

Requirements for the Hygienic Control of the Manufacture,
Distribution and Use of Lead Tetraethyl for the Preparation
of Motor Fuel.

Foreword

The hygienic control of operations involving the production or use of lead tetraethyl differs from that required in the more common lead trades, in that there is serious danger of exposure to a liquid organic lead compound, as well as to inorganic lead compounds. Exposure to lead tetraethyl arises from the volatility of this compound and also from its absorbability through the healthy unbroken skin. Its vapor pressure is such that under the conditions of equilibrium at 25°C, a concentration of approximately 5 mgm. of lead per liter of air will exist. Its absorption through the skin occurs at such a rate that it must be removed from the skin (best done with kerosene) within fifteen minutes of contact, if appreciable and even dangerous (dependent upon the area of skin involved) absorption is to be avoided. For these reasons it is essential that all steps of the processes of manufacture, transportation, storage, and introduction into gasoline be surrounded by such safeguards as will prevent exposure until the material has been diluted with gasoline to the concentrations which, in commercial motor fuels, have been shown to be safe.

Manufacturing operations involving the presence of lead dust and fume must be rendered safe by the customary methods of segregation of dusty spaces and equipment, by the use of properly designed containers for the handling of lead-bearing materials, and by cleansing floors and the outside of equipment at frequent and regular intervals by methods that will not disseminate dust. All vents and stacks from furnaces and buildings, must be so situated or so dealt with as to

prevent significant contamination of the general atmosphere.

I. Manufacture.

Safety depends basically upon the use of proper equipment. Hygienic and medical supervision is a necessary adjunct. The following constitute minimum requirements for safe operation.

1. The concentration of lead in the air around workmen, under operating conditions, whether from dust, fume, or vapor, must not exceed 2 mgm. of Pb per 10 cubic meters of air for more than short periods, and the average concentration during the working day must not exceed 1.5 mgm. per 10 cubic meters. This may be achieved only by the use of properly designed equipment, by good house-keeping, and by adequate ventilation. The requirements will vary with the kind and size of the plant.

2. The manufacturing equipment must be so constructed as to withstand the normal conditions of use for reasonable periods of time, and adequate pressure releases or safety disks, venting to the outside of the building, must be provided where indicated for emergency purposes.

3. Two kinds of ventilation must be provided by systems which are completely separate so that the one cannot connect with the other.

(a) General ventilation must maintain adequate change in the general atmosphere of the buildings to meet the requirements of the specifications for the lead content of such atmosphere.

(b) Local or unit ventilation of such equipment as may give rise to frequent or regular leakage of dust, fume or vapor, as over melting pots, casting molds, around the packing of pumps, along the shafts or joints of reaction vessels, and at openings used in loading or emptying operations.

4. Frequently and regularly collected samples of the air of all working spaces must be analysed for their lead content, as a check upon the operating conditions.

5. Positive-pressure air-line respirators must be available throughout the plant to provide protection during emergencies, repair operations, and at such times as it may be necessary to enter any space or area of the plant in which lead compounds may be present in unsafe concentrations in the air. Other masks, equipped with full face pieces, and with canisters containing not less than 500 c.c. of high-grade activated charcoal, must be available in sufficient number and at proper locations to be available for use in any emergency in which air-line respirators cannot be used, (as for example, in power failures, or in accidents resulting in extensive contamination of outside air.)

6. A detailed system of operating and safety procedure for the process and for maintenance and repair operations, should be provided for workmen, and adequate individual instructions and general supervision must be provided to ensure familiarity and compliance with such procedure.

7. Toilet facilities, and emergency showers, together with an adequate supply of kerosene for the prompt removal of any lead tetraethyl that may come in contact with the skin, must be provided at easily accessible locations.

8. Clean clothing from the skin out, must be furnished, daily, to all workmen. Immediately after any actual or suspected skin contact with lead tetraethyl the exposed part of the body must be cleansed thoroughly with kerosene, then with soap and water. Contaminated clothing must be replaced at once. All clothing must be changed at the end of the working day and a bath must be taken.

9. Incidental hazards arising from the use of inflammable or corrosive materials require special safeguards. Inflammable materials should not be stored in the main operating building or buildings, and should be amply protected against leakage and fire hazard.

10. All wastes from the plant must be confined or treated or diluted sufficiently to prevent hazardous contamination of adjacent soils or streams.

11. Slag, used equipment, and other materials that have been contaminated with lead tetraethyl must be destroyed, buried, or otherwise disposed of, so as to prevent danger to uniformed persons.

12. All lead tetraethyl intended for use in fuels must contain a sufficient amount of dye to color it brightly and to color definitely the finished motor fuel.

13. Medical supervision of all workmen must be provided. At a minimum, this shall consist of an initial examination, and periodic examinations of all potentially exposed employees at intervals of not more than three months, in the case of those exposed only to inorganic lead compounds, and not more than one month, in the case of those exposed to lead tetraethyl. Complete records shall be kept of the examinations, which must include a complete medical history of each employee, such physical examination as is necessary to establish his physical and hygienic status, the determination of the hemoglobin, a quantitative count of stippled erythrocytes (or an equivalent procedure) and a clinical urinalysis.

14. At intervals of not more than six months, accurate analyses for lead content should be carried out on samples of the blood and/or excreta of a group of employees selected to represent all phases of the conditions of exposure, in such a manner as clearly to indicate the

extent of the lead absorption associated with the various occupations in the plant. Such analytical observations should be continued at least until such time as the operating conditions have been stabilized into a demonstrably safe regime.

II. Transportation.

Containers of lead tetraethyl shall be labeled as to their exact content and the dangers associated therewith, and shall conform to the regulations of the Interstate Commerce Commission and the Bureau of Explosives. Empty containers must be closed tightly, and returned to the manufacturer in accordance with the existing regulations of the Interstate Commerce Commission and the Bureau of Explosives.

III. Storage.

All storage of lead tetraethyl outside the manufacturing plant must be in locked and adequately ventilated (natural or artificial) enclosures. Except in the case of specially designed storage and mixing equipment, the original shipping containers must be employed for storage.

IV. Mixing Motor Fuels.

1. The maximum content of lead tetraethyl in commercial motor gasoline shall be in the proportion of 1:1260 by volume for commercial lead tetraethyl, or 1:1300 for $\text{Pb}(\text{C}_2\text{H}_5)_4\text{C.P.}$

2. Mixing lead tetraethyl with gasoline, except for certain specific requirements such as research, military and naval use, and air-mail service, shall be done only at gasoline distribution points at which properly designed mixing equipment has been installed for that purpose.

3. Except under conditions which must be defined in detail, mixing equipment for emptying drums of lead tetraethyl must be so

designed as to empty the entire contents of one or more standard shipping containers into a tank of gasoline, and to thoroughly mix that quantity of lead tetraethyl into such a volume of gasoline as to provide a final and uniform concentration of lead tetraethyl not in excess of that specified above.

4. Lead tetraethyl, and fluids containing lead tetraethyl in high concentrations, must not be mixed with gasoline in pipe-lines, in tank-trucks, tank-cars or other mobile equipment for transporting gasoline, except under conditions which must be defined in detail.

5. The mixing of lead tetraethyl with gasoline must be carried out by men who are thoroughly instructed in the dangers of this work and in the means of avoiding such danger, and who are maintained under adequate hygienic and medical supervision.

6. The rules and instructions affecting the mixing personnel shall be posted in a conspicuous place where the mixing is carried out.