ETHYL GASOLINE CORPORATION

CHRYSLER BUILDING
405 LEXINGTON AVENUE

SAFETY COMMITTEE
O. B. LEWIS
CHAIRMAN

NEW YORK October 15, 1937

Dr. R. A. Kehoe
Kettering Laboratory of Applied Physiology
College of Medicine
Eden Avenue
Cincinnati, Ohio.

Dear Dr. Kehoe:

We are attaching hereto copy of a report from Chuck Colvin concerning the handling of Tetraethyl Lead by the Dow Chemical Company, which you will find self-explanatory.

We should appreciate your comments and suggestions.

Very truly yours,

O. B. Lewis.

SW:GCL
Enclosure

A REPORT ON

USE and HANDLING of TETRAETHYL LEAD

by

DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

** ** **

General — The purpose of the following is to describe briefly the present use and handling of tetraethyl lead by Dow Chemical Company at Midland, Michigan, and to suggest certain recommendations for more safely handling the material.

Pure tetraethyl lead is being used as one of three catalysts in a polymerization process designed to produce a particular plastic. The process so far, and probably for the next several months, is on an experimental basis, housed in a large laboratory room 40' x 40' with 30' ceiling, ventilated by one 48" ceiling ventilator. (Dimensions are all approximate, merely giving relative sizes) Five other experimental projects are housed in the same room. The experimental work is under the coordination direction of Dr. W. R. Veazey and directly under the supervision of Dr. Grebe and his assistant. Dr. Irish is the biochemist cooperating with that department in studying problems of toxicity.

Dr. Veazey acquainted me with the Dow personnel interested in this project and with the details of their use and handling of tetraethyl lead. He asked that some such report as this be prepared for their guidance in drawing up a set of instructions for their handling of the material.

Description of Present Handling -- Wooden cases containing litre cans of TEL are delivered to the room in which all present handling takes place. Unopened cases were stacked just inside the doorway. Litre cans from opened cases are shelved in the room in the open. Four operators, one per shift, do all subsequent handling. Attached hereto is a copy of instructions for that handling; however, as will be noted from the following, these instructions were not being followed in all details.

The operator on duty, when necessary to charge the reaction chamber, opens a litre can under a general hood, pours 55 cc TEL into a 100 cc graduate, caps the litre container, carries the graduate 30 feet or so to the equipment, pours the TEL into a fill-pipe through a funnel, returns to the hood, washes graduate and funnel with kerosene. The operator is careful to avoid spillage, wears rubber gloves, and holds the graduate at arm's length when carrying and pouring. The fill-pipe is one-inch with two brass globe valves between open end and chamber. The open end is not capped. This routine is a daily occurrence and the operator interviewed stated that he occasionally got a whiff of odor during it.

The hood is entirely open in front, ventilated only at the top, and was quite crowded with bottles of various materials. In it was also a wooden rack holding a steam bath arrangement and quite a bit of an absorbent cheese cloth material. It is constructed of wood, with the bottom faced with metal. The size is approximately 2' x 4' bottom area, and about the same open frontal area.

The plastic polymerizing equipment in which TEL is charged consists of a 15-gallon round, vertical reaction chamber equipped with a motor-driven stirring device operating at very low RPM. The chamber is charged with reacting materials and three catalysts, one of which is TEL. The 55 cc charge of TEL is about one-half of one per cent of the total charge. After charging, the system is a closed affair. Volatile material escapes through a pipe out of the top, goes through a small drying tank, condenser, charcoal absorber, and back into the reaction chamber. About 30# pressure is maintained on the reaction chamber during polymerization. After a batch is finished, it is dropped out the bottom, carried 10 or 15 feet to a washing container where catalyst and end products are washed out. Acetone is one of the washing materials. The wash is dumped into an open sump sewer four or five feet away. There is continually running water through the sump to the plant sewer. The concrete floor around the washing arrangement is hosed down twice a day, but at the time of my visit there was quite a bit of wet material covering the floor at the washer.

The finished material is entirely free of lead, but there is no information on either organic or inorganic lead content of the wash. Their estimate is that about half of the 55 cc charge of TEL is broken down during the process. Dr. Irish is sending a sample of the wash water to Dr. Kehoe with a letter asking for an analysis of it for organic lead content.

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Before listing my personal recommendations for future handling, there are several points to which particular attention should be directed:

1. Storage of litre containers is not now under positive control so that it would be relatively easy for anyone so minded to take TEL out to another part of the plant. Also, in the event of fire or mishap, quantities of TEL are stored in a spot too intimate with personnel.

2. Present hood is inadequate for safely handling TEL, both in design and because of its other general use and contents.

3. Present handling instructions, dated November 9, 1936, are not being followed.

4. Frequency of handling is almost, if not, daily, and a second, larger outfit is being set up so that future frequency will be

doubled and quantity probably tripled.

5. Probably our best Ethyl Fluid handling safeguard, vivid color, cannot be employed here due to necessity for the TEL being colorless.

6. Actual knowledge of the properties of the TEL when actually in the equipment and during washing is virtually impossible, due to the complex chemical reactions going on. No attempt whatever has been made in the following recommendations either to limit the hazard because of possibility of TEL being reduced to less hazardous form or to magnify the hazard in case circumstances exist in that direction.

7. TEL is handled in much smaller quantity in another laboratory in the same building, one cc at a time. A spacious baffled hood is provided for storing the single litre can and for measuring out the quantity to be used. Since that is entirely a research matter, presumably in the hands of a trained technician who works continually with many toxic compounds, no attempt is being made herein to cover that handling.

Safety Recommendations —

1. An isolated, well ventilated, fireproof, and locked storage space should be provided for unopened litre cans, the keys to which to be entrusted to a minimum number of responsible persons.

