

MEDICAL REPORT ON ETHYL.

CONTAMINATED OILY DEPOSITS.

RISKS TO BARE HANDS

The following is the second section of the medical report on ethyl petrol which has been prepared for "The Daily Mail" by Dr. Myer Coplans, D.S.O., O.B.E., the eminent research worker. It is based on his own personal experiments and data supplied by the Research Association of British Motor and Allied Manufacturers, who carried out a scientific analysis of exhaust gases from motor engines.

The first section appeared yesterday.

By DR. MYER COPLANS, D.S.O.

It will be noted in the description of the examination of the exhaust apparatus of the several vehicles under test with ethyl petrol that the leaded deposits were in many cases found to be firmly adherent, and could only be scraped away by the use of steel or iron instruments in order that the underlying metal surfaces might be examined. A number of the samples sent to me for the purpose of examination are in the form of a dry powder.

Mechanics or garage hands engaged in cleaning or overhauling a car following the use of ethyl petrol are therefore exposed to an occupational lead dust risk with danger to health, and in this connection it is important to note that in the official regulations relating to the lead paint industry, dry rubbing or scraping of painted surfaces containing lead is specifically prohibited. It is further provided that all debris produced by rubbing down or scraping of any such painted surface shall be removed before it becomes dry.

In these regulations (Lead Paint Regulations, 1927) it is laid down that "lead paint" means any paint, paste, spray, stopping or filling, or other material used in painting which yields to an aqueous solution of hydrochloric acid a quantity of soluble lead compound exceeding, when calculated as lead monoxide, five per cent. of the dry weight of the portion taken for analysis.

By reference to the results of the analyses of the several deposits submitted to me for examination it will be seen that the proportion of lead present considerably exceeds the minimal limits laid down for lead paint, and that if these materials were being handled by a painter the Lead Paint Regulations, 1927, would automatically apply to the industry for the protection of the health of the worker immediately concerned, in this instance the mechanic or garage employee.

SPRAYED FROM EXHAUSTS.

It is within the power of the Home Secretary under Part 4 (Sections 73-86) of the Factory and Workshops Act, 1901, which relates to dangerous and unhealthy industries, to frame a special code of regulations applicable to mechanics and workshops, garage workers, and garages having to deal with cars using ethyl or other form of leaded petrol, and, in any case, it is obviously too dangerous for women and young persons to be employed in such garages or workshops, whether as cleaners or otherwise, in the absence of such regulations, on account of the presence of lead dust.

It will be noted that in the Lead Paint Regulations, 1927, it is expressly forbidden to apply lead paint in the form of a spray in the interior painting of buildings, yet it must not be forgotten that the motor exhaust from a car using ethyl petrol is delivering lead into the atmosphere in the form of a fine spray from the exhaust pipe. The grounds for prohibition of the use of spraying are based on the danger of inhalation of lead dust to the person in the immediate proximity of the spray, but there can be no distinction drawn between the workman engaged at his calling and the passer-by. There are even more cogent grounds for prohibiting the spraying of the atmosphere of the streets by the leaded exhaust of motor-cars using leaded petrol, for the dust present in this discharge contains considerable quantities of lead bromide.

LEAD BROMIDE DANGER.

The particular danger attaching to lead bromide is that this material is soluble in water, and its power to cause chronic lead poisoning is therefore correspondingly increased. The extent of the presence of lead bromide in the several deposits is shown by a reference to the analyses I have made (mentioned yesterday), wherein it will be seen that the quantity of lead bromide present in a deposit obtained from the exhaust pipe of the medium-powered car reaches 27.3 per cent.

All lead compounds more or less are to be regarded as poisonous, although the intensity of the action depends on the amount absorbed. For this, its solubility in water or in weak acids (hydrochloric acid or the gastric juice) is the simplest test.

According to this test acetate of lead, lead chloride, carbonate of lead (white lead), oxide of lead (lead dross), and minium (red oxide of lead) are relatively the most poisonous. Lead sulphide and lead iodide are to be regarded as relatively less poisonous, though by no means innocuous. The least poisonous, if not altogether innocuous, is sulphide of lead, because it is an insoluble lead compound.

