DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

GHQ/SCAP Records(RG 331)
Description of contents

THE NATIONAL ARCHIVES OF THE UNITED STATES

(1) Box no. 2723

(2) Folder title/number: (14)
Report on Tetra-Ethyl Lead in Japan

(3) Date: Jan. 1950 - July 1950

(4) Subject:

Classification	Type of record
212, 9212	a, d

(5) Item description and comment:
Kanto

(6) Reproduction: (Yes) No

(7) Film no.

Sheet no.

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Civil Affairs Section
APO 500

463.8 (21 JUL 1950) CAS-EM 21 JUL 1950

SUBJECT: Report on Tetra Ethyl Lead in Japan

TO: Chief, Hokkaido Civil Affairs Region, APO 7-5
Chief, Kanto Civil Affairs Region, APO 500
Chief, Tohoku Civil Affairs Region, APO 7
Chief, Chugoku Civil Affairs Region, APO 182
Chief, Shikoku Civil Affairs Region, APO 1050
Chief, Kyushu Civil Affairs Region, APO 24-5
Chief, Tokai-Hokuriku Civil Affairs Region, APO 710
Chief, Kinki Civil Affairs Region, APO 25-1

Forwarded herewith for your information is a Report on Tetra Ethyl Lead in Japan prepared by Mr. C. D. Carter, Visiting Expert Consultant, under supervision of the Industry Division, Economic and Scientific Section, General Headquarters, Supreme Commander for the Allied Powers.

FOR THE CHIEF, CIVIL AFFAIRS SECTION:

J. A. O'BRIAN
CWO USA
Adm Off

1 Incl
Report, ESS, GHQ, SCAP
dtd 6 July 50

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FOR THE CHIEF, CIVIL AFFAIRS SECTION:

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dtd 6 July 50

J. R. D. FOX
Col, AGD
Adjutant

RECORD

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Civil Affairs Section
APO 500

463.8 (26 Jun 1950)CAS-EM

SUBJECT: Disposal of Former Military Stocks of Tetra-Ethyl Lead

F-348

TO: Chief, Hokkaido Civil Affairs Region, APO 7-5
Chief, Tohoku Civil Affairs Region, APO 7
Chief, Kanto Civil Affairs Region, APO 500
Chief, Tokai-Hokuriku Civil Affairs Region, APO 710
Chief, Kinki Civil Affairs Region, APO 25
Chief, Chugoku Civil Affairs Region, APO 182
Chief, Shikoku Civil Affairs Region, APO 1050
Chief, Kyushu Civil Affairs Region, APO 24-5

1. Reference is memorandum for Ministry of International Trade and Industry, Mining Bureau, Petroleum Administrative Section, from General Headquarters, Supreme Commander for the Allied Powers, Economic and Scientific Section, Industry Division, subject as above dated 21 June 1950.

2. Surveillance will be exercised in accordance with provisions of paragraph 3, Operational Directive No. 11, General Headquarters, Supreme Commander for the Allied Powers, Civil Affairs Section dated 10 April 1950.

FOR THE CHIEF, CIVIL AFFAIRS SECTION:

J. A. O'BRIEN
CWO USA
Adm Off

1 Incl:
Memo for MITI,
21 Jun 50 (cpy)

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Civil Affairs Section
APO 500

463.8 (26 Jun 1950)CAS-EM

SUBJECT: Disposal of Former Military Stocks of Tetra-Ethyl Lead

TO: Chief, Hokkaido Civil Affairs Region, APO 7-5
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Chief, Kanto Civil Affairs Region, APO 500
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Chief, Kinki Civil Affairs Region, APO 25
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Chief, Shikoku Civil Affairs Region, APO 1050
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FOR THE CHIEF, CIVIL AFFAIRS SECTION:

J. A. O'BRIAN
CWO
USA
Adm Off

1 Incl:
Memo for MITI,
21 Jun 50 (cpy)

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GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Economic and Scientific Section
APO 500

HBO/WT/TMc/yt

463.8(21 Jun 50)ESS/IND

21 June 1950

MEMORANDUM FOR: Ministry of International Trade and Industry,
Mining Bureau, Petroleum Administrative Section,
No. 2-chome, Kasumigaseki, Chiyoda-ku, Tokyo

SUBJECT: Disposal of Former Military Stocks of Tetra-Ethyl Lead

1. References are:

a. Memorandum for the Japanese Government from General Headquarters, Supreme Commander for the Allied Powers, AG 463.7(13 Oct 49)GD, SCAPIN 6898-A, subject: Disposal of Former Military Stocks of Tetra-Ethyl Lead, 13 October 1949.

b. Attached inspection reports on depots containing tetra-ethyl lead, tetra-ethyl blending units in petroleum refineries, former Japanese manufacturers of tetra-ethyl lead and shipments of tetra-ethyl lead prepared by visiting Expert Consultant.

2. Reference reports are forwarded for implementation of recommendations and instructions contained therein in accordance with paragraph No. 5 of reference 1a.

3. Reports will be submitted on the thirtieth of each month commencing with 30 June 1950 to Industry Division, Economic and Scientific Section, General Headquarters, Supreme Commander for the Allied Powers, indicating action taken during the previous month with respect to recommendations contained in reference reports.

FOR THE CHIEF, ECONOMIC AND SCIENTIFIC SECTION:

MAURICE M. CLASS
Chief, Industry Division

1 Incl
Inspection Reports on
Tetra-ethyl Lead (13 copies)

Copies furnished:
CAS
CBS

Incl 1

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-C O P Y-

Former Japanese Manufacturers of Tetraethyl Lead

This is supplementary to a similar report of 5/6/50 and summarizes the results of inspections made 5/16/50 and 5/19/50 at Hodagaya Chemical Company, Koriyama and Nippon Soda Company, Nihongi.

Hodagaya Chemical Company, Koriyama

The subject company operated 88 autoclaves (plus 10 unused) and attendent facilities in the war time manufacture of tetraethyl lead. On March 12, 1945 the plant was almost completely destroyed by bombing and subsequently, the equipment remaining was removed from the buildings and scattered over the whole plant area to minimize damage from possible future air raids. Therefore many areas of this plant constitute a possible poisoning hazard at the present time. An air sample taken in the open air in the vicinity of some TEL vessels showed a lead content of 4 micrograms per cubic foot of air or just within the safe breathing limits for a single continuous 8 hour exposure. It is probable this area would have a much higher lead-in-air content on still days in warmer weather so that workmen in the vicinity might experience lead poisoning symptoms after exposure. Other areas throughout the plant are similarly hazardous, so it is recommended they be made off limits to all personnel until decontamination is carried out.

Of the original 558 pieces of lead-contaminated equipment at the plant, 36 have been decontaminated by heating to 300°C in a specially designed furnace. Following this decontamination the equipment was put into dye service manufacture without testing for complete decontamination. An additional 24 vessels were converted to dye stuff manufacture after repair, but without decontamination. Of the remaining 498 vessels and equipment plus piping, 237 pieces were turned into scrap by bombing and 261 pieces remain to be decontaminated.

A large number of empty TEL drums remaining at the factory after the war constitute a potential poisoning hazard and these were treated as follows:

TEL Drums

1.	Decontaminated by burning and now used for storage of dye intermediate -	430
2.	Scrapped (To be burned)	356
3.	On hand to be decontaminated (including 456 broken)	834
		1,620

In addition to the above, two full drums of tetraethyl lead were discovered this date and will be allocated to one of the refineries for blending.

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Nippon Soda Company, Nihongi

Inspection of the plant this date showed sources of TEL odors which were not apparent during the earlier mid-winter inspection. A lead-in-air sample taken near the idle autoclaves in the large #1. Reaction Shop showed 4 micrograms of Pb/cu ft of air, while TEL odors were so strong in the vicinity of the still's sump pit it was considered dangerous to remain in the area long enough to secure a sample which would certainly be over safe breathing limits. Building #296, formerly used for the continuous recovery of lead, also had strong TEL odors and should be a prohibited area until it is decontainated.

One drum containing 90 liters of tetraethyl lead was discovered since the last inspection. In addition several hundred empty TEL drums are scattered around the plant constituting a present hazard from odors and a future hazard if placed in service without decontamination.

Recommendations

1. All present TEL contaminated areas should be made "Off Limits" for workmen and should be decontaminated, at an early date, by one of the methods described in the writer's report of 5/6/50.

2. Any equipment that is to be placed in service making products destined for human consumption should be checked for complete decontamination prior to conversion. This includes the many empty drums on hand at both companies.

3. Any possible future desire to reactivate these plants for TEL manufacture should include consideration of a competent medical supervision in order that deaths from lead poisoning can be avoided. Dr. Keigi Akatsuka the war time TEL advisor for the Japanese Government reports 12 deaths at these plants from TEL poisoning and 3 from an explosion during the "drying" of TEL with sodium and 1 post-war death during the repair of a vacuum pump. Therefore, it is recommended a competent TEL authority make a check of any former TEL equipment before conversion to other use and that any reactivation of the plants be under the medical direction of an authority on TEL such as Dr. Akatsuka.

C. D. Carter
5/27/50

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- C O P Y -

Tetraethyl Lead Blending Plant Operation
Nippon Oil Company, Yokohama 5/25/50

At the request of the Nippon Oil Company and upon their representation that their TEL blending plant was complete, the first leaded gasoline mix was made at the refinery this date. Although this first mix was carried out without serious difficulty, several changes should be made before the plant makes another blend. The refinery intends to make changes as follows:

1. Re-pipe manifold tightening all loose fittings and installing standard type swing joints which are now being fabricated.

2. Re-locate the eductor manifold against the wall to provide more operating and storage space.

3. The plant will be converted to a Partial Drum Mix type (as previously recommended), by installing a new standpipe, scale, and scale-pit.

4. The interceptor tank will be installed in the platform drain line according to drawing #250B(E.C.).

5. If the blending tank jet-mixers prove inefficient at the operation pressures of this first mix, they will be replaced by swing lines, or in-tank mixers.

6. A block valve will be installed in the concentrated lead-gasoline line to prevent high lead build up in the dead-end pipe during mixes in tanks 221 and 224.

7. Gas mask straps will be made safe for future use.

8. The method for checking TEL content in gasoline by Laboratory analysis will be changed according to the information furnished by the writer this date.

9. Future mixes will be calculated on the basis of 372.5cc of TEL/kg. of Fluid and the sampling and laboratory analysis of tetraethyl lead from each drum will be abandoned.

Mix calculations and plant operation characteristics this date were as follows:

Mix

Gasoline in Mix- (839.6 kl.)= 221,838 gallons
Fluid used (345 kg. x 372.5)= 128,512 cc TEL = 0.579cc TEL/gal.
221,838 gal.