2. A separate hood should be provided for TEL handling, constructed from our hood print #L-H. The hood should be provided with a quantity of kerosene for washing, and running water for flushing. I would suggest that a pan or trough be built into the hood to hold an open quantity of a non-inflammable TEL reducing agent into which all vessels and equipment can be immersed after TEL use. (Mr. Schaefer can probably name such a material.)

3. A complete set of handling instructions should be framed and posted at the hood.

4. Both polymerizing units should be gone over thoroughly to eliminate all leakage through joints, packing, and valves, and a slick finish applied which can be kept absolutely clean. Fill-pipes should be kept capped.

5. Under the washing containers a pan should be installed sloping to the sump. The running water at the sump should be changed so that it is introduced in the pan, thus at the same time keeping both pan and sump continually clean.

6. The item of periodic medical examination of operators is hereby referred to Dr. Kehoe for his opinion, as to both frequency and procedure.

7. Rubber gloves, rubber aprons, and rubber face-piece canister masks should be provided for operator's use in handling TEL. Routine for keeping such equipment absolutely clean should be established.

8. Following is a suggested routine for operators' handling of TEL, assuming that there are four necessary operators:

Since the same 55 cc quantity of TEL is used each time in the present unit, and a constant, though larger amount will be used in the second unit, exposure can be decreased materially if those quantities are measured out several at a time. For instance, operators taking turns could, in a few minutes, measure into several small bottles a sufficient number of charges to last perhaps ten days. Thus, measuring exposure per man could be limited to perhaps once per month. I would suggest heavy glass, glass-stoppered bottles with pouring lips - of two sizes to correspond to quantities of charges.

Routine for measuring then would be: operator dons clean rubber gloves and apron, lines up his clean bottles in the hood, uncaps the TEL can, measures by graduate into the bottles until the line is filled, caps the litre can, stoppers the bottles, washes the graduate either by dipping it into the trough of reducing agent or with kerosene and soap and water, flushes off the can and bottom of hood with kerosene then water, arranges the hood, closes and locks it, and then thoroughly cleans his gloves and apron and washes his hands.

Suggested routine for charging: operator dons mask, rubber gloves, apron, obtains bottle of correct size from the hood for the particular unit, removes cap on fill-pipe, unstoppers bottle, carefully pours in the contents, recaps fill-pipe and stoppers bottle, returns to hood and drops bottle and stopper into the trough of reducing agent, cleans his equipment, and washes. It would probably be best to put the TEL into the fill-pipe ahead of the next materials so that the following additions would act as a wash.

9. A practice should be established whereby each litre can as it is emptied is rinsed out with kerosene, mutilated, and burned immediately.

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I would suggest that the above recommendations be examined by Mr. Schaefer and Dr. Kehoe, and that their thoughts pro and con be included in a final report which I could turn over to Dr. Veazey. He asked for such a report, written exactly as though it, the problem, were our responsibility, and is rather anxious that he receive it as soon as possible so that a possible danger period can be reduced to a minimum.

C. E. Colvin
October 9, 1937

PHYSICAL RESEARCH LABORATORY
The Dow Chemical Company

Subject DIRECTIONS FOR HANDLING TETRA ETHYL LEAD

File 6138
Chg. 223
Rec'd.
Fin'd. 11-9-36
By H. J. Winnicki

1. The equipment used for handling tetra ethyl lead shall be kept, at all times, in the white enameled dish, which should never be taken from underneath the hood.

2. In obtaining tetra ethyl lead for a batch, the following procedure should be followed:

   a. Put rubber gloves on before touching anything in the enameled dish.

   b. Place glass stoppered flask in the glass dish and put them both upon the scales.

   c. Weigh out the required amount of tetra ethyl lead in the glass stoppered flask, and then stopper the flask.

   d. If you spill any tetra ethyl lead upon the table top, scales, or anywhere else, be absolutely sure to wash it off with kerosene immediately.

   e. Put the can of tetra ethyl lead back into the enameled dish after you are thru using it. Do not set it down any place, other than in the enameled dish, at any time. Be sure that it is well stoppered.

   f. Leave the glass stoppered flask under the hood until you are ready to pour the tetra ethyl lead into the polymerizer. Do not weigh out the tetra ethyl lead until you are ready for it. Avoid allowing a batch of tetra ethyl lead to stand in the glass stoppered flask under the hood for any length of time.

   g. When pouring the sample into the polymerizer, use a funnel, and be absolutely sure to wash off any tetra ethyl lead that you may spill. Wash the funnel by pouring some dichlor ethylene thru it into the polymerizer.

   h. Remove the funnel and then wash the funnel, the glass stoppered weighing bottle, and the glass dish with kerosene, preferably out of doors, then wash off kerosene with acetone and dry with air, then put them back into the enameled dish.

3. Always wear rubber gloves when handling tetra ethyl lead or anything th t comes in direct contact with it.

Personal Precautions

1. Avoid coming in contact with tetra ethyl lead.

2. Avoid inhaling any fumes of tetra ethyl lead.

3. If you spill any on yourself, even a drop, wash it off immediately with plenty of kerosene, and it is your duty to see that a filled bottle of kerosene is always kept in the enameled dish. Remove any clothing that comes in contact with tetra ethyl lead, and do not wear the garment again until it has been dry cleaned.

4. Keep yourself and your clothing clean. Take a shower as often as possible when you are working with that material.

If these precautions of cleanliness and care are followed, there should never be any danger. Your carelessness may not only endanger you, but every man that is working on this problem. Be sure to report to Ray Boundy any accidents in handling this material, so that proper attention may be paid.

H. S. Winnicki

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