

~~CONFIDENTIAL~~

REPORT ON THE MEETING HELD AT SHELL-MEX HOUSE ON 15TH OCTOBER 1943.

SUBJECT:- CLEANING OF TANKER COMPARTMENTS
 WHICH HAVE CONTAINED LEADED SPIRIT.

PRESENT:-

Mr. T.R.A. Bevan (In the Chair)	- Associated Ethyl Co., Ltd.
Mr. Stewart L. Browne	- Ministry of War Transport.
Mr. S.H. Fleming	- Ministry of War Transport.
Dr. Kehoe	- Associated Ethyl Co., Ltd.
Mr. Fossett	- Associated Ethyl Co., Ltd.
Mr. H.A. Wilson	- Anglo-American Oil Co., Ltd.
Capt. S.F. Golds	- Anglo-Saxon Petroleum Co., Ltd.
Mr. H.S. Humphreys	- British Tanker Co., Ltd.
Capt. W.M. Hutchison	- British Tanker Co., Ltd.
Mr. W.L. Nelson	- Eagle Oil & Shipping Co., Ltd.
Capt. J.P. Thomson	- Eagle Oil & Shipping Co., Ltd.
Mr. A.R. Stark	- Anglo-Iranian Oil Co., Ltd.
Mr. Mitchell	- Eagle Oil & Shipping Co., Ltd.
Mr. Lewis	- Shell Refining & Marketing Co. Ltd.
Dr. Footner	- Asiatic Petroleum Co., Ltd.
Mr. R. Tabb (In attendance)	- Tanker Tonnage Committee.

The meeting which was convened with the approval of the Ministry of War Transport, arose out of a letter dated the 11th October 1943, addressed by Mr. John Lamb (Anglo-Saxon Petroleum Co., Ltd.) to the Tanker Tonnage Committee. This letter was tabled and the suggestion was adopted that the subject should be discussed under two headings:-

- (a) Proposal for the cleaning of tanker compartments which have contained Leaded Spirit, and the equipment which should be provided by each tanker for the protection of personnel.
- (b) The necessary cleaning of tankers which have carried Leaded Spirit to bring them into a satisfactory condition to load a cargo of edible oils.

The Chairman opening the proceedings, called upon Dr. Kehoe to outline his experience of this subject.

Dr. Kehoe said that his experience had been mostly concerned with the cleaning of shore tanks, in which over a period the accumulation of sludge and scale may be considerable. When leaded spirit stands in a container for any length of time, there is some decomposition of the tetraethyl lead, with the formation of crystalline substances, chiefly triethyl lead compounds which are but slightly soluble in the spirit. These come to be incorporated in the scale which forms on the surface of an iron or steel container, and they also separate out of the spirit and accumulate at the bottom of the container. The

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Dr. Kehoe	- Associated Ethyl Co., Ltd.
Mr. Fossett	- Associated Ethyl Co., Ltd.
Mr. H.A. Wilson	- Anglo-American Oil Co., Ltd.
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Dr. Kehoe said that his experience had been mostly concerned with the cleaning of shore tanks, in which over a period the accumulation of sludge and scale may be considerable. When leaded spirit stands in a container for any length of time, there is some decomposition of the tetraethyl lead, with the formation of crystalline substances, chiefly triethyl lead compounds which are but slightly soluble in the spirit. These come to be incorporated in the scale which forms on the surface of an iron or steel container, and they also separate out of the spirit and accumulate at the bottom of the container. The quantities of these compounds that are produced are quite small, rarely exceeding more than a few hundredths of 1% in the scale, and rarely reaching concentrations of the order of 0.1% in the sludge at the bottom. Under certain conditions it appears that these triethyl lead compounds within the sludge, (not that in the adherent scale), may be reconverted into tetraethyl lead. Whether this is true or not, the sludge under certain unpredictable circumstances may be found to contain appreciable quantities of tetraethyl lead.

For the foregoing reasons, workmen who enter these tanks to clean them may be exposed to the vapour of tetraethyl lead arising from the sludge, and in addition may absorb this lead compound through the skin of their hands or other parts of the body that come in contact with the sludge. This may result in their being fatally poisoned after comparatively short periods of exposure, (one to several hours). Much less dangerous exposure may result from the inhalation of dust created by handling sludge which has been permitted to dry out, or by attempts made to remove scale from the metal surface of the tank. Such dust is composed largely of scale, but the triethyl lead compounds therein tend to be suspended in the air in fine particles, producing irritation of the eyes and the membranes of the nose, and perhaps some burning of the skin if the latter becomes warm and moist with perspiration. Such dust may be prevented entirely by keeping the scale and sludge wet. (It has not been found possible to remove the lead compounds from adherent scale by any chemical means, mechanical removal being the only effective means.)

