

This booklet has been prepared with the object of creating a better understanding of the lead hazards, as distinct from other hazards, encountered in the cleaning of storage tanks which have contained leaded gasoline.

Regulations governing the cleaning, scaling and repairing of tanks which have contained leaded gasoline have been issued by The Associated Ethyl Co. Ltd, and these regulations must be read in conjunction with the subject matter of this booklet.

(b) Nature and Source of Hazard

Organic compounds of lead, whether in liquid, solid or vapour form are highly poisonous.

Tetraethyl lead is an important example of this type of compound. It can be absorbed into the human system either by the inhalation of its vapour, by skin contact, or through the mouth, with serious or even fatal results.

It should be realized that the nature and symptoms of organic lead poisoning are quite different from inorganic lead poisoning or plumbism. As an example, a tumblerful of tetraethyl lead completely evaporated in a 4,000 ton storage tank will produce an atmosphere which may be fatal after an hour's exposure.

After removal of the gasoline from a tank which is to be cleaned, the main dangers to persons entering the tank arise from:

- (i) Sludge on the tank bottom;
- (ii) Rust scale on the inside surfaces; and
- (iii) Residual gasoline vapours.

(i) During storage of lead-treated gasoline, small quantities of organic lead are deposited on the bottom of the tank and remain in suspension in the sludge on the tank bottom. This sludge will vary in depth according to the amount of water present and the degree of irregularity of the tank bottom, and will consist generally of water, rust and scale, tetraethyl lead and its

compounds and thus make dangerous to breathe. Sludge removed from a tank is to be handled, even when wet, and must be taken to avoid exposure to it.

(ii) Rust scale on the inside of the tank contains traces of lead, and this scale must be avoided.

(iii) The residual vapours of leaded gasoline are both asphyxiating and poisonous, and must not be breathed in any circumstances.

Any tank which has at any time contained leaded gasoline, and has not been cleaned thereafter, may present a danger of lead exposure, irrespective of the size of tank, frequency of cleaning, or location, length of service, etc. If a tank not thoroughly cleaned this time is subsequently even if a different product, is subsequently stored.

Even when all sludge and scale have been removed, and the tank has been ventilated and gas-freed, a hazard may exist, namely that repair work, involving the application of heat, may result in the formation of lead compounds still present in the metal and particularly in the

2. RESPONSIBILITIES

It is recommended that the person responsible for the whole operation be responsible for the whole operation, and no work should be done without his written authority.

3. PLANNING THE OPERATION

The whole operation should be planned by the Chief Engineer who should be responsible on the following points:

(a) Method of Cleaning

Certain alternative methods of cleaning will be described later.

satisfy himself that each man in the tank cleaning crew has read and understood the regulations.

(c) Medical Examination

Experience has shown that certain diseases and disabilities can make the wearing of protective equipment unduly onerous. It is recommended, therefore, that before being selected for tank cleaning, workmen be medically examined to ensure that they are in good health and not suffering from any disability which might seriously interfere with their work. If this be done, and the proper precautions observed, there will be no injury to health from the lead hazard during tank cleaning. As a general precaution, no man who has a perforated ear-drum should be employed in a tank which has not been completely gas-freed, as it is possible for a person so afflicted to breathe gasoline vapours through the ears.

(d) Clothing and Protective Equipment

All protective clothing and safety equipment must be carefully inspected by the foreman, who must satisfy himself that it is in first-class condition before work commences.

The tank should not be entered (even for a short period) until it has been thoroughly ventilated and all residual vapours and sludge removed, unless the person concerned is adequately protected against skin contact with the sludge, and has an air supply which is completely independent of the air in the tank. This can only be assured by:

- (i) Wearing protective clothing as set out in Section I.A. of the Associated Ethyl Company's Tank Cleaning Regulations; and
- (ii) Using a positive-pressure full face-piece air-line mask with hoselines and blower.

Men so equipped should see that they have a clear path of escape in the event of an accident

put on clean clothes.
Hoses for air masks should always be tested, or later when in use, for any offensive odour, such as gas, and the user should leave the tank to cause and remedy it, if necessary. Hose connections should be tested for fittings should be tested for damage or leaking, and for strains which can be caused by hoses inside a tank.

The intake of the air supply should be to windward of the tank, and fresh uncontaminated air should be the men inside the tank.

