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GASOLINE POISONING

Gasoline is obtained from crude petroleum oil which is the source of a number of commercial products, including, in the order of their volatility, petroleum ether, naptha, benzine, kerosene, fuel oil, lubricating oil and asphalt. Gasoline is a mixture of paraffin hydro-carbons higher than butane, particularly pentane, hexane, heptane and octane. The predominating hydro-carbons liberated by petroleum and its products from storage tanks, tankers, and similar places, are butane and propane.

With the exception of high-sulphur petroleum and leaded gasolines, petroleum vapors are not very poisonous. Percentages of gasoline vapor in air sufficiently high to reduce the oxygen content below that needed for respiration will act as an asphyxiant. Morris B. Jacobs: Analytical Chemistry of Industrial Poisons, Hazards, and Solvents, pp. 391-2 (1941).

There are wide variations in the combinations of commercial gasoline. Naptha and benzine may be classed physiologically with gasoline, but are less varied in composition. They are inherently more toxic than the lighter fractions of gasoline but as they are less volatile, they are not so readily inhaled. They are largely used for dry cleaning, grease extraction and in paint as a substitute for turpentine. Benzine should not be confused with the cyclic compound benzene.

Besides benzene, other organic substances have been added to various gasolines as anti-detonants to prevent so-called "knocking" in highcompression motors. Most important of these components is lead tetraethyl.

For motorists, poisoning by gasoline rarely constitutes a hazard, although, as a result of incomplete combustion in the engine, gasoline vapor may appear in the exhaust gas. This results from a too rich mixture of gasoline with too little air because of a faulty adjustment of the carburetor or from failure of the gasoline vapor to ignite. It is carbon monoxide, almost alone, which gives exhaust gas its poisonous character.

Men employed in the care and repair of automobiles are exposed to gasoline fumes to a greater extent than are the drivers. Gasoline spilled in confined quarters or in low places, such as the pit in a repair shop floor, during the draining of a gasoline tank, occasionally reaches a toxic concentration. Toxic concentrations of gasoline vapors are occasionally encountered in confined quarters, as when gasoline leaks from storage tanks and pumping machinery or is accidentally spilled in the underground pipe rooms of gasoline storage and dispensing stations. Men employed in cleaning the interiors of tank cars or storage tanks which have contained gasoline are liable to poisoning, unless precautions are taken to remove, as nearly as possible, all the volatile matter and to insure a supply of uncontaminated air to the men.

The striking feature of acute gasoline poisoning is the severe muscular jactitation occurring during the stage of excitement. In some cases the muscular movements are as violent as in an epileptic convulsion. They are particularly marked during the recovery in fresh air. With vapors of this type, there is only a narrow margin between the concentration which produces anesthesia and that which causes death. However, if respiratory failure does not result, the chances for recovery without any serious after-effects are excellent -- as with the surgical anesthetics. Henderson and Haggard, Noxious Gases (2d ed.) pp.189-192 (1943).

Tetraethyl lead is widely used as an anti-detonant for internal combustion engines. The danger of poisoning occurs during the manufacture of the compounds and in the process of blending it with gasoline. Poisoning may occur, to a lesser extent, among those handling the blended gasoline. Tetraethyl lead may be absorbed through the skin, and the vapors through the lungs. Chronic poisoning by tetraethyl lead resembles the ordinary and far more common chronic form of lead poisoning from paint and lead dusts, and is characterized by nutritional disturbances, paralysis of motor nerves and

increased susceptibility to such diseases as pyorrhea and tuberculosis, pp.239-40.

As is true of all the industrial poisons, the study of acute forms is not nearly so important as the study of chronic forms and of possible sequelae of the acute. Chronic benzine poison is considered by some experienced men as fairly common among industrial workers, but others think it is very rare. Since there are wide differences in the conditions under which work is done, so the results of different surveys may not be comparable.

Machle, in an article in the American Medical Association Journal (1941) entitled "Gasoline Intoxication" reports that he had some 2300 refinery workers under observation for ten or twelve years and that he believed chronic benzine poisoning is very rare. Hamilton and Johnstone, Industrial Toxicology, p. 663 (10-13),an Oxford Medical Publication (1945). Only among the barrel fillers, who are more heavily exposed, did he find suggestive symptoms. Pallor, low red cell count, hemoglobin, nausea and nervousness. These symptoms were clearly connected with the men's work. The history of exposure is of great importance in making a diagnosis, for no laboratory tests are significant. Dr. Moorman also considers the danger of chronic poisoning slight.