Simple methods have been devised for the protection of workmen engaged in cleaning the tanks. These methods have been found to be practicable and are entirely adequate when carried out. Regulations to this end have been issued and incorporated into the current regulations which are generally employed for the purpose of avoiding the risks of fire, explosion and toxic exposure to spirit.

A supplementary statement was made to the effect that skin contact with the leaded spirit is not to be regarded as hazardous, since absorption through the skin does not occur appreciably as the result of such contact.

(a) Mr. Wilson described the process of gas-freeing, cleaning and ballasting tanker compartments. Generally the process consisted first in steaming, followed by washing down, and the sludge thus formed on the bottom shovelled into buckets and hoisted upon deck. The tanks which are to be ballasted are then filled with salt water ballast. At the loading port, ballast is pumped out, the bottom mopped dry, any sludge on the bottom shovelled up and removed by hand. The tanks are then inspected before being passed as being in a fit state for loading.

When a tanker is proceeding to dry dock for repairs, generally the same process of steaming, washing down, pumping out slops is carried out, or on those vessels so installed, the Butterworth system is used. This consists of two opposed nozzles revolving, from which issues a jet of water at a pressure of about 160 lbs./sq.in. and at a temperature of between 160/170°F. The jet impinges against the sides of the tank knocking off the scale and dispersing spirit absorbed by the rust. As in other processes, the fallen scale is shovelled up and bucketted out of the tank by hand. Rust found on the bottom of tanks may be in the nature of a powder in the case of

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Following the cleaning process, further gas-freeing is then assisted by leaving tank lids open and ventilating with

wind sails. Asked by Dr. Kehoe if this practice was common in all tankers, Mr. Wilson said that as far as British vessels were concerned, the assumption was correct, but he could not vouch for American vessels as he believed in some cases they were allowed to put to sea after discharging without cleaning or gas-freeing.

In Mr. Wilson's opinion "sludge" was hardly the correct term to apply to the residue that remained in the bottom of a tank after steaming and washing down. It was really only flaky rust and because it is removed each voyage before reloading does not accumulate to any appreciable extent.

Capt. Hutchison confirmed that on British Tanker Company vessels, after loading and discharging, each compartment was steamed out, washed down, the resulting "sludge" shovelled up and removed and clean ballast water pumped in. He also asked if rust in small particles could be regarded as "sludge".

Mr. Stark was of the opinion that owing to the introduction of ballast water into tanks, small particles of scale should be regarded as mud or sludge since finely divided rust is comparable in particle size with river silt.

Mr. Nelson and Capt. Thomson also held the view that sludge was introduced by ballast water in the form of mud or silt, sand, etc., and this being so, danger to personnel cleaning tanks commenced after ballast water had been pumped out rather than during the process of cleaning tanks after gas-freeing.

Capt. Hutchison read a letter of instructions issued some two or three months ago to Masters of British Tanker Company vessels regarding the precautions to be taken in the cleaning of tanks having contained Leaded Spirit. These instructions stipulated that personnel engaged in this work must wear rubber gloves and boots and the wearing of gas masks was recommended but left to the discretion of the Master, having regard to the condition of the air in the tank at the time. It was further stipulated that all tank surfaces should be kept wet during cleaning operations.

The Chairman said that the conclusion to be drawn from all that had been said was that the sludge problem met with in store tanks did not appear to exist in anything like the same degree in tanker compartments. It was agreed, however, that Associated Ethyl should submit, in draft, instructions for consideration by those concerned with a view to the adoption of a uniform set of regulations for the cleaning of tanker compartments which have contained leaded petrol.

Discussion then centred on:-

The cleaning of tanks preparatory to drydocking. This presented a different and much more difficult problem. The question was, could tanks be sufficiently cleaned and made free of hard scale so that when dried out, no particles of lead dust were disturbed and suspended in the air whilst repairs were going on in the tank?

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Dr. Kehoe said that dust masks of satisfactory design (including goggles as an integral part of the mask or separately) could be used to prevent the inhalation of this dust, and that such masks might be worn by repairmen. The latter, however, especially rivetters and welders, were likely to object to wearing such masks, and in some instances had been known to refuse to wear them. On this account it had been regarded as good practice to

have all necessary cleaning and scaling done by other fully protected workmen, prior to the beginning of repair work. This involved careful removal of all scale and rust from the surface of metal that would be heated during rivetting or welding.