(e) Mechanical Equipment

All equipment which is used for work, such as fire hose, pumps, ejectors and blowers, should be examined by the foreman to satisfy himself that all mechanical parts are in good running order before use.

(f) Provision of Shelter

The foreman should provide shelter for the burial of sludge, if provided. They should be provided to take all the material removed, and should be located in a position not to be disturbed at a later date.

Authority to commence work should not be given until all the above conditions are satisfied.

4. MANHOLES

The job of removing sludge from a tank which is found to present a significant hazard of lead and gasoline vapour openings. It is important that men undertaking this work

5. REMOVAL OF SLUDGE

There are several ways of removing sludge from a tank, and the foreman should be fully instructed in the method to be employed.

(a) Facilities at Tank

The experience of some companies is that substantial saving in time and much greater convenience in cleaning tanks can be effected by removing one complete plate from the bottom strake of the tank, thus leaving a large opening through which sludge can be flushed by means of high-pressure water hoses. This method has the advantage of easy entry and exit, better light and ventilation, and almost eliminates the need to handle the sludge. However, before adopting this method, the tank design should be investigated to see that the structure is not weakened by the removal of a plate. Fig. 1 shows the opening provided when a plate has been removed in this way. Figs 2 and 3 illustrate the added convenience and improved illumination.

The ideal type of tank from the cleaning point of view is one with an opening or drain at the lowest point in the tank bottom, but even in the case of tanks to which such outlets have been fitted, the advantages to be gained by removing one or more of the plates from the bottom strake would fully justify this procedure.

Obviously, the best time to fit a drainage outlet is during the construction of the tank, but it is possible to install a similar drain as a field modification to an existing tank, as shown in Fig. 4. Once such a drain has been fitted, the greater part of the sludge and loose scale can be removed before entering, thus greatly reducing the lead hazard. Where there is no suitable drainage outlet from the tank, the use of a portable pump or an ejector is desirable for removing the bulk of the sludge, in order to reduce the length of time that the men would have to

(b) Water Flushing Method

The safest way to remove sludge is to do the work entirely from outside the tank, a person actually entering the tank. Loose scale and loose sludge have been removed in many cases this can be done and, if done effectively, it has the advantage of reducing to a large extent the risk of exposure to toxic men concerned. The water pressure necessitates the use of high pressure (100 p.s.i.), fire hoses, and an ejector for removing the sludge from the tank. (Where there is a bottom drain in the tank no ejector is required). A suitable ejector is shown in Fig. 5.

The water is directed through the rigging, walls, and floor. At the same time, the pump or ejector is operating on the water-sludge mixture. The flushing and ejecting is continued until all loose material has been removed. Usually this takes from 15 to 30 minutes depending upon the size of the tank, the amount and nature of the sludge. After the flushing is continued until the tank is as clean as the inside of a new tank.

If the men operating the tank detect gasoline or other flammable vapors, they should immediately put on their air-line masks.

With large tanks, it may be necessary to wear air-line masks to enter the tank. The hoses so as to remove sludge from areas difficult of access. In some cases it is preferable to remove as much of the sludge and loose material by means of a pump or ejector from the outside before so complete the flushing operation. The benefit of proportionately reducing the lead hazard.

The sludge should be discarded in a previously prepared capacity to hold all the sludge.



Fig. 1

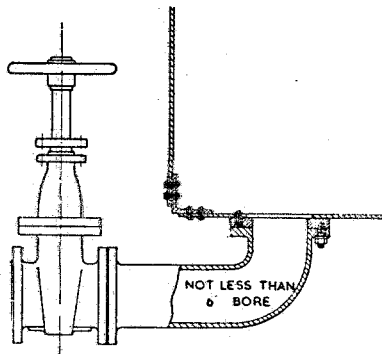
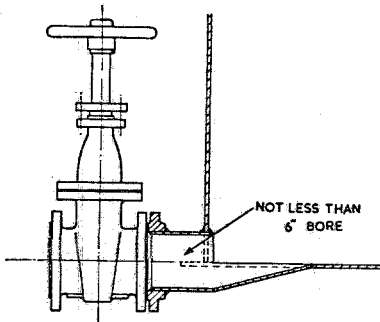
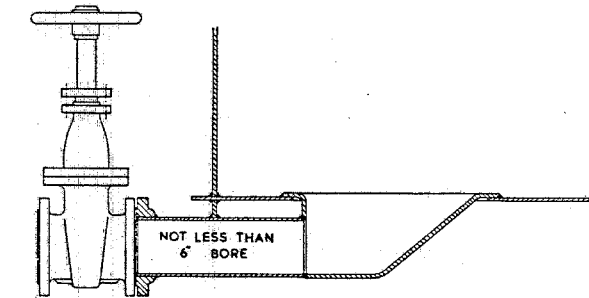