Dr. Kehoe determined the fatal dose of lead for rabbits as follows:

Compound.	Intravenous.	Cutaneous.	(Oral)
Lead tetraethyl gr. per kilo of body weight. — — —	0.014	0.7	0.11
Lead chloride gr. per kilo of body weight. — — —	0.015	—	0.37
Lead nitrate gr. per kilo of body weight. — — —	0.011	—	—

He states that an animal died after breathing air containing approximately 0.182 mg. of lead tetraethyl per cc. of air daily for six hours for about three days. Eldridge, of the United States Chemical Warfare Service, placed the lethal concentration of lead tetraethyl for mice by inhalation at 5.11 mg. per litre.

It will be seen from the above table of solubilities that lead bromide is nearly as soluble in water as lead chloride, and that the latter, when injected into the circulatory system of animals (rabbits) is found to be almost identically as poisonous as lead tetraethyl.

VOLATILE LEAD.

The intensely poisonous character of lead tetraethyl has been proved; but it is claimed by the makers that when this material is diluted with petrol for use as motor fuel (as in the form of ethyl petrol), with attention to certain rules and precautions in handling, little danger is to be apprehended because of the great dilution in the spirit. Reference to the table of analyses (in yesterday's paper) will show that both in the case of the medium-powered car and the motor-cycle I have found volatile lead (lead tetraethyl) to be present in the crank case oil to the extent of 0.062 per cent. and 0.078 per cent. respectively, while in the sludge from the medium-powered car, lead tetraethyl was found to be present to the extent of 2.31 per cent., this amount being 14.9 times as great as in the case with a similar weight of ethyl petrol.

Again, in the case of the washings (with benzol) of the chain sprocket of the motor-cycle employed in these tests, tetraethyl lead was found to be present to the extent of 0.327 per cent. These washings represent a great dilution of the material actually removed from the washed parts of the motor-cycle, and therefore the concentration of lead tetraethyl in the material before being washed off must have been many times greater than that contained in the ethyl petrol.

No handling with the bare hands, by any person, man or woman, of these oily deposits and contaminated parts should be permitted or undertaken, by reason of the intense concentration in the oily contents of lead tetraethyl.

RISK OF EVAPORATION.

Although it is known that much of the oil used in lubrication is burnt off during the gas explosions in the cylinders, a certain quantity escapes to the ground and there acts as a local source of lead pollution. It may so affect water supplies in that water subsequently percolating or washing the contaminated ground readily becomes contaminated with water soluble lead in a highly dangerous degree of pollution.

I would here point out the danger of evaporation from a vessel containing ethyl petrol—as may occur with a loose stopper—so leading to an increased concentration of lead tetraethyl in the un-evaporated spirit in a highly dangerous degree. This is shown by the following experiment conducted at air temperature (60deg. F.):

Percentage of spirit evaporated.	Concentration of lead tetraethyl in the unevaporated portion.
0	1.2
20	1.55
37.5	1.9
51.5	2.53
65	2.9
74	3.0
94	11.27
96.8	14.55

It will be seen that when the spirit is half evaporated the lead tetraethyl content is almost doubled in strength, there having been but very slight evaporation of the lead compound. When three-fourths of the spirit has been evaporated the strength of lead tetraethyl in the spirit remaining in the vessel is nearly threefold, and as evaporation continues until 97 per cent. of the total spirit has disappeared into the air the degree of concentration of the tetraethyl remaining in the liquid residue in the vessel is 15 times as great as that originally present.

The degree of danger in handling this material is in direct proportion to the quantity and degree of concentration of lead tetraethyl present in the remaining liquid. This increase of danger may take place at any time, owing to the slightest of causes—namely, a loose or ill-fitting stopper to the vessel in which ethyl petrol is stored. It is, therefore, dangerous to allow ethyl spirit to dry upon the skin.

ANGLO-AMERICAN CO.'S VIEW.

Mr. Francis E. Powell, chairman of the Anglo-American Oil Co., writes to "The Daily Mail":

The Government has appointed a committee of eminent scientists to investigate ethyl petrol, and in view of this we feel it would be improper, to say the least of it, for us to anticipate their findings by prematurely to make to the public any statement.

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