers with methanol. It is a rather common practice among still-house operations at wood distillation plants to wet their hands with methanol and smell the product as a guide in still operation. Likewise, it is a common practice at these plants to use methanol for washing wood tar from the hands and tools and for cleaning parts of machinery.

The above are usual and observed exposures. Under unusual conditions, it was learned by interview of workmen, that some frequently got their trouser legs wet and others, on a number of cases, have been practically drenched with methanol. They stated that the unusual procedure in these cases is to merely allow the methanol to evaporate as they suffer no discomfort other than the cooling effect

NOV 10 1935