Fig. 4. Alternative drainage outlets

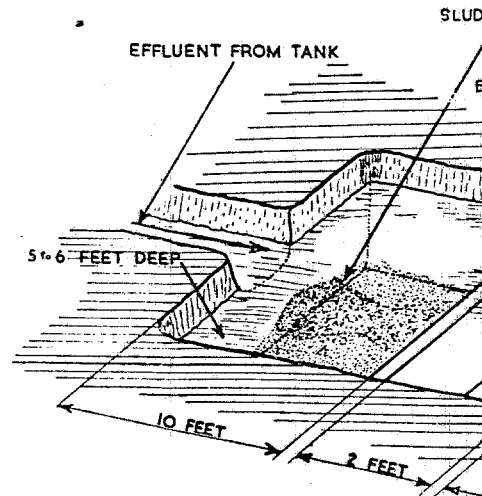


Fig. 6. Double-bottom outlet



Fig. 2

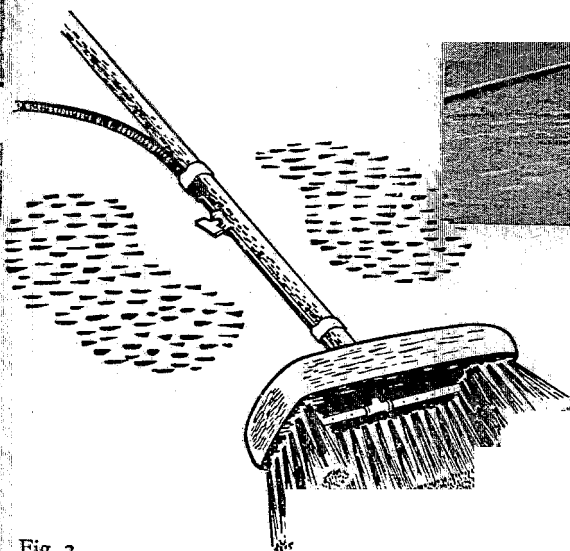


Fig. 7. Broom with water connection

E FOR FLOATING MATTER

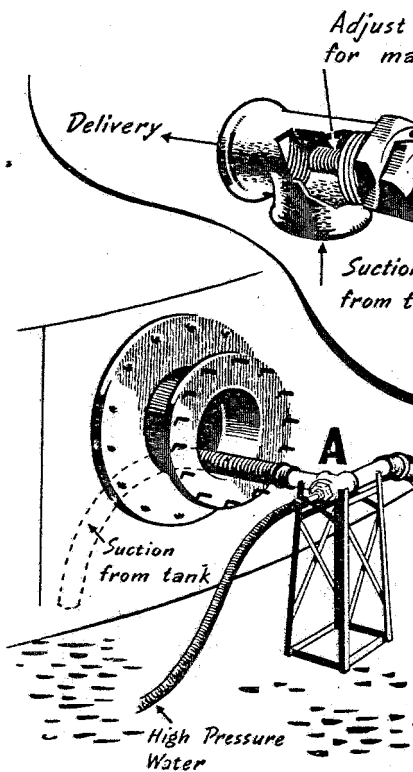
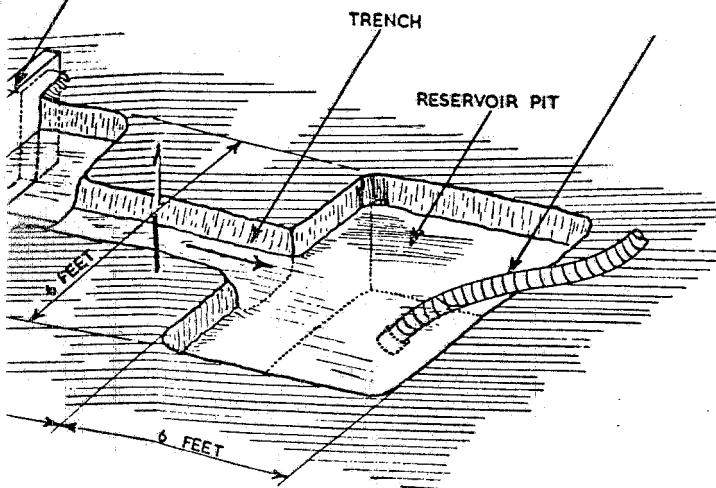


Fig. 5. Water-sludge e

of three feet should be allowed. In certain cases it may be possible to flush the sludge and water through a drain into the sea, but this will depend upon local regulations regarding disposal of effluents from factories and plants.