The volatile petroleum oils -- naptha, benzin, petroleum ether -- have a toxic action on the central nervous system (p.401). Acute poisoning in the industry is characterized by symptoms of mild intoxication of the central nervous system. There is an increasing restlessness and excitement very like that of alcoholic intoxication. To some men it is pleasureable and they become hilarious, others are irritable and unreasonable and prone to quarrel. (p.401-2)

More serious forms of poisoning occur when men are obliged to go into a tank or tank car which has held petroleum. Such poisoning ending in death has been reported from refineries, from oil wells and from work in gasoline tanks and tank cars (p.402).

Acute cases of benzin poisoning are striking, but chronic cases which attract less attention are not only far more numerous but are usually more lasting in their effects. Chronic naptha poisoning is probably common, but it is not easy to diagnose because it does not produce characteristic symptoms (p.404).

The pumping, refining and distilling of lubricating oils has gone on for many decades in the United States, yet there is singularly little in the literature to show that the petroleum industry, as such, has ever given rise to industrial poisoning (p.407). As a usual thing, workers in petroleum refining suffer no impairment of health. But if a man were obliged to enter a tank he might lose consciousness (p.407). Hamilton, Industrial Poisons in the United States (1929).

GASOLINE

Gasoline, sometimes called benzin, is a petroleum distillate, a refined petroleum naphtha, and has no relation to benzene or benzol, which is a coal-tar distillate.

Occurrence. The chief use of gasoline is as a fuel for internal combustion engines. Gasoline exposure may occur in refineries, in the storage and transportation of gasoline, in dispensing stations, ga[illegible]s, and to a slight extent in the handling of automobiles and other forms of gas[illegible]line engines. The second most important use for gasoline is because of its solvent action on many substances. It is used extensively in the rubber industry in making rubber cement, in compounding rubber, and in the manufacture of rubber tires, tubes, sheeting, gloves and waterproof cloth. As a cleaning fluid, it is used by dry cleaners, in the degreasing of metal parts, by printers in cleaning type, lithograph stones and ink rollers. Gasoline is also used by artglass workers, bronzers, electroplaters, tanners, enamel makers, mordanters, painters, varnishers

and shoe finishers, and in the manufacture of furniture polish, glue, japan, lacquer, paint, putty, shellac, varnish, pyroxylin-plastic materials and window shades.

Symptoms. Acute intoxication from the inhalation of an excessive amount of gasoline is very much like that of acute alcohol intoxication. It is commonly called a "naphtha jag" which clears up promptly on getting into the fresh air, leaving no after effect except a few hours of nausea, headache or dizziness. In some industries where the workers breathe concentrated gasoline fumes day after day, it has been noted that in the forepart of the day they are quite hilarious, but towards evening they become morose, depressed and, in some instances, quite quarrelsome, symptoms common to habitual alcoholics.

An overwhelming dose of gasoline may produce a profound degree of intoxication to the point of rendering the patient unconscious. Such a circumstance is generally considered as an accident and may occur under the following circumstances: From a leak in a gasoline tank or pipe, from fumes of gasoline accumulating in an enclosed space, from working in an enclosed space with paint, varnish or other material in which gasoline is used as a solvent, from cleaning or repairing tanks in which the vapor of gasoline remains, and from absorption through the skin in persons who have fallen into a tank of gasoline, or who have spilled a large quantity on their clothing without promptly removing them.

CHRONIC GASOLINE POISONING has been described as occurring in men who have been exposed to the inhalation of the vapor for many months, or who have over a long period of time worked with their hands or arms immersed in a gasoline solution. Chronic gasoline poisoning does not produce a definite clinical picture, and the symptoms of which these workers complain are quite variable. Moreover, the number of such patients is quite small compared with the large number of persons working in industries using gasoline

extensively. However, we must consider the possibility of a functional disturbance in some instances because there are enough workmen who are exposed to the vapors of gasoline who, over a period of months or years, show a loss of energy, are dull mentally, complain of headache, dizziness, loss of appetite and gastric distress. While these symptoms may not indicate a distinct occupational disease, they do show that certain persons have a susceptibility to the influence of gasoline vapors which causes in them unpleasant symptoms and a lowering of their efficiency. (Author's italics)

E.R. Hayhurst (Poisoning by Petroleum Distillates, J. Indust. Med., Feb., 1936), who has studied several such cases most carefully, concludes in the main as follows: The persons studied had been exposed to gasoline for periods ranging from five weeks to four years before disability began. They complained of headache, dizziness, loss of appetite, dyspepsie, itching of the skin, cough, shortness of breath, mouth and throat infections, neuroasthenic and psychoasthenic symptoms.