Mr. Humphreys thought that in the case of a small job such as fitting a doubling plate, the surface and its immediate surroundings, where most vibration from hammers would be felt, could be specially prepared by scaling, chipping and cleaning in preparation for repairs.

Mr. Stark suggested that the Regulations protecting lead burners in the process of lead-lining chemical containers might be studied and possibly applied in the operation under review as he was of the opinion that the dangers to health were greater in the case of lead burning than in the cleaning of Leaded Spirit tanks.

Dr. Kehoe stated that any official regulations that might be in force for the protection of lead burners engaged in lining chemical receptacles would not apply necessarily to this problem (that of exposure to dust containing small quantities of lead) for a number of reasons:-

- (a) the dangers of the two situations are different in origin and in quantity, those under consideration here being on the whole less than those arising in repairing lead-lined containers; and
- (b) the dangers of lead burning have been known for a long time and are therefore accepted without alarm and, to some degree condoned, whereas the danger of lead poisoning in connection with the repair of tankers would be thought of as new and as such would be viewed with alarm.

Other suggestions such as driving out dust by means of compressed air were made, but this was thought to have a worse effect and the meeting therefore agreed to give further consideration to this problem and pool their ideas at a later date.

(b) Regarding the carriage of edible oils and other products destined for use as food for men and animals after disposing of a cargo of leaded spirit, Dr. Kehoe advised that this was generally to be regarded as an undesirable practice. The difficulties to be expected divide themselves into two categories, -

- (i) the real danger that might be incurred through the contamination of food products and beverages with lead compounds, and
- (ii) the apprehension of danger which might result in complaints and in claims that contamination had occurred when in actual fact it had not.

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There are in fact certain well-defined risks.

Grain and other granular or pulverised foods may be significantly contaminated with lead compounds at the point of contact with the surfaces of the tank compartments. The degree of contamination would be quite difficult to determine in any given case, and there would be the further difficulty that the contaminated material would not be evenly distributed throughout the cargo and thereby, so to speak, diluted to a point of

practical insignificance. Obviously such materials should not normally be transported in such a manner, but under emergency conditions this might well be unavoidable or even desirable. In such circumstances, the compartments of the tanker must be thoroughly cleaned, detached scale must be removed completely, and all adherent scale should be removed so far as it is possible to do so. There must be no moist surface in contact with the cargo.

Edible liquids may or may not tend to dissolve the small quantities of lead that may be present upon the surfaces of the compartments of the tanker. Oils in general would not be expected to do so to any considerable degree. Moreover, if materials of this type are to be subjected to distillation, filtration or other processing, before being employed as foods, the factor of contamination induced by transportation in a tanker may be eliminated thereby. On the other hand, a material that is to be concentrated by evaporation or otherwise may be found to have been excessively contaminated when it comes to be a finished product. All of these factors have to be considered in connection with a liquid cargo intended for use as a food or beverage. On the whole it is wise to avoid these possibilities as far as possible. Moreover, in general it is recommended that such materials be sampled and subjected to analysis for lead at their destination, if it is found necessary in emergency to transport them in petrol tankers.

There has been little experience by which to assess in practical terms the magnitude of the danger of lead contamination of products of the above types. One cargo of cotton seed oil has been analysed and found to be quite free of significant contamination. In general, the lead content of edible oils and liquids intended for beverages or food should not exceed 0.1 m.g. per kilogram. The limits of lead concentration in such products that may be permitted by the health authorities in various countries vary somewhat, but generally they do not exceed one or two parts per million by weight, (i.e. 1.00 to 2.00 m.g. per kilogram). However, cargoes may be condemned for hygienic reasons if it can be established that any actual contamination with lead has occurred in processing or in transport, on the theory that such contamination is unnecessary and is not in the interest of the public health.

Mr. Lewis mentioned that many tankers are called upon to carry a cargo of drinking water, and in dealing with this problem Dr. Kehoe said that water to be used for beverage purposes and cooking may be significantly contaminated with both petrol and lead by being transported in containers that have been used for the transport and storage of leaded petrol. The degree of contamination (with lead) depends upon the quantity of lead-containing scale remaining on the surface of the container, and upon the relationship between the surface of the container and the volume of the water therein. It is not possible to state what the maximum degree of contamination would be, but it can be said that water for use for drinking and cooking should not contain more than 0.1 m.g. lead per litre. This concentration is likely to be exceeded by waters transported in tanks that have been in contact with leaded gasoline for some time.

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In abeyance:-

- (1) Final drafting of instructions for the cleaning of tanks.
- (2) Steps to be taken for the purpose of rendering tanks sufficiently safe for workmen carrying out repairs.