The foregoing is a general procedure for tank cleaning which will involve the men in the absolute minimum of exposure to toxic vapours, but necessitates the use of a large quantity of water to flush out the sludge. In certain cases it is not practical to have a large volume of water running to waste, because either there is insufficient water available, or the tank bottoms are so close to the natural ground water-level that there is inadequate drainage. In such cases it is still possible to use the flushing method by constructing a double interceptor pit consisting of two pits or holes connected by a trench as shown in Fig. 6. A baffle should be so placed that any gasoline or oily substances floating on the surface of the water will be prevented from passing between the two pits while still permitting the flow of water from one pit to the other. Another baffle to prevent solid materials passing between the pits will also be required.

The first pit is used as the depository for the effluent from the tank, and the second as a water reservoir. A portable high-pressure pumping unit (such as a fire pump) is required, taking its suction from the reservoir pit, and delivering water to the fire hoses used for flushing the tank interior. It is desirable for the water in the reservoir pit to be as free as possible of suspended matter. The size and type of construction of the pits are governed by the capacity of the tank and the conditions at the site.

(c) Cleaning Without the Use of Water

Where there is no water available for flushing the tank interior it is desirable to pump out as much sludge as possible before men enter the tank to remove the remainder. Brooms, buckets, and possibly a rubber squeegee should then be used to dry up any sludge remaining in pools

non-adherent lead deposits and sludge that should be gas-freed before commencing repair or painting operations. If, however, the tank has been cleaned merely for the purpose of changing products, it should not be necessary to proceed further than the elimination of sludge and non-adherent material on the bottom.

(d) Supervision

There is a need for constant supervision by a foreman of all cleaning operations to ensure that men do not remove their air-line masks while inside the tank. These masks can undoubtedly become most uncomfortable, especially at high temperatures. Each face-piece should be thoroughly tested to make certain that only air from the blower can be breathed. Due to the possibility of the presence of gasoline fumes, air deficient in oxygen, canister masks should never be used in a storage tank which has not been thoroughly cleaned and ventilated.

Supervision is also necessary to ensure that men engaged on work in leaded gasoline tanks change their clothes and wash before taking meals, as laid down in Section 1A of the Regulations.

6. DISPOSAL OF SLUDGE

If the tank is cleaned by the water flushing method the sludge will be discharged directly into a pit as already described. Where there is no water available for this method, the sludge should be removed in buckets, or, if a plate has been removed, wheelbarrows may be used for this purpose. All men handling sludge in this manner outside the tank should be equipped with canister type gas-masks until such time as the sludge pit has been back-filled.

The pit should then be marked with a notice warning that lead sludge has been buried and should not be disturbed. The notice should be numbered and dated to correspond with the point recorded on a map of the installation.

that it has been properly back-filled, and that the lead hazard has been completely eliminated. The warning notices should be in place and a record made of the location of the pits. Any area around the tank which has been contaminated should be dug over and the contaminated earth buried.

(b) Mechanical Equipment and Tools

Care should be taken to see that all tools are removed from the tank. These, and any mechanical equipment used, should be thoroughly cleaned before being stored.

(c) Clothing and Protective Equipment

All clothing should be collected and washed at the end of each day's work and at the completion of the job. All rubber equipment, air-line hoses, face-pieces, boots and gloves should be washed and dried immediately after use.

(d) Bathing

All men should change their clothes and bathe at the end of each day's work and when the job is finished.

(a) Cold repair work is dust, and for this reason out under Paragraph VII scale" are applicable.

(b) For repairs involving important that the parts as the areas around the heated, be cleaned down reason for this is that well may volatilize solid lead the surface of the metal hazard.

Tanks which have lead be treated with special gasoline which has seeped the ground beneath, can danger. It is impossible to eliminate the lead hazard cases and, therefore, it for the men carrying out fully equipped with protective line masks. Until the finished it will not be safe for men without wearing protective