The objective findings in this group of patients are loss of weight, increased pulse rate, secondary anemia, in some cases an eosinophilia, skin rashes, furunculosis, mouth and throat infections, persistent diarrhea, at times, alternating with constipation, muscle twitching and tremors, slight ataxia, and, in severe cases, semistupor and disorientation.

When one analyzes the above symptoms, it is quite evident that these same symptoms, both subjective and objective, are frequently encountered in patients in all walks of life and are in no way confined to workers in gasoline. The above studies are very complete and deserve our consideration. Nevertheless, when confronted with a patient presenting the above named symptoms, even when he is a worker in gasoline, he should be examined carefully to exclude other forms of disease or degenerative processes. On the other hand, a person who

does present these symptoms and in whom no other cause for his complaints can be found, should be given the benefit of the doubt, and his condition should be considered to be due to the effects of gasoline absorption. Jewett V. Reed and A. K. Harcourt: The Essentials of Occupational Diseases, pp. 45-47 (1941).

Dr. Willard Machle, Kettering Laboratory of Applied Physiology, University of Cincinnati College of Medicine published (1941) an article entitled "Gasoline Intoxication"in 117 Am. Med. Ass'n. Journ. 1965, from which the following is summarized:

Investigations and reports over a span of years have demonstrated that lead poisoning will not result from the use of leaded gasoline as it is usually handled in commerce. The hazard is limited to the manufacture of the tetraethyl lead and the antiknox mixtures, the mixing of these materials with gasoline and the cleaning of tanks in which leaded gasoline has been stored (p.1966).

The usual mode of absorption of gasoline is through the respiratory tract. In Chronic poisoning the anatomic changes are neither pronounced nor specific.

The term "chronic intoxication" is applied to poisoning which results from exposure to low concentrations of gasoline vapor for long periods of time (p.1968). While Hamilton (Industrial Poisons in U.S.,1925) states (pp.400-409) that chronic naptha poisoning is probably common, Machle's experience indicates that it is rare. He has had more than 2,300 refinery workers under observation, in some instances for ten to twelve years, and found no signs of chronic gasoline poisoning in any case. Negative results, in respect to signs of chronic gasoline intoxication, were also obtained in studies of large numbers of filling station attendants, tank wagon drivers and garage mechanics (p.1969).

The clinical manifestations in chronic gasoline intoxication are usually vague and not characteristic. The first symptoms are of a general nature or psychasthenic and neurasthenic manifestations, followed by muscular weakness and cramps, listlessness and a feeling of dullness, fatigue and loss of weight. Usually the irritative properties of the vapor cause conjunctivitis with lacrimation and cough with expectoration.

Nervous symptoms may occur in wide variety and degree. Indigestion is usual, some nausea. Generalized abdominal pain is a frequent complaint. Changes in the circulatory system are not considerable, but usually the pulse rate is increased. Nor are changes in the blood chemistry significant.

Diagnosis: Any one of the gastro-enteric, cerebral or peripheral neuritic manifestations of chronic gasoline intoxication may occur in infections, metabolic or degenerative disease; and, for this reason, great dependence must be placed on the history of exposure to gasoline. Knowledge of working conditions may be necessary to establish the magnitude of exposure. Other cases with similar symptoms in workmen having similar exposure will be of considerable aid.

Amelioration of symptoms may be expected to follow cessation of exposure in chronic cases, and this may be the best expedient in establishing the diagnosis. Psychoneurotic symptoms in a person with chronic exposure to gasoline should suggest the possibility of intoxication, and relief from these symptoms should follow soon after removal from exposure.

Chronic intoxication from gasoline is rare (p.1971).

Public Health Bulletin No. 163 entitled "The Use of Tetraethyl Lead Gasoline in its Relation to Public Health", which was prepared by direction of the Surgeon General and published by the Government Printing Office in June 1926, contains the following:

Tetraethyl lead is universally appreciated to be very dangerous in its undiluted form. However, City and State Health authorities and labor leaders, who are in a position to know, gave absolutely negative evidence as to any such harmfulness when diluted in gasoline (p.39).

One filling station attendant was said to have suffered from handling ethyl gasoline. When visited he said that he had had a badly enlarged heart for many years; that he had stopped work because he became short of breath. He had to remain upright to breathe with any comfort (p.40).

The investigation concluded (p.40) that "in no case was any evidence obtained as to harmful effects of ethyl gasoline".