

General Hygienic Measures and Facilities Required in the Manufacture of Tetraethyl Lead and in Blending Ethyl Fluid.

The potential hazards associated with the manufacture and blending of Ethyl Fluid are probably the most serious that can be found in any of the lead trades. However, they are capable of complete control if proper provisions are made to maintain an adequate degree of precision and caution in carrying out plant operations. It is exceedingly doubtful if this can be done unless the most rigid and critical medical supervision is established and maintained, but the experience of the past twelve years has proved that complete success can be assured by the means of measures of control recommended herein. It would be most unfortunate, in view of the demonstrated adequacy of such methods, if cases of intoxication and fatalities were to occur in plants not so safeguarded, since it would be quite obvious that such incidents were the result of carelessness or lack of regard for past experience.

The control measures consist of the following co-ordinated types of hygienic supervision, namely, (1) a continual clinical study of all workmen, (2) regular study of the magnitude of the lead exposure and lead absorption of representative groups of workmen through periodic determinations of the rate of lead excretion in the urine and feces, (3) regular periodic critical survey of plant activities and operations by the physician-in-charge, and (4) regular determination of the lead content of the air of all rooms and working spaces in the plant.

Clinical Work. Not only is it necessary to maintain a sharp search for clinical evidences of lead absorption, but it is also imperative that all types of illness among workmen be recognized and identified, if there is to be a proper degree of mutual confidence between the workmen and the medical department. It is not enough to be on the lookout for subjective symptoms of incipient intoxication, or to watch for changes in the blood of workmen, or to see the cruder evidences of lead absorption. It is also necessary to recognize the occurrence and the character of non-occupational disease and to see that it is adequately cared for or at least that it is brought to the attention of the workmen. These things cannot be accomplished by cursory and slipshod examinations or by certain partially specific laboratory tests, but only by careful and regular study of each workman as a whole.

In these occupations each workman should be examined once a week, at which time he is questioned carefully in search of subjective symptoms and other evidences of incipient illness. The temperature, pulse, blood pressure, and weight should be noted and recorded, and the urine should be examined as to its reaction, and the presence or absence in it of sugar, albumin and microscopic abnormalities. Once a month each man should have a complete examination of his blood, including the enumeration of leucocytes and erythrocytes, determination of the hemoglobin and percentage distribution of various types of leucocytes, and a quantitative determination of the number of erythrocytes which show basophilic granulation, ("stippling"). The teeth and gums should be examined

for sponginess or congestion and for the presence of a lead line, especially on the inner aspect of the gums opposite the molar teeth. The strength of the grip of each hand should also be determined and recorded. At least once a year each man must have a complete and detailed physical examination, including a general neurological examination.

An initial examination of a complete and thorough type should be employed as the basis for the selection of an essentially sound and healthy operating crew. The results of this examination should be carefully recorded in the case of all men accepted for employment and should be used as a basis for future comparisons. Workmen should be rejected:

- (1) When they have had significant exposure to lead compounds in their previous occupations;
- (2) When they have had an illness associated with their previous occupation which indicates or strongly suggests the occurrence of significant lead exposure in such occupation;
- (3) When they have organic disease of the circulatory system, especially symptoms and signs of arterio-sclerosis;
- (4) When they have organic disease of the nervous system, a history of epilepsy, or of functional disturbances associated with mental instability;
- (5) When they have organic disease of the kidneys, liver or lungs;
- (6) When they have other types of chronic disease, such as tonsillitis or gingivitis, which in the opinion of the examiner is unlikely to respond to corrective measures;
- (7) When they are excessively addicted to the use of alcohol, or when because of ignorance, stupidity, undue apprehensiveness, or other evidences of unreliability, they are unsuited to employment in a potentially hazardous occupation.
- (8) When they are less than 21 years of age or more than 45 to 50 years of age.

Men should be removed from employment:

- (a) When they develop symptoms suggestive of tetraethyl lead intoxication.
- (b) When they develop physical signs and laboratory evidences of significant lead absorption.
- (c) When they develop organic disease, which, in the mind of the examiner, involves undue risk to their safety and that of others.
- (d) When they show a careless or irresponsible attitude toward the hazards of the occupation, or, alternately, when they show undue anxiety with respect to such hazards.

Excretory Analyses.

It has been shown that the study of the lead excretion of representative workers portrays a surprisingly accurate picture of the conditions of exposure to which they are subjected. One cannot detail here the significance of such results but reference can be had to our published accounts. Suffice it here to say that we do not believe adequate precision can be obtained in the control of plant conditions without such information. The methods employed in the collection of samples and in their analysis must have the utmost precision to be of value. In our experience this work cannot be done within the plant, but must be carried out elsewhere in order to avoid the contamination of samples from the plant environment.

The diagnostic value of the use of analytic methods on the blood and excreta, in suspected or doubtful cases of intoxication, cannot be over-emphasized. We believe that such facilities are absolutely essential to sound clinical work in this occupation.

Plant Supervision.

The plant physician should make a critical inspection of the plant under operating conditions at intervals of approximately one month, at which time he should criticize all the procedures and recommend such changes as are advisable for the maintenance of safety.

Air Analysis.

Equipment should be installed and operated regularly to test the air of all working spaces for its lead content. Long pipe lines and rubber hose lines must be avoided in collecting air samples for analysis, in order to avoid condensation and absorption of tetra-ethyl lead in the carrying lines. Methods have been devised for obtaining accurate results here. Complete details of methods and drawings of apparatus will be supplied if desired.

All the data referred to above should be reported to the physician-in-charge and should be used by him to keep himself and the management fully informed as to the hygienic status of the plant as a whole.

Clothing, Protective Equipment, and Washroom Facilities.

Excellent facilities must be made available for the protection and cleanliness of the workmen. Each workman must be provided with complete clothing, so that he may not, under any circumstances, make use of his regular clothing in the plant. There must be a system of double lockers, and comfortable and adequate washrooms, shower baths and toilets. At the beginning of the day's work the workmen must change into work-clothing. At lunch-time they must wash carefully and eat their lunch in a clean lunch room. At the end of the day they must remove all their clothing, bathe and change into their own clothing. The proper arrangement of these facilities will not only add to the willingness of workmen to comply with the regulations, but also will provide for such supervision as will not permit carelessness on the part of the workmen.

Impervious gloves, dust masks where required, and airline masks as needed, must be supplied and maintained in satisfactory condition by the management of the plant.