Kanto
Yokohama

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The refinery had indicated their clear gasoline octane was 67.2 (MM) and they expected to get 72.2 octane with 0.3cc TEL/gal. and 75.1 octane with 0.5cc TEL/gal. If this CFR engine information is presumed to be correct, the initial gasoline Mix will be in excess of 75 octane and it will be cut back with clear gasoline to the octane the refinery desires.

Plant Operation

Drum	Weights, kg.			Unloading	Gauge Readings			
	G	T	N	Minutes	In	Out	Vac.	Closed Vac.
#12	399	54	345	8.5	50 psi.	11.4 psi.	16"Hg	20"Hg

Before mixing, Safety discussions and Safety Procedures were reviewed with management and blenders and blender medical examinations were completed by Dr. K. Akatsuka. As previously stated, this plant will be not resume TEL blending until the recommended changes have been made and the plant found safe for continued operation.

C. D. Carter
5/26/50

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Inspection of TEL Drum Storage

1. Nippon Mining Company, Funakawa, 5/18/50
2. Nippon Oil Company, Akita, 5/18/50
3. Inoue-Sangyo K.K., Takasaki, 5/21/50

1. Nippon Mining Co., Funakawa

This refinery blended tetraethyl lead into its straight run gasoline during the war. The blending system was a simple gravity feed from a drum into which the TEL was poured and measured by sight glass into the gasoline discharging to a tank car. This equipment is no longer on hand having been scrapped. The TEL inventory left on hand was originally reported as 75 drums, but subsequently 5 more drums were discovered and reported on the date of inspection. All drums were found in good condition except for 2 with broken end chimes which should be handled with care during shipments. The refinery warehouse was appropriately placarded and well ventilated and since no leaks had occurred, movement from this point should be handled without difficulty by box car or ship.

The refinery is now considering blending TEL again in the future and requested assistance with their plans for a standard type blending plant. Accordingly, their plans were revised for construction of a Partial Drum Mixing plant with a storage space for 20 drums based on an estimated usage of from one to three drums per month.

2. Nippon Oil Company, Akita

The fifteen drums previously inspected at the Akita Central Trucking Company have been moved to storage at the Nippon Oil refinery. Prior to movement the contents of leaking drums were transfered to sound drums and the empty drums properly disposed of per instructions. The drums are now stored in good condition in an isolated warehouse from which point they will be shipped to Nippon's Yokohama refinery for use. The Akita Central Trucking Company garage where the drums were previously stored had been decontaminated by the removal of contaminated soil and the treatment of the concrete floor with 1kg. of KMno4 crystals. A check for lead vapors at this location showed no trace of TEL so it may be presumed the decontamination was complete and the area can now be used without fear of future poisonings.

The Nippon Oil Akita refinery is now considering the possible future use of TEL in its straight run gasoline and requested that their blending plant construction plans be reviewed and a plant site be recommended. This was handled in an unofficial capacity with an excellent site being finally selected in an isolated part of the refinery at the end of the railroad siding.

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3. Ihoue-Sangyo K.K., Takasaki

This company had purchased 8 drums of TEL from a trucker with the understanding they were buying gasoline. The drums are now in outdoor storage in good shape with the exception of one drum which has a one inch wooden plug driven into its side to stop leakage. Since these drums are to be trucked to Nippon Oil's Yokohama refinery, it was recommended the drum be handled with care and placed in a metal pan to avoid contaminating the truck during shipment. Appropriate safety clothing and decontaminants should be on hand during movement.

It is recommended the past history of the drums originally secured by the trucker (mentioned above) be secured. Information this date stated that the trucker found 20 TEL drums buried at Nagano and that he sold these drums throughout Gunma prefecture representing the contents to be gasoline or cutting oil. After several poisonings had occurred notably at the Oki Electric Company, Tamioka where the TEL was used for cutting oil, the trucker was apprehended by the police and the majority of the drums were located and allocated to the Nippon Oil Company who has transported same to their refinery. An attempt should be made by the Nagano prefectural government to trace any drums still at large, or in the custody of Shimizu Tayadashi at Nagano, or any drums that might still be buried at Nagano.

In connection with past inspections the former storage areas for TEL were investigated at Showa Oil Company and Nippon Oil Company, Niigata. These locations were found to be safe for other use from a TEL standpoint.

C. D. Carter
5/23/50

Kanto
Takasaki

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TEL Blending Plant Construction
Toa Nenryo Kogyo Co., Shimizu 5/12/50

Little progress has been made to date on the construction of the adequate storage space for drums to be built as a part of the lead blending plant. The need for adequate drum storage space was cited in the writer's previous reports of 2/22/50, 3/14/50 and 4/3/50. It is now recommended the refinery complete this work within 10 days as they have indicated they will do. As discussed with the refinery this date, (1) standard drainage should be installed and tied into the operating plant's interceptor tank, (2) sprinkler system should be installed, (3) the platform should be completely curbed, and (4) the platform should be smoothly trowelled and sloped to the drain 1 inch in 10 feet.

This work should be completed as rapidly as possible so that the refinery's allocation of tetraethyl lead now being shipped can be stored immediately in a safe location.

C. D. Carter
5/15/50

Kanto

Shimizu

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Inspection of Tetraethyl Lead Shipment, Kanto Motors

The movement of 539 drums of TEL started from the above location by barge for the Kawasaki refinery of the Mitsubishi Oil Company, 5/10/50. Nineteen leaking drums were punctured with an axe and the contents transfered to new drums filled only one half full because of their light gauge. At the time of inspection all of the leaking drums had been broached in which process lead fluid had been splashed on the ground and on the workmen handling. The TEL spills were ordered decontaminated with $KMnO_4$ solution and the workmen instructed to wear gas masks and protective clothing. The strong TEL odor in the vicinity was decreased by the decontamination and by moving the emptied drums to windward and plugging with waste. After this handling the drum movement was resumed in a relatively fresh atmosphere. It is felt that had work continued in the TEL contaminated air without gas masks that certain lead poisonings would have occurred among the workmen.

It is recommended, again, that all transfers of TEL fluid be handled by workmen who are completely equipped with full protective clothing. All oil company supervisors of TEL transfers should be acquainted with and enforce proper handling procedures.

Kanto

Tokyo

C. D. Carter
5/11/50

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Inspection of TEL Drums, Yokosuka City Government 5/4/50

The twenty eight drums of tetraethyl lead at this location were reported by Lt. Commander John W. Holtom of the Civil Affairs Section, Yokosuka. At present the drums are in the custody of the Yokosuka City Gov't., Bureau of Construction to which location they were shipped only one month ago from the City Hall. Eight of the drums are leaking and the soil is now so contaminated that the lead odor could be detected 20 feet from the drums in spite of a steady rain. Fortunately the drums are stored in a remote location and fenced off from the general public. The past history of this lead is vague, but it has been stated they were thought to contain potable ethyl alcohol until the contents were sampled and tested.

Recommendation:

The contents of the badly leaking drums should be transfered to new drums before shipment by the refiner receiving the allocation. The contaminated soil should be removed and dumped in the ocean only 100 feet away.

Since these drums were located by the Civil Affairs Section, and were moved to this city government depot only one month ago, it is suggested that possibly the Petroleum Advisory Section of MITI has not successfully informed their people regarding the TEL hazard and the reporting of same. It is recommended this program be sponsored more vigorously in the future before some tetraethyl lead is disposed of as ethyl alcohol and results in poisonings to the people handling or receiving.

Kante

C. D. Carter
5/6/50

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Former Japanese Manufacturers of Tetraethyl Lead

Tetraethyl Lead was formerly produced in Japan at the following location:

1. Nippon Soda Company, Ltd., Nihongi
2. Hodagaya Chemical Company, Koriyama
3. Mitsui Chemical Company, Arao
4. Second Naval Fuel Depot, Yokkaichi
5. Third Naval Fuel Depot, Tokuyama

In addition a pilot plant was built at the Naval Fuel Research Depot, Ofuna for research on TEL; this plant was probably never placed in service.

To emphasize the hazards of handling, listed below are the authenticated deaths from tetraethyl lead at the supervised manufacturing plants:

Nihongi	6 (plus 3 unauthenticated)
Koriyama	6 (plus 2 from lab testing of tin tetraethyl and 2 during autoclave decontamination with H_2SO_4 and $Ca(OCl)2$)
Tokuyama	2
Yokkaichi	1
Arao	1 (During pilot plant testing)
Total	16

Due to the poisonous nature of tetraethyl lead a potential hazard now exists at these manufacturing plants as follows:

1. The handling of contaminated equipment by uninformed personnel who may be poisoned by skin contact or breathin of TEL vapors.

2. The dismantling of contaminated equipment (for scrapping) under supervision that is ignorant of the hazard may result in lead poisonings.

3. The conversion of autoclaves, receivers, and other contaminated equipment, to the production of food stuff or medicine may result in poisonings to the general public unless a complete decontamination program is carried out.

The present condition of tetraethyl lead manufacturing equipment is as follows:

Tokyo

Nippon Soda Company, Ltd., Nihongi

This company was the largest manufacturer of tetraethyl lead in Japan, producing 13,712,798 pounds of the finished compound during their period of operation from January 1941 to August 1945. They operated 73 autoclave units of which 36 have been decontaminated and placed in the production of "Barbital" (medicine), auramine(dye), and "resolcine" (medicine, anti-acid) and "B.H.C." (insecticide). The remaining 37 autoclave units, plus intermediate piping, coolers, receivers, filters, mixing and storage tanks, pumps, and concrete ventilating ducts are still contaminated by TEL, or its compounds, and should

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not be placed in other service, or dismantled, until they have been completely decontaminated.

Hadagava Chemical Company, Koriyama

This company was comparable in size to Nippon Soda, but was nearly destroyed by bombing. Subsequently 15 autoclaves were decontaminated with H_2SO_4 and Ca(OCl)2 and converted to the production of dyestuffs. It is probable some contaminated equipment was sold and the remainder is still on hand.

Mitsui Chemical Company, Arao

Tetraethyl lead production did not start at this plant until October 1944 and it stopped in August 1945. The company operated 16 autoclaves of 1000 liter size. They have stated these units were dismantled and "decontaminated and boiled" using "bleaching powder and liquid of bleaching powder" and at the present time "whatever that is felt poisonous can never be seen at all". These autoclaves are now used for the manufacture of dulcine, sweetening agent, intermediates for dyestuffs, ethyl chloride, and ethyl alcohol. Also 16 condensers of 120 liter size are in service for ethyl alcohol. The company has stated their contaminated autoclave units have been cleaned as above and by using a 10% sulfuryl chloride solution in naphtha after which the equipment was checked for safety by a member of the Branch Office of the Finance Ministry in 1946. However, during the writer's inspection 3/3/50 it seemed probable some TEL contaminated units were still on hand among: 16, 90 liter TEL Receiver; 2,3000 liter Storage Tanks; 4,1000 liter Stills; 4,160 liter Separators; 4,1600 liter Receivers; and 2,600 liter Mixing Tanks.

Second Naval Fuel Depot, Yokkaichi

This installation was nearly destroyed by bombing and subsequently the autoclaves and other tetraethyl lead manufacturing equipment was partly dismantled and moved out of the buildings and into the open air. Between 18 and 24 autoclaves are still on hand with some having been dismantled and broken up for scrap. The reaction mass residues were being removed from these autoclaves manually without any special protective safety equipment. Although some decomposition of the reaction mass had occurred during the outside airing period, with vents and discharge ports open, it is probable TEL residues still exist which will make any unsupervised dismantling hazardous until complete decontamination has been carried out. In addition a very real hazard exists should the Intermediate TEL receivers and mixing and storage tanks be opened and dismantled, or sold, without using protective safety equipment or until after complete decontamination. In addition to the manufacturing equipment, a TEL blending plant for gasoline was operated at this location. It is recommended this contaminated piping be destroyed by burning at the same time the manufacturing plant is cleaned up. The three drums of TEL found abandoned at the blending plant should be allocated for use by a refinery.

Third Naval Fuel Depot, Tokuyama

This depot suffered some damage from air raids, but the tetraethyl lead equipment is largely intact and still contaminated. The equipment consists of 12 autoclave units and attendant facilities. The present supervisory personnel

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is ignorant of the exact number of TEL contaminated vessels and so some possible mishandling could occur at this location.

Recommendations:

1. Decontamination of TEL manufacturing facilities should be carried out under the supervision of informed personnel.

2. Equipment should not be placed in service making foodstuffs, medicine, potables, etc, until it has been tested and found safe for such use. It is suggested MITI or PH&W check such equipment in the future before it is placed in service making materials for human consumption.

3. The contaminated equipment should not be sold until it is completely decontaminated. All clean up work and dismantling should be carried out by personnel completely protected by safety clothing and approved gas masks.

4. Decontamination can be accomplished by following the procedures listed below under "Decontamination".

5. After decontamination the equipment should be checked for cleanliness and if any odor of TEL remains, the equipment should be recleaned. If no odor is apparent, a diluent for TEL can be washed through the vessel and extracted with 25cc CCl_4 which is then treated with 1cc of a 10 bromine in carbon tetra chloride solution. Any precipitation (lead bromide) is an indication that decontamination is not complete and the vessel should not be converted to use for materials for human consumption until the decontamination job is completed whether tested by the above simple method, or some other.

DECONTAMINATION

Burning:

The simplest and perhaps most effective decontaminant is fire. When the contaminated object is of little value, or when the cost of decontamination is excessive, it is best to destroy by burning it thoroughly throughout.

Tetraethyl lead fluid should never be burned without dilution by kerosene; otherwise a violent reaction may result. For safe burning operations at least ten volumes of kerosene should be mixed with one volume of tetraethyl lead. The burning should be carried out in the open air where persons or buildings will not be harmed by the smoke. The fire should be brisk so that the TEL will be consumed and not merely evaporated by the heat.

Any wood contaminated by TEL should be removed from the building and destroyed by burning since it can probably not be adequately decontaminated by other methods, and lead vapors will continue to emanate from the wood and create a hazard.

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Decontaminating Agents:

1. Potassium permanganate ($KMnO_4$) 5% solution of crystals in water, or the crystals may be sprinkled over the contaminated area and sprayed with water. A minimum of 2 pounds of $KMnO_4$ is required to decontaminate 1 pound of TEL and several times this quantity should be used to complete the operation with the rate of decontamination being quite rapid.

2. Sulfuryl chloride (SO_2Cl_2) 10% solution in kerosene given a fairly rapid rate of decontamination. The mixing with kerosene should be done in the open air using goggles and rubber gloves. The solution should be made up fresh as it deteriorates rapidly during storage, and upon exposure to sunlight. A minimum of 4 pounds of SO_2Cl_2 is required to decontaminate 1 pound of TEL and several times this quantity should be used for complete decontamination.

3. Calcium hypochlorite (Ca(OCl)2), also known as chloride of lime, or bleaching powder, should always be used as a slurry with water. Dry Ca(OCl)2 must never be used because of the danger of fire from its chemical reaction with tetraethyl lead. A minimum of 2 pounds of Ca(OCl)2 is required to decontaminate 1 pound of TEL and several times this quantity should be used for complete decontamination; the rate of decontamination is slow. The slurry should be prepared fresh just before use because Ca(OCl)2 readily gives up its chlorine when exposed to air or moisture.

(It should be emphasized that, with the exception of $KMnO_4$, use of the above reagents undiluted will result in explosive reactions and resultant fire.)

In addition to the above reagents some of the common acids such as HCl can be used for decontamination in 10% dilution with water. In the event such acids are used it recommended an inhibitor be added to the solution to protect the vessel in the event it is to be used again.

C. D. Carter
5/6/50

-COPY-

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

- C O P Y -

Movement of TEL Drums to Refineries 4/21/50

This date the Mitsubishi Oil Company moved its tetraethyl lead allocations of 65 drums from the Nippon Oil Co. depot, Sumidagawa to their refinery at Kawasaki. The movement from the depot was correctly handled by leading no more than 10 drums per truck, bung-up, blocked and lashed. The seven trucks moved to Kawasaki in a single carevan with red danger flags, two men per truck, 14 gas masks, rubber gloves, and aprons available. Also on hand on one truck was a 50 gallon supply of kerosene, $KMnO_4$ and chloride of lime in case of a leak of spill in transit. Loading operations were by drum skid and winch lift. The entire operation was well organized and safely handled under the direct supervision of Mr. Fujio Sumitani of the Mitsubishi Oil Company.

It is recommended other oil companies follow the same safe procedure during TEL movement.

Kanto

Other TEL shipments reported to date are as follows:

From	To	Carrier	Drums	Date
Kanto Motors, Tokyo	Mitsubishi, Kawasaki	Truck	539	4/24-4/30/50
Standard Vacuum, Otaru	Maruzen, Shimotsu	R.R.	65	4/25-4/26
Kizugawa (Shell), Osaka	" "	Boat	225	4/25
Funamachi, Osaka	" "	"	19	4/25

It is recommended the oil companies move their TEL allocations at an early date per the writers Conference Report and Recommandation of March 31, stating the lead should be moved within 30 days, if possible. At an early date MITI should secure a report from each refiner giving the following information:

1. Has their allocation been moved.
2. Condition of the storage depot after movement.
3. Disposal of empty drums.
4. Did any leaks occur during handling - if leaks occured in transit give box car number, etc.
5. How are drums stored at the refinery.

C. D. Carter
4/24/50

Incl 8 of Incl 1

- C O P Y -

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

-COPY-

TAL Discovery, Yokosuka 4/20/50

Lt. Commander Holtom, Civil Affairs Section, Yokosuka, reports 28 drums (180 liter size) reported by the Chief of Police, Yokosuka. At present the drums are stored at the Construction Dept., Yokosuka City Office building. The contents were sampled and analyzed as tetraethyl lead in March 1949. The present holders are very anxious to be relieved of the responsibility of further custody. It would be appreciated if M.I.T.I. would investigate this report so that the writer can inspect the depot and recommend methods for handling.

C. D. Carter
4/21/50

Incl 9 of Incl 1

-COPY-

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

- C O P Y -

Activation of Tetraethyl Lead Blending Plant
Showa Oil Company, Kawasaki, 4/19/50

This is the second TEL blending plant to be placed in service in Japan since the war. It was the first gasoline to be leaded at this refinery. The refinery (by CFR engine tests) had estimated their 58 octane (MM) clear gasoline would require 1,8cc TEL/gallon to raise the octane to 72 (MM), accordingly, this amount of TEL was added. An attempt to start this plant had been made April 13th, but this proved unsuccessful as the writer advised certain mechanical changes be made. These changes having been made, the plant operated very efficiently this date, with operating chracteristics as follows:

Mix

Gasoline in Mix (454.155 kiloliters)= 119,978 gallons
TEL needed (1.8cc/gal x 119.978)= 215,960cc= 1278 lb (580 kg)
168.818

Operating Characteristics

Kanto
Kawasaki

Drum #	Weights kg G	T	N	Unloading TEL	Wash	Gauge Readings IN	OUT	VACUUM
1	415	79	336	21 min.	15 min.	90 psi	28 psi	4-6" Hg
2	421	177	244	8 min.	(Not emptied)	92 psi	22 psi	13" Hg
Closed TEL valve operation, no jet pressure						95 psi	7.5 psi	23.5" Hg
Decreased jet back pressure to approx.							15 psi	

The above figures show that plant operation is satisfactory and the writer's inspection showed that all the physical and safety requirements had been fulfilled. Safety and operation discussions were held with refinery management and the blending personnel prior to starting the plant. Dr. K. Akatsuka will handle medical examinations of the three blenders within the week. These examinations, and plant inspections, will subsequently be continued on a quarterly basis in order to insure future safe operations. Top and bottom gasoline samples will be checked for efficiency of jet-mixing operations.

C. D. Carter
4/20/50

Incl 10 of Incl 1

- C O P Y -

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

Activation of Tetraethyl Lead Blending Plant
Toa Nenryo Kogyo Oil Co., Wakayama, 4/28/50

This is the third TEL blending plant to be placed in service in Japan since the war. The plant was inspected 4/26 and some basic changes were recommended in piping and construction. After these changes had been made, the examined blenders, and management, were instrudted regarding safe operating procedures. By CFR engine tests it was calculated 1.13 cc TEL/gal was needed to raise the octane of the clear gasoline from 63.6 to 72.5 (M.M.). However, an approximate 1.10 cc TEL/gal was actually added because of the difficulty of opening drums and to avoid leaving the standpipe in a final, nearly full, drum. Calculations and operating characteristics of the plant were as follows:

Mix

Gasoline in Mix = (998 kiloliter) 263,472 gallons
TEL needed (1.13 cc x 263,472) = $\frac{297,723}{168.818}$ cc = 1763 lb (795 kg)

However, only 776.8 kg lead was used, so final gasoline TEL content was 1.097 cc/gal. instead of 1.13 cc/gal. This small difference should have little effect on the octane of the gasoline.

Plant Operation

Drum	Weights, kg.			Unloading	Gauge Readings		
	G	T	N	Minutes	Inlet	Outlet	Vacuum
1	409.0	68.5	340.5	10	78	7	13" Hg
2	162.0	76.3	85.7	4	80	7	14" Hg
3	424.0	73.4	350.6	10	80	7	14" Hg

The "closed Valve" operation of the eductor showed about 23" Hg vacuum indicating the refinery had fabricated a satisfactory home made eductor from the dimensions furnished by the writer's plans. Minor plant hanges suggested by the writer are now being made; these consist of: ramp construction at doorways, "interceptor tank" welding and drain line extension, and installation of sufficient lockers for five blenders in the washroom.

The present piping hook up is suction from tank and discharge to tank using a 65 kiloliter/hour pump which indicates a minimum circulation time for this mix of 12 to 13 hours. The refinery has requested information on in-tank mixers which the writer will supply. The use of such mixers would probably reduce mixing time to about an hour with a consequent decrease in vapor losses.

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The small TEL spill that occurred was caused by the inexperience and eagerness of the five blenders who attempted to remove an inadequately washed drum from the scale before the bungs had been properly installed. The one quart spill was cleaned up with kerosene followed by soap and water rinsing into the interceptor tank. Subsequent mixes will be handled by three men, or less, which should result in safer operation.

C. D. Carter
5/1/ 50

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

Inspection of TEL Facilities, Naval Fuel Research Depot
Ofuna, 4/10/50

TEL PLANT

The tetraethyl lead pilot plant at this location is intact and has apparently never been operated. Further information will be requested from the prefectural government and from former laboratory workers as to whether the plant was ever operated. If the subsequent investigation shows the equipment was never contaminated it may be used "as is" for any purpose to which it can be adapted as far as safety is concerned.

TEL DRUM STORAGE

Some confusion still exists about the amount of TEL that was stored, or moved from this location. This date, Ofuna personnel was unable to agree on the amount of TEL stored here, or even to locate the former storage area. The figures on the fluid inventory of the agencies involved here are as follows:

MITI	1,260 l	99 drums	(revised to 9 drums 4/1/50
Ofuna	1,260 kiloliters	30 drums	(including 10 emtpy and 19 glass ampoules)
Showa Oil Co. (Receiver)		16 drums	(9 leaking - Showa transfered to new drums ending with 13 full drums and 10 empties at thier refinery; 1 drum left at Ofuna)

Kanto
OFUNA

It is recommended a further investigation be made by MITI that will reconcile the above discrepancies and trace any TEL shipped to unauthorized receivers or still held at Ofuna. It is recommended the former drum storage area be located and appropriate decontamination be carried out on any spill area. Any empty drums remaining should be picked up by Showa Oil Co. for proper disposal.

C. D. Carter
4/11/50

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

TEL Blending Plant Construction
Toa Nenryo Kogyo Co. Shimizu 5/12/50

Little progress has been made to date on the construction of the adequate storage space for drums to be built as a part of the lead blending plant. The need for adequate drum storage space was cited in the writer's previous reports of 2/23/50, 3/14/50 and 4/3/50. It is now recommended the refinery complete this work within 10 days as they have indicated they will do. As discussed with the refinery this date, (1) standard drainage should be installed and tied into the operating plant's interceptor tank, (2) sprinkler system should be installed, (3) the platform should be completely curbed, and (4) the platform should be smoothly trowelled and sloped to the drain 1 inch in 10 feet.

This work should be completed as rapidly as possible so that the refinery's allocation of tetraethyl lead now being shipped can be stored immediately in a safe location.

C. D. Carter
5/15/50

Kanto
Shimizu

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

Jones

Pleadings 7/10

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Civil Affairs Section
APO 500

463.8 (19 Jun 1950)CAS-EM

26 JUN 1950

F/145

SUBJECT: Disposal of Former Military Stocks of Tetra-Ethyl Lead

TO: Chief, Hokkaido Civil Affairs Region, APO 7-5
Chief, Kanto Civil Affairs Region, APO 500
Chief, Tohoku Civil Affairs Region, APO 7
Chief, Chugoku Civil Affairs Region, APO 182
Chief, Shikoku Civil Affairs Region, APO 1050
Chief, Kyushu Civil Affairs Region, APO 24-5
Chief, Tokai-Hokuriku Civil Affairs Region, APO 710
Chief, Kinki Civil Affairs Region, APO 25

1. Reference is Memorandum for Ministry of International Trade and Industry, Mining Bureau, Petroleum Administrative Section, from General Headquarters, Supreme Commander for the Allied Powers, Economic and Scientific Section, subject as above, dated 15 June 1950.

2. Subject Memorandum referenced in paragraph 1, SCAPIN 6898-A, 13 October 1949, is attached for your information.

3. Surveillance will be exercised in accordance with provisions of Paragraph 3, Operational Directive No. 11, General Headquarters, Supreme Commander for the Allied Powers, Civil Affairs Section, dated 10 April 1950.

FOR THE CHIEF, CIVIL AFFAIRS SECTION:

Note report 26 June by Q

2 Incls:
1. ESS, Memo for MITI, dtd 15 June 50 (Cy)
2. SCAPIN 6898-A dtd 13 Oct 49 (Cy)

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ASM [illegible] Off

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DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Civil Affairs Section
APO 500

463.8 (19 Jun 1950)CAS-SM

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2. SCAPIN 6898-A dtd 13 Oct 49 (Cy)

J. A. O'BRIEN
CWO, USA
Adjutant Gen

CADF JAPAN

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

KANTO
INFORMATION:
O.D. "
JUN 23 1950

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Economic and Scientific Section
APO 500

EBO/eT/TMc/yt

463.8(15 Jun 50)TSS/IND

15 June 1950

MEMORANDUM FOR: Ministry of International Trade and Industry,
Mining Bureau, Petroleum Administrative Section.
No. 2-chome, Kasumigaseki, Chiyoda-ku, Tokyo.

SUBJECT: Disposal of Former Military Stocks of Tetra-Ethyl Lead

1. Reference is memorandum for the Japanese Government from General Headquarters, Supreme Commander for the Allied Powers, AG 463.7.(13 Oct 49)GD, SCAPIN 6899-A, 13 October 1949, subject: Disposal of Former Military Stocks of Tetra-Ethyl Lead.

2. Numerous quantities of tetra-ethyl lead have been recently located at various locations in Japan and there are indications that further quantities have not been disclosed. It is desired that a report be submitted by 26 June 1950 giving a current inventory of all known stocks of tetra-ethyl lead indicating quantity by liquid volume and number of containers, location by address and owner and condition of containers. It is further desired that necessary action be taken to locate and disclose other stocks that may exist and report thereon as such disclosures are made.

3. Information received to date indicates that allocations of tetra-ethyl lead have not been in accordance with reference memorandum and an equitable and efficient distribution is not being made. A plan of allocation of supplies of tetra-ethyl lead as made in accordance with reference memorandum will be submitted by 26 June 1950 giving justification for each allocation and amounts received by each petroleum refinery as of that date.

FOR THE CHIEF, ECONOMIC AND SCIENTIFIC SECTION:

MAURICE M. CLASS
Chief, Industry Division

Copies furnished:
CAS
CWS

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

-COPY-

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
APO 500

13 October 1949

AG 463.7 (13 Oct 49)ED
SCAPIN 6896-A

MEMORANDUM FOR: JAPANESE GOVERNMENT

SUBJECT: Disposal of Former Military Stocks of Tetra-Ethyl Lead

1. The Japanese Government is directed to dispose of all stocks of tetra-ethyl lead formerly the property of the Japanese military agencies and now located in the Japanese home islands, including the stocks now in custody of the Commanding General, Eighth Army.

2. Disposition of this material will be limited to sale to refiners of imported crude oil, and the quantities sold to any refiner will be based on an estimated straight run gasoline yield of 25% of the initial crude oil allotment. Any requests for subsequent resale of subject material between authorized refiners will be submitted to General Headquarters, Supreme Commander for the Allied Powers, for approval.

3. Sale of this material to the refiners will be at a price not less than necessary to satisfy existing bona fide claims for the purchase and storage of said material plus a pro rata portion of the total cost of transportation of all stocks of tetra-ethyl lead to such destinations as designated by the buyers.

4. When the above action has been accomplished, the Japanese Government will report to General Headquarters, Supreme Commander for the Allied Powers, the quantities purchased by each authorized refiner and the cost thereof.

5. The Japanese Government will insure that adequate and proper caution is exercised in the handling and shipment of the material to prevent injury to persons and property.

FOR THE SUPREME COMMANDER:

R. K. LEVY
Colonel, AGD
Adjutant General

-COPY-

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

26 June 1950

To : The Chief, Economic and Scientific Section,
GHQ, SCAP

From : Petroleum Administrative Section, Mining Bureau,
Ministry of International Trade and Industry

Subject: Answer to the Memorandum re Disposal of Tetra Ethyl Lead

This is to inform you that, in compliance with your memorandum dated 15 June 1950, the Petroleum Section, Mining Bureau, MITI submits you with a report and has taken the following steps along the line suggested by the said memorandum.

(1) With reference to the second paragraph of the memorandum, the current inventory of located TEL is herewith submitted as per attached Table 1, indicating each lot by liquid volume, address etc.

(2) In regard to the other TEL which might exist not located and discovered a s yet, the Petroleum Administrative Section, Mining Bureau has taken as step to broadcast by radio, informing the people throughout the country that the Petroleum Administrative Section is disposing of TEL in accordance with memorandum SCAPIN 6898-A and requesting those who have hold or custody of TEL to report to the competent agency. In this connection, we add that the Mining Bureau had already requested prefectural governors, chieves of District Bureaus of International Trade and Industry and other local governmental agencies to investigate locations of TEL.

(3) With reference to the third paragraph of your memorandum related to appropriate allocation of TEL instructed by SCAPIN 6898-A dated 13 Oct 49, our program is as follows:

Since the allocation of TEL instructed by SCAPIN 6898-A is based on an assumption that the topped gasoline be yielded 25% as much as the imported crude oil, the monthly demand for TEL of the refineries now in operation and refineries scheduled to be operated soon will be, assuming 3 cc of TEL needed per gallon of gasoline, as per attached Table 2.

Against this demand, program of allocation of so-far discovered TEL to refineries is as per attached Table 3. Between the two, there is a small difference unfavorable for the latter, This difference, however, is expected to possibly be made up for by undiscovered TEL which will most probably be located in near future.

According to Table 3, the Mitsubishi Oil is allotted with TEL over its demand. The reason is that, since we have let Mitsubishi take over the whole lot of TEL belonging to the Kanto Motors Company,

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

Mitsubishi is over-allotted. We are prepared, therefore, to revise the allocation to Mitsubishi in future, so that we may have surplus to readjust the future allocation.

(4) As we got your understanding the other day, TEL located and existing on the Japan Sea Coast is left unmoved there in order to give equal opportunities to refineries on the Japan Sea Coast to blend TEL with their gasoline. As a result, no figure corresponding to TEL on the Japan Sea Coast is shown in the "Supply" column of Table 3. According to the situation in future, however, part of allocations to the Pacific Coast and the Japan Sea Coast refineries may be drastically readjusted.

(5) So-far discovered TEL have been picked up by refineries as per attached Table 4.

Director of
Chief, ~~Petroleum Administrative Section~~,
Mining Bureau,
Ministry of International Trade and Industry.
M. T. KUNUGI.

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

Draft of Message by Radio

(Broadcast at the time exclusively appointed
for the official announcement by the Government)
The Ministry of International Trade & Industry.

Since the war ended, numerous quantities of Tetra Ethyl Lead liquid have been located throughout the country, which the Japanese Army and Navy had been using during the war for the purpose of making aviation gasoline. They have usually been found packed in drums, each being made stronger bound by a couple of iron bands. The general properties of TEL liquid are: dark blue in color like ink, having a peculiar odor and a high toxicity.

It is because of its high toxicity that the general use of TEL is strictly prohibited except as additive to gasoline, operation of adding it to gasoline being made only under a close surveillance by the government.

Now that the Oil Companies in Japan are now in the process of buying the whole lots of TEL liquid existing in Japan for the purpose ofblending gasoline, it is requested that those who have hold or custody of TEL Lead apply to their convenient oil companies for the sale of their keeping.

It is further requested that those who are aware of the location but have no hold or custody of TEL will promptly report to their prefectural governments or their convenient police stations and let them know the quantity, location and the owner of the TEL liquid.

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

(Table 1) Current Inventory of allknown stocks of T.E.L.

23rd June 1950

Petroleum administrative
Section of Mining Bureau.

	Inventory Location & adress	Quantity (Unit Liter)	No. of Drum	Owner	Remarks
1	Standard Oil Co. Otaru Warehouse, Arihoro, Otaru, Hokkaido	16,608	65	P.D.C.	
2	Ise Bricks Factory, 45 Nishisaihata, Nagamachi Sendai-shi, Miyagi-ken	45,400	242	P.D.C.	
3	Showa Oil Co. Niigata Ref. Niigata-shi, Niigata Prefect.	26,000	102	Ministry of constraction	
4.	Nippon Soda, Nihongi Factory Nakakubiki-gun, Niigata Prefect.	22,000	110	ditto	
5	Nippon Oil Co. Niigata Ref. Niigata-shi, Niigata Pref.	200	1	ditto	
6	209 Yatabori, Kerita-mura Yamagata-gun Gunma-ken	400	2	ditto	
7	207 Kamitakeshi, Takechi-mura, Saba-gun, Gunma-ken	200	1	ditto	
8	15 Miyoshi-machi, Isezaki-shi, Gunma-ken	200	1	ditto	
9	28 Miyoshi-machi, Isezaki-shi	200	1	ditto	

	[illegible], Niigata Prefect.	26,000	102	Ministry of constraction
4.	Nippon Soda, Nihongi Factory Nakakubiki-gun, Niigata Prefect.	22,000	110	ditto
5	Nippon Oil Co. Niigata Ref. Niigata-shi, Niigata Pref.	200	1	ditto
6	209 Yatabori, Kerita-mura Yamagata-gun Gunma-ken	400	2	ditto
7	207 Kamitakeshi, Takechi-mura, Saba-gun, Gunma-ken	200	1	ditto
8	15 Hiyoshi-machi, Isezaki-shi, Gunma-ken	200	1	ditto
9	28 Hiyoshi-machi, Isezaki-shi Gunma-ken	200	1	ditto

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	Location & Address	Quantity (Unit Liter)	No. of Drum	Owner
10	Sagami-Ungu Warehous 512. Toyokawa-machi Joto-ku Tokyo-to	107,800	539	Kanto Motors K. K.
11	Nippon Oil Co. Sumidagawa Oil Dep. 1012 Minami-Senju Arakawa-Ku Tokyo-to	88,615	555	P.D.C.
12	No.1 Ex-Naval Fuel Dep. Totsuka-Kasuyacho, Yokohama-shi, Kanagawa-ken	1,660	11	Ministry of Construction
13	Sakaori Oil Storage, 1-223 Sakaori-cho Kofu-shi Yamanashi-Ken	30,400	170	P.D.C.
14	Ōe Oil Storage Depot. Nagoyashi, Aichi-Ken	5,590	29	ditto
15	Fukiai Police station Fukiai-Ku Kobe-shi	600	3	ditto
16	Shell Oil Co. Osaka Oil Depot. 457 Minami-Ogajima, Taishio-Ku Osaka-shi	45,000	225	ditto
17	Nippon Paint K.K. Tsunashima-cho Miyakojima-Ku, Osaka-shi	3,350	15	Ministry of Construction
18	Teishio-Sangyo K.K. 2-27 Naka-Dogen-cho Tosei-Ku Osaka-shi	2,000	10	ditto

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 77501/3

	Yamanashi-Ken			
14	Ōe Oil Storage Depot. Nagoyashi, Aichi-Ken	5,590	29	ditto
15	Fukiai Police station Fukiai-Ku Kobe-shi	800	3	ditto
16	Shell Oil Co. Osaka Oil Depot. 457 Minami-Ogajima, Taishio-Ku Osaka-shi	45,000	225	ditto
17	Nippon Paint K.K. Tsunashima-cho Miyakojima-Ku, Osaka-shi	3,350	15	Ministry of Construction
18	Teishio-Sangyo K.K. 2-27 Naka-Dogen-cho Tosei-Ku Osaka-shi	2,000	10	ditto
19	Warehous of Osaka Metropolitan Office	300	2	ditto

Nippon Mining Co. Funakawa Ref. Nippon Kogyo ... 11,500

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

Location and Place	Owner	Quantity (Unit Liter)	No. of Drum
20 Nakatani-mura, Nawabe-gun Hyogo prefecture.	Ministry of Construction	3,500	16
21 Nippon Oil Co. Hikoshima Depot. 1374 Deshima-cho, Shimonoseki-shi, Yamaguchi Prefecture.	ditto	134,850	660
22 Kudamatsu Ref., Nippon Oil Co. Yamaguchi Prefecture.	ditto	17,040	84
23 Mitsubishi Oil Co., Saitozaki Oil Depot., Shiga-mura Kasuya-gun, Fukuoka Prefecture.	ditto	47,792	242
24 Misumi-shoji Co., Kumura Warehouse 3976 Noboritate-cho, Amakusa-gun, Kumamoto Prefecture.	ditto	7,792	32
25 Miike Kogyosho, Mitsui Chemical Co. Arae-shi, Kumamoto Prefecture.	Ministry of Construction	7,260	35
26 Nichibei-Koyu, 7-3 Higashi-Minato-machi, Kokura-shi, Fukuoka Prefecture.	P.D.C.	13,481	55
27 Iorizaki Saseho-shi, Nagasaki Prefecture (include of Goto's T.E.L.)	Ministry of Construction	29,200	147
28 Azumajima Yokosuka-shi, Kanagawa Prefecture.	8 Army	90,400	452
29 Yoshizawa-Yuka K.K. 3 Yasuga-cho, Yokosuka-shi. Yokosuka-Bunka Kyokai	Ministry of Construction	19,200	96
30 Akita Central Trucks Co. Warehouse Hotono, Tetaupocho, Akita-shi.	ditto	2,800	15
31 Daikyo Oil Co. Yokkaichi Ref. Mie Prefecture.	Daikyo Oil Co.	4,250	19
32 Nippon Mining Co. Funakawa Ref.	Nippon [illegible]	[illegible]	[illegible]

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	Arae-shi, Kumamoto Prefecture.	Construction		
26	Nichibei-Koyu, 7-3 Higashi-Minato-machi, Kokura-shi, Fukuoka Prefecture.	P.D.C.	13,481	55
27	Iorizaki Saseho-shi, Nagasaki Prefecture (include of Goto's T.E.L.)	Ministry of Construction	29,200	147
28	Azumajima Yokosuka-shi, Kanagawa Prefecture.	8 Army	90,400	452
29	Yoshizawa-Yuka K.K. 3 Kasuga-cho, Yokosuka-shi. Yokosuka-Bunka Kyokai	Ministry of Construction	19,200	96
30	Akita Central Trucks Co. Warehouse Hotono, Tetaupocho, Akita-shi.	ditto	2,800	15
31	Daikyo Oil Co. Yokkaichi Ref. Mie Prefecture.	Daikyo Oil Co.	4,250	19
32	Nippon Mining Co. Funakawa Ref. Akita-Prefecture.	Nippon Kogyo Co.	14,500	80
33	Tokuyama No.3. Ex-Naval. Depot.		1,000	5
34	Shimizu Ref. Toa Nenryo Oil Co. shimizu-shi, Shizuoka Prefecture	Toa Nenryo Oil Co.	600	3
35	Wakayama Re. Toa Nenryo Oil Co. Wakayama Prefecture.	ditto	4,000	20
36	Kashiwazaki Ref. Nippon Oil Co. Niigata Prefecture.	Nippon Oil Co.	11,500	58
37	Inoue-Sangyo K.K. Tsurumi-machi, Takasaki-shi.	Civil	1,440	8
38	Yamanaka Electric Co. Warehouse 198, 2-chome, Omori, Ota-ku, Toyo.	Civil Kiyoshi Imahashi	3,400	17

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	Location and Place	Custodian	Quantity (Unit Liter)	No. of Drum
39	Fusitora Manufactory, 179, 2-chome, Shibayaki-machi, Tachikawa-shi.	Civil Tsuyoshi Ogushi	200	1
40	Nagashima Chemical Co. Sodeshi-machi, Shimizu-shi, Shizuoka-Prefecture.	Civil	12,800	64
41	Yokosuka City Office Warehouse	Ministry of Construction	5,430	28
42	510 Shukugo-machi, Utsunomiya-shi.	Civil Hiroshi Noguchi	250	1
43	2,772 Kiyozumi-machi, Utsunomiya-shi.	Civil Sadao Ikeda	250	1
44	1,621 Kuranobori-machi, Utsunomiya-shi.	Civil Tetsusaburo Nakamura	1,000	4
45	Central Truck Motor Car Co., 1834 Hanabusa-machi, Utsunomiya-shi.	Civil	1,250	5
46	Kikuchi Motor Car Repair Factory 1357 Tomatsuri-machi, Utsunomiya-shi.	Civil	1,250	5
47	Asano Spinning Co., 1438 Komata-machi, Ashikaga-gun, Tochigi-Prefecture.	Civil	5,062	21
48	Karasuyama-Tumber Co. Karasuyama Karasuyama-machi, Nasu-gun, Tochigi Prefecture.	Civil	3,250	13
49	Front of Karasuyama Station Karasuyama-machi, Nasu-gun, Tochigi-Prefecture.	Civil	1,750	7

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44	1,621 Kuranobori-machi, Utsunomiya-shi.	Civil Tatsusaburo Nakamura	1,000	4
45	Central Truck Motor Car Co., 1834 Hanabusa-machi, Utsunomiya-shi.	Civil	1,250	5
46	Kikuchi Motor Car Repair Factory 1357 Tomatsuri-machi, Utsunomiya-shi.	Civil	1,250	5
47	Asano Spinning Co., 1438 Komata-machi, Ashikaga-gun, Tochigi-Prefecture.	Civil	5,062	21
48	Karasuyama-Tumber Co. Karasuyama Karasuyama-machi, Nasu-gun, Tochigi Prefecture.	Civil	3,250	13
49	Front of Karasuyama Station Karasuyama-machi, Nasu-gun, Tochigi-Prefecture.	Civil	1,750	7
50	Arimasuko Manufactory Masuko Masuko-machi, Haga-gun, Tochigi Prefecture.	Civil	2,480	10
51	194 Shimomaruko Maruko-machi, Nagano Prefecture.	Civil	800	4
52	Suginami-ku, Tokyo Midori-motor K.K.		800	4
53	4-469 Ikebukuro, Toshima-ku Tokyo Toshima public health office		200	1
54	18 Yanagi-machi Aza Tanabe-machi shimokita-gun Aomori-ken.		9,600	48
55	Meigi-muro Tochigi-ken Meigi wooden work.	Civil	2,000	10
56	469 Daiku-machi Utsunomiya-shi.	Mr. Shimada	400	2
57	Hino-machi Utsunomiya-shi central wooden work.	Civil	1,000	5

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	Location and Place	Custodian	Quantity (Unit Liter)	No. of Drum
58	Nanawada-machi Utsunomiya-shi Tochigi Prefect.	Civil	200	1
59	Osawa-mura Tochigi Prefect, agriculture comitty office	Civil	400	2
60	Imaichi-machi Tochigi Prefect.	Ohashi Toshiro	200	1
61	Shinden, Minami Kajio, Kaganoi, Kitatama-gun.	Civil	600	3
		Total	861,700	4,254

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(Table 2)

In case of the estimated straight run gasoline yield of 25% of the initial imported crude oil allotment

	Thru-put of imported crude oil	Estimated gasoline production	Wanted quantities of T.E.L.	Equitable distribut (unit
Nippon Oil Co.				
Yokohama	4,000 Bbl/Day	30,000 Bbl/Mongh	3.8 Kl/Month	111
Kudamatsu	4,000	30,000	3.8	111
Showa Oil Co.				
Kawasaki	4,000	30,000	3.8	111
Toa Nenryo Oil Co.				
Shimizu	4,000	30,000	3.8	111
Wakayama	6,000	45,000	5.71	167
Maruzen Oil Co.				
Shimotsu	3,000	22,500	2.85	83
Mitsubishi Oil Co.				
Kawasaki	3,000	22,500	2.85	83
Total	31,000	~~77,500~~ 732,570	29.46	861

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imated straight run gasoline yield
tial imported crude oil allotment

Estimated gasoline production	Wanted quantities of T.E.L.	Equitable & efficient distribution of T.E.L. (unit liter)
30,000 Bbl/Mongh	3.8 Kl/Month	111,159
30,000	3.8	111,159
30,000	3.8	111,159
30,000	3.8	111;159
45,000	5.71	167,086
22,500	2.85	83,326
22,500	2.85	83,326
~~77,500~~ 232,500	29.46	861,700

(Table 3) **Actual Transportation Report of T.E.L.**

Inventory Number of allocated T.E.L.

Name of Co.	Name of Rfy.	Inventory No.	Quantity (Unit) (liter)	No. of Drum	Remark
Nippon Oil	Yokohama	5	200	1	
		6	400	2	
		7	200	1	
		8	200	1	
		9	200	1	
		30	2,800	15	
		36	11,500	58	
		37	1,440	6	
		38	3,400	17	
		39	200	1	
		42	250	1	
		43	250	1	
		44	1,000	4	
		45	1,250	5	
		46	1,250	5	
		47	5,062	21	
		52	800	4	
		53	200	1	
		54	9,600	48	
		55	2,000	10	
		56	400	2	
		57	1,000	5	
		58	200	1	
		59	400	2	
		60	200	1	
		61	600	3	
		11	73,615	365	
	Partial Total	28	23,600	118	
			142,217	702	
Nippon Oil	Kudamatsu	22	17,040	84	
		23	47,792	242	
		26	13,481	55	
	Partial Total	21	3,000	15	
			81,313	396	
	Nenryo	Shimizu	8	43,400	242

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		47	5,062	21
		52	800	4
		53	200	1
		54	9,600	48
		55	2,000	10
		56	400	2
		57	1,000	5
		58	200	1
		59	400	2
		60	200	1
		61	600	3
		11	73,615	365
	Partial Total	28	23,600	118
			142,217	702
Nippon Oil	Kudamatsu	22	17,040	84
		23	47,792	242
		26	13,481	55
	Partial Total	21	3,000	15
			81,313	396
[illegible] Menryo	Shimizu	2	43,400	242
		13	30,400	170
		34	600	3
		40	12,800	64
		48	3,250	13
		49	1,750	7
		50	2,480	10
	Partial Total	51	800	4
			97,480	513

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Name of Co.	Name of Rfy.	Inventory No.	Quantity (Unit) (liter)	No. of Drum	Remark
Toa Nenryo	Nakayama	4	22,000	110	
		14	5,500	28	
		17	3,350	15	
		18	2,000	10	
		19	300	2	
		24	7,702	32	
		31	4,250	19	
		35	4,000	20	
	Partial Total	21	101,850	495	
			151,132	732	
Showa Oil	Kawasaki	3	26,000	102	
		12	1,660	11	
		41	5,430	28	
		29	19,200	96	
		11	3,000	15	
	Partial Total	28	66,800	334	
			122,090	586	
Maruzen	Shimotsu	1	16,608	65	
		15	600	3	
		20	3,500	16	
	Partial Total	16	45,000	225	
			65,708	309	
Mitsubishi	Kawasaki	10	107,800	539	
	Partial Total	11	12,000	60	

KL	Drum	for
15,000	75	Maruzen Oil
15,000	75	Koa Oil
6,000	30	Shimizu Rfy. of Toa

Showa Oil	Kawasaki	3	26,000	102			
		12	1,660	11			
		41	5,430	28			
		28	19,200	96			
		11	3,000	15			
	Partial Total	28	66,800	334			
			122,090	586			
Maruzen	Shimotsu	1	16,608	65			
		15	600	3			
		20	3,500	16			
	Partial Total	16	45,000	225			
			65,708	309			
					KL	Drum	for
					15,000	75	Maruzen Oil
Mitsubishi	Kawasaki	10	107,800	539	15,000	75	Koa Oil
					6,000	30	Shimizu Rfy. of Toa Nenryo
	Partial Total	11	12,000	60			
			119,800	599			
Koa Oil	Marifu	25	7,260	35			
		27	29,200	147			
		33	1,000	5			
	Partial Total	21	30,000	150			
			67,460	337			
Reserve		32	14,500	80			
TOTAL			861,700	4,254			

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(Table 4).

Actual Transportation Report of T.E.L.

Inventory Number of Transported T.E.L.

23rd June 1950

Name of Co.	Name of Rfy.	Inventory No.	Number of Drum	Quantity (Unit) (liter)	Remark
Nippon Oil	Yokohama	6	2	400	
		7	1	200	
		8	1	200	
		9	1	200	
		5	1	200	
	Partial Total	11	365	73,615	
			371	74,815	
Nippon Oil	Kudamatsu	21	15	3,000	
		23	242	47,792	
	Partial Total	26	55	13,481	
			312	64,273	
Toa Nenryo	Shimizu	13	170	30,400	
	Wakayama	18	10	2,000	
		17	15	3,350	
		19	2	300	
	Partial Total	4	110	22,000	
			307	58,050	
Showa Oil	Kawasaki	28	334	66,800	
		12	11	1,660	
		11	15	3,000	

Nippon Oil	Kudamatsu	21	15	3,000
		23	242	47,792
	Partial Total	26	55	13,481
			312	64,273
Toa Nenryo	Shimizu	13	170	30,400
	Wakayama	18	10	2,000
		17	15	3,350
		19	2	300
	Partial Total	4	110	22,000
			307	58,050
Showa Oil	Kawasaki	28	334	66,800
		12	11	1,660
		11	15	3,000
	Partial Total	3	102	26,000
			462	97,460
Maruzen Oil	Shimotsu	15	3	600
		16	225	45,000
		20	16	3,500
	Partial Total	1	65	16,608
			309	65,708
Mitsubishi Oil	Kawasaki	10	539	107,800
	Partial Total	11	60	12,000
			599	119,800
TOTAL			2,360	480,106

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Preface

The report that follows was prepared by Mr. C. D. Carter, Visiting Expert Consultant, under the supervision of the Industry Division, Economic and Scientific Section, General Headquarters, Supreme Commander for the Allied Powers.

The services of Mr. Carter were obtained through the Department of Army from the Ethyl Corporation, New York City, for a temporary duty assignment to the Economic and Scientific Section. Mr. Carter is at present the Safety Engineer for the Ethyl Corporation stationed in Detroit, Michigan where his company operates its main research Laboratory; he has had over eight years' experience in Safety with the Ethyl Corporation.

His mission, now completed, was to assist and advise SCAP, Japanese Government officials, and the petroleum refining industry, in the construction and operation of tetraethyl lead mixing plants, the shipment and handling of tetraethyl lead, the testing of the compound, and the formulation of public health regulations to protect against the misuse of the product.

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Appendix A - Reports on Inspection of Tetraethyl Lead Storage Locations

Appendix B - Reports on Blending Plant Construction and Operation

Appendix C - Reports on Former Manufacturers of Tetraethyl Lead

Appendix D - Reports on the Use and Transportation of Tetraethyl Lead

Appendix E - Regulations Governing the Transportation of Motor Fuel Antiknock Compound

Appendix F - Draft Revision of the Control Law on the Business of Poisons or Powerful Agents and Draft of General Rules

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Report on Tetraethyl Lead in Japan

Tetraethyl Lead:

The tetraethyl lead compound made in Japan is composed of 64.5% tetraethyl lead, 33% ethylene dibromide, and small quantities of dye and a soluble oil such as kerosene. This fluid is poisonous and may give rise to fatal illness if allowed to get into the mouth, on the skin, or into the air breathed into the lungs; therefore, if any is spilled it should not be allowed to remain on the skin or clothing, and the vapor should not be inhaled. The hazard of prolonged exposure (hours) to vapors rising from spilled material may be considerable even at some distance from the area of a spill and especially in the pathway of prevailing air currents. (Air completely saturated with the fluid vapor at ordinary temperatures, when breathed for ten minutes, may cause fatal poisoning, and if the air is only 1/50 saturated it may cause illness if breathed for an hour). Therefore, the compound should be handled with the utmost care in order that the personnel handling will not be poisoned by leakage, or the general public poisoned by possible spills on the highways during the transportation of the drums.

The tetraethyl lead fluid will be used as an antiknock which when added to gasoline in small quantities of not more than one part to 1260 parts of gasoline will increase the octane number of the gasoline. The compound in this country will be used by refiners of imported crude oil to improve the quality of their low octane straight run, or thermally cracked, gasoline. At the present time straight run gasoline of 58 to 68 motor octane clear can be raised approximately 16.5 octane numbers by the addition of 3cc of tetraethyl lead per gallon. The premium grade gasoline of 72 octane contains less than 2cc TEL/gal. After July 1st a changed type crude oil will yield gasoline with a clear octane of 45 and 67 octane with 3cc TEL/gal.

Summary:

I. Location and Transportation of Tetraethyl Lead:

At the end of the war the approximate 4,600-drum inventory of TEL that had been made in Japan was scattered at some 56 points around the islands. At many of these points the identity of the fluid had been lost and the product was misused for purposes ranging from cutting oil and a general solvent to the manufacture of paint and furniture polish. These misuses of the compound probably caused some deaths which were not recognized as being due to tetraethyl lead. In view of the above, it seemed apparent that the first duty of the writer in Japan was to locate the tetraethyl lead storage points, inform the custodians of the potential hazard and of the proper method of handling, and to supervise the safe shipment of the compound to the refineries where it would be used.

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Attached are reports of inspections made at the storage points, records of deaths from mishandling and recommendations for decontamination, handling of broken drums, and safe shipment of the inventory.

II. Blending Plants:

Previous experience with tetraethyl lead in the United States had indicated that the compound could be handled safely in properly designed blending plants at oil refineries, but that sub-standard handling methods would probably result in poisonings of the operating personnel. Because the previous use of TEL in Japan had been limited to the manufacture of aviation gasoline under the control of the war-time government, the present oil refineries lacked complete knowledge of safe methods of handling tetraethyl lead for blending into motor gasoline. The writer supplied this information and officially assisted the eight Pacific Coast refineries with the plans, construction, and, finally, the activation of proper, safe, blending plants. Unofficial advisory assistance also was given on this matter to two indigenous crude refineries who are considering the use of tetraethyl lead.

III. Manufacturing Plants:

Originally the manufacture of tetraethyl lead in Japan had been carried on without sufficient regard for the poisonous properties of the compound. Even after the appointment of competent medical supervision, sixteen deaths occurred in manufacturing due to the disregard of the safety recommendations. When the demand for TEL ceased with the end of the war, the manufacturing plants (bombed and unbombed) were left with their equipment in a badly contaminated condition from TEL manufacture. The desire to use this equipment for other purposes (making medicine, dye, etc.) caused the principal vessels to be converted to other uses after what may have been incomplete decontamination. The writer inspected these plants and provided information on methods for decontamination and, finally, for checking the equipment before its use for other purposes. A recommendation was made that in the future a competent medical expert test such equipment before its reactivation and that he also supervise any subsequent TEL manufacturing at these plants.

IV. Public Health and Welfare:

Specifications were recommended that would insure the proper handling of the tetraethyl lead at refineries, manufacturing plants, and the safe use of leaded gasoline by the general public. These recommendations were made to the Public Health and Welfare Section and are now written into directives by the Japanese Government in order to control the sale and use of the product in a manner similar to that of the Public Health Service in the United States.

V. Product Quality:

Apprehension regarding the usability of the 5-10-year-old tetraethyl was eased after the writer sampled and had tested fluid from twenty locations ranging from Hokkaido to Kyushu. Analysis of these samples showed the fluid

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had undergone only the expected normal decomposition and that it could be used safely without alteration in motor gasoline at the specified lead concentrations without harmful effects on car engines.

Reference to the attached progress reports will furnish timely detailed information on the points summarized above. Therefore, the following pages will be in the form of a review of the work accomplished under each of the points as discussed in the foregoing "Summary".

LOCATION AND TRANSPORTATION OF TETRAETHYL LEAD

First reports from Japan indicated some 3011 drums in the country in September 1949. From information obtained from Japanese agencies and the Civil Affairs Section, additional lead was located so that on this date the total TEL discovered in Japan was 4,592 drums of which 4,370 drums were allocated for use. Of the remainder, 133 were buried at sea and 120 were reported stolen and have not been recovered to date.

Credit should be given particularly to the Civil Affairs Section for their discoveries of TEL storage points and their subsequent checks of the locations for cleanliness after the drums had been moved. The attached inspection reports contain references to the dangerous conditions at the storage depots due to tetraethyl lead leakage and also references to deaths from lead poisoning ranging from the use of TEL as a cleaner for auto parts, to use as a cutting oil, or a paint solvent. The contamination of storage points by leakage of the fluid also produced a potential poisoning hazard that was mitigated by a recommendation that all storage areas should be decontaminated after the transfer of the tetraethyl lead.

The writer personnally inspected 56 storage points to recommend safe methods for handling the TEL; a re-check was also made at 19 points after the drums had been moved in order to insure that the areas had been properly cleaned up.

The transportation of the old and weakened drums was a potential source of mass poisoning of the general public due to the early desire of the oil companies to ship their allocations without regard for basic safety principles. This involved the desire to transport leaking drums in less than carload lots and a lack of knowledge concerning the necessity for decontamination of lead spills before release of box cars for other uses. In general the decontamination of the wood flooring in railroad cars would be difficult, if not impossible; thus a subsequent use of the car for shipping foodstuffs would result in the absorption of TEL into the food with consequent poisoning of the ultimate consumer. Shortly after a general survey of shipping methods, a "stop order" was imposed on TEL shipments until inspections and recommendations for proper handling could be made. Subsequently, the "stop order" was removed and the shipments were well supervised and safely

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handled, box car leakage was cleaned up and reported for checking. Incidentally, a check of box cars, in which TEL leakage had occurred revealed the cars had been used subsequently for shipment of foodstuff such as onions and seaweed which could have absorbed TEL and resulted in poisoning of the public. The fact that the oil companies were made aware of their responsibilities and properly decontaminated the cars and reported the leaks for checking probably prevented any poisonings from this source. Nevertheless, it was found necessary to request more prompt notification of leakage from the oil companies so that the carrier could be checked for safety by CTS before release for other service.

BLENDING PLANTS

Inspection of the type blending plants for TEL that the Japanese refiners intended to construct revealed basic faults that would have rendered plant operation dangerous. Accordingly, all refiners were supplied the Ethyl Corporation drawings and specifications for construction of drum type blending plants. All TEL blending plants built in Japan now are basically of this design although it was later found necessary to modify the drawings slightly and construct partial drum mixing plants in order to use the different weight and size drums made in Japan. For the benefit of future users of TEL, there are on file drawings and specifications for blending plant construction along with photographs of completed plants. Also attached are reports concerning the starting up and operating characteristics of the six blending plants now built in Japan. In connection with starting these plants the writer revised and approved the individual refiners' drawings, checked the plants during construction, arranged for medical examinations of blending personnel, held safety discussions with management and workmen, and instructed the workmen regarding the correct procedures for operating the plants. This was in line with the same service method employed by the Ethyl Corporation in the United States in the starting up of new plants.

Listed below are the blending plants started in Japan and their present status.

Refinery	Location	Started	Approved	Approved Start
Toa Nenryo Kogyo Co.	Shimizu	2/22/50	3/14/50	3/14/50
Showa Oil Co., Ltd.	Kawasaki	4/13/50	4/19/50	4/19/50
Toa Nenryo Kogyo Co.	Wakayama	4/28/50	4/28/50	4/28/50
Nippon Oil Co., Ltd.	Yokohama	5/25/50	6/21/50	6/21/50
Nippon Oil Co., Ltd.	Kudamatsu	6/23/50	6/23/50	6/23/50
Maruzen Oil Ltd.	Shimotsu	6/26/50	6/26/50+	6/26/50+
Mitsubishi Oil Ltd.	Kawasaki	--	7/7/50	--
Koa Oil Co. Ltd.	Marifu	--	6/25/50++	--
Nippon Oil Co.	Akita	) Selected plant site, discussed and		
Nippon Mining Co.	Funakawa	) furnished plans and specifications.		

++Plans and construction approved, plant to be completed about 7/30/50.
+Qualified approval, plant to start using TEL under Dr. Akatsuka's supervision in July.

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The operation of the completed plants is now on a safe basis and the plants are expected to continue under such operation due to the safety and medical inspections that will be made quarterly on an unofficial (gratis) basis by Dr. K. Akatsuka, the Japanese Medical Consultant to the Ethyl Corporation. If it is desired to have this service continued indefinitely, Dr. Akatsuka's inspections should be changed to an official basis until the responsibility is assumed by an importer, or domestic, supplier of tetraethyl lead.

PUBLIC HEALTH AND WELFARE

Work was initiated with the Public Health and Welfare Section of SCAP that resulted in the drawing up of a draft for a control law by the Japanese Ministry for the manufacture, shipment, mixing, and handling of tetraethyl lead compound and leaded gasoline. Previous conferences resulted in the writing of the attached "Draft for the Revision of the Control Law on the Business of Poisonous (compounds) or Powerful Agents" with relation to tetraethyl lead. A subsequent conference July 6th will complete the revised draft which will be presented to the Japanese Diet for passage during the current session. It is felt this law will direct the manufacture and handling of tetraethyl lead so that no further work will need to be done with this section unless the manufacture of the compound is resumed in Japan.

Reference to the attached draft "Revision of the Control Law" will show that most of the points of hazard in handling TEL are covered; however, some changes will be made from a medical standpoint through discussions with Dr. Akatsuka, Medical Consultant to the Ethyl Corporation.

Because the wide distribution of the drums of tetraethyl lead had created a general public health hazard, the Japanese language radio broadcast was made for seven days starting 6/24/50. It is hoped this message will reach sufficient people so that it will result in the discovery of the remaining TEL in Japan and thus remove the poisoning hazard.

Draft of Message by Radio

(Broadcast at the time exclusively appointed
for the official announcement by the Government)
The Ministry of International Trade & Industry

"Since the war ended, numerous quantities of tetraethyl lead liquid have been located throughout the country, which the Japanese Army and Navy had been using during the war for the purpose of making aviation gasoline. They have usually been found packed in drums, each being made stronger bound by a couple of iron bands. The general properties of TEL liquid are: dark blue in color like ink, having a peculiar odor and a

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high toxicity.

It is because of its high toxicity that the general use of TEL is strictly prohibited except as additive to gasoline, operation of adding it to gasoline being made only under a close surveillance by the government.

Now that the oil companies in Japan are now in the process of buying the whole lots of TEL liquid existing in Japan.for the purpose of blending gasoline, it is requested that those who have hold or custody of TEL lead apply to their convenient oil companies for the sale of their keeping.

It is further requested that those who are aware of the location but have no hold or custody of TEL will promptly report to their prefectural governments or their convenient police stations and let them know the quantity, location and the owner of the TEL liquid.

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MANUFACTURING PLANTS

The manufacture of tetraethyl lead in Japan was stopped by the bombing of three plants and the end of the war which halted the manufacture of aviation gasoline. The manufacturing plants thus were left with much equipment which had been contaminated by the tetraethyl lead compound and intermediate products. Subsequently some of the equipment was converted to the manufacture of other products such as: dye, food, and medicine either without decontamination or with possibly incomplete cleaning and with inadequate methods for testing. At some of the bombed plants the identity and potential poisoning hazard of the equipment was not recognized and the equipment was sold or scrapped thereby presenting the opportunity of poisoning workmen who were ignorant of the dangers to which they were being exposed.

The conversion of equipment to the manufacture of medicine or food could result in mass poisoning of the consumer unless the equipment was completely decontaminated. Following decontamination, the equipment should be tested to insure that the work has been done thoroughly before the equipment is converted to other service, or handled without complete protective equipment. In the past, the Japanese tetraethyl lead manufacturers have employed various methods of decontamination, some of which may not have been effective. They have omitted testing for complete decontamination, or have employed testing methods that may have been inadequate or inaccurate.

Decontamination and testing methods are discussed below; attention is also directed to the attached reports on the manufacturing plants in Japan.

DECONTAMINATION

Decontamination is the rapid conversion of tetraethyl lead to other lead compounds which are less dangerous and more readily eliminated. The conversion of the liquid lead compound to a solid reduces its capacity to vaporize or penetrate the skin and renders it more or less soluble in water, thus allowing it to be diluted to harmless levels of concentration. Such conversion can be accomplished by chemical means and by burning. The job of decontamination is not completed until all tetraethyl lead has been converted to inorganic lead salts. While the incomplete conversion to intermediate organic lead compounds will reduce the hazards of inhalation or absorption, these compounds also must be handled with care as they are an irritant to the skin and under suitable conditions they will react to again produce tetraethyl lead, thereby recreating the

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original hazard. Complete decontamination is normally accomplished by burning thoroughly, or by providing such an excess of the decontaminating reagent that complete decomposition of all organic compounds is assured.

1. Decontamination by Burning. The simplest and perhaps most effective decontaminant is fire. This is accomplished by placing the object on a hot fire (so the fluid will be consumed and not merely evaporated) and burning it thoroughly throughout. The burning should be carried out where no hazard to persons or buildings will be created by the smoke that is produced. Tetraethyl lead should never be burned unless diluted with at least 10 volumes of kerosene; otherwise, a violent reaction may result.

The Hodagaya Chemical Company at Koriyama has constructed a furnace of a size large enough to decontaminate a 1,000 liter autoclave. This furnace apparently operated satisfactorily although the company employed no method for testing the completeness of decontamination.

2. Chemical Decontamination. All of the decontaminants for tetraethyl lead must be used in the recommended dilutions; otherwise, explosive reactions and fire will result.

Decontaminating Agents

Reagent	Solvent Concentration
Potassium permanganate	5% (2 lbs. in 5 gal. of water)
Sulfuryl chloride	10% (10% volume in kerosene)
Calcium hypochlorite	Slurry (equal parts with water)
HCl and other common acids	10% (with water and inhibitor)

Care should be exercised while handling all of the above reagents and later information indicates the writer's previous recommendation that potassium permanganate could be used undiluted should be amended. It is recommended now that all reagents be used in the dilutions indicated above. The solid potassium permanganate oxidizes paper, cloth, and other organic materials and may cause active burning. The sulfuryl chloride and calcium hypochlorite solutions should be made up in the open air wearing rubber gloves and goggles; the solutions should be made up fresh as they deteriorate rapidly.

The decontamination of fittings is difficult as the TEL and other organic compounds are entrapped by scale or rust

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which prevents the reagent from coming in contact with the lead; however, most of the scale can be removed by boiling the fitting in 5% sodium phosphate solution for one hour followed by mechanical brushing in clear water. Satisfactory decontamination can then be obtained by the use of 5% potassium permanganate solution. An extremely hazardous condition is created during the phosphate treatment by the vaporization of TEL into the air, hence adequate ventilation must be provided during this part of the procedure.

With regard to the use of inhibited hydrochloric acid, it is recommended the acid treatment be preceded by steaming, flushing with water, and scraping.

After decontamination the equipment should be checked for cleanliness and if any TEL odor remains, it should be recleaned. Before placing equipment in any service making medicine or foodstuff, it should be tested and approved for such use by a competent authority on tetraethyl lead. Since sixteen deaths occurred in TEL manufacture during the war years, the service of a medical authority on tetraethyl lead should be employed in the event this industry is ever reactivated in Japan.

The present condition of the plants is as follows:

1.	Nippon Soda Co. Nihongi (unbombed)	(36 autoclaves converted to (medicine, etc., manufacture ((37 autoclaves still largely (intact, contaminated.
2.	Hodagaya Chemical Co. Koriyama (badly bombed)	(11 decontaminated autoclaves (making dye ((87 contaminated autoclaves, (dismantled and damaged.
3.	Mitsui Chemical Co. Arao (unbombed)	16 decontaminated autoclaves making foodstuff, dye, and chemicals
4.	Second Naval Fuel Depot Yokkaichi (badly bombed)	All autoclaves contaminated, damaged and/or sold for scrap.
5.	Third Naval Fuel Depot Tokuyama (bombed)	Plant bombed but equipment partly intact although contaminated and deteriorated.

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Decontaminating Agents, cont'd

It has been suggested consideration be given to the reactivation of TEL manufacture in Japan, or that TEL be imported after the present one-to-three-year inventory of the compound has been used by the oil refiners. Due to the fact that it is not economical to establish the TEL industry in each country where gasoline is manufactured, the TEL needed is usually imported from one of the three export manufactures: Ethyl Corporation, du Pont Corporation, or Associated Ethyl, Ltd. In the case of Japan, the Nippon Soda Company seems to be in the most likely position for any reactivation due to the following:

1. One-half of its equipment is still intact and unbombed.

2. It is close to the center of the oil refining area.

3. Its 37 inactive autoclaves could supply the estimated demand.

4. Its equipment could be reactivated with less expense than that of the other former manufacturers.

Both Hodagaya Chemical and Nippon Soda have estimated what it would cost them to manufacture the aviation tetraethyl lead compound; these approximate costs are compared below:

Hodagaya	.00472¢/cc TEL	79¢/lb.	$560.90/Drum (710 lb. net)
Nippon Soda	.00461¢/cc TEL	78¢/lb.	553.80/Drum
Ethyl Corp. (USA)	.0023¢/cc TEL	38.8¢ lb.	275.98/Drum
Ethyl Corp. (USA)	.0021¢/cc TEL*	35¢/lb.	248.50/Drum

* Approximate current cost in the U.S. for Motor Compound.

Both of these Japanese manufacturers have indicated they would appreciate, or need, the technical assistance and "know how" of one of the export TEL manufacturers in order to reactivate or operate their plants on an efficient basis. From a comparison of the above costs, it can be seen such assistance would be needed and if it were provided the cost could no doubt be reduced considerably. Whether such assistance is feasible, economical, or available is beyond the scope of this report.

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PRODUCT QUALITY

Considerable early concern was exhibited by the Japanese refiners as to whether the tetraethyl lead in this country would be usable after its long storage period under comparatively adverse field conditions. However, field tests of samples and later laboratory analysis indicated all of the fluid tested would be usable without having harmful effects on car engines.

The fluid was tested as follows:

1. Density: Considerable variation in density could have been expected since this property is sensitive to the effects of normal diluents, such as dye, light oil, etc. However, density variation was actually only plus or minus a maximum of 0.020 from 1.745 on any sample tested and in general it could be considered this property was subject to wide variation as the five manufacturing plants had differing specifications and some differences in the diluent used.

2. Color: All samples tested had an intensity at least equal to standard at the 3cc TEL level.

3. Appearance: All samples tested were clear in solution with gasoline at the 3cc TEL level, an indication that little or no precipitation would occur upon mixing with gasoline at the refinery.

4. Total Lead: No sample tested varied more than 4% from a total TEL weight percent of 61.41.

5. Decomposition: The potential sludge of the fluid is composed of tri-ethyl lead bromide which may be considered as soluble in nearly all organic liquids including tetraethyl lead. Hence, the fact that solid sludge was not visible in any quantity in the drum was not a valid indication that no fluid decomposition had occurred. While the concentration of ammonia-soluble lead salts in the fluid is an indication of the extent of TEL decomposition, these decomposition products also exhibit antiknock effects (possibly 75% of TEL), so that considerable decomposition can be tolerated. However, fluid with more than 5% decomposition might form troublesome amounts of sludge in the gasoline. The two fluid samples tested at the Ethyl Corporation in the U.S. showed 1.77 and 3.74 g Pb/100 ml TEL and while this is higher than that of fresh fluid, the compound is certainly usable particularly at the present TEL gasoline concentrations needed in Japan.

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Product Quality, cont'd

5. Scavenger: A variation in TEL content in the fluid will be indicative of some variation in the theories of scavenger (ethylene dibromide) in the compound. However, it was expected that a variation of 0.8 to 1.2 theory of scavenger could be permitted without producing measurable changes in the performance or wear of engines. The samples tested actually varied only between the lesser limits of 0.9 to 1.1 theory from the perfect specification of 1.0 theory; thus, the fluid was safely usable in this respect.

CONTINUED STORAGE

With reference to the stability of the fluid after additional storage time at the refineries, the following factors have an effect on the "aging" of the compound.

1. Exposure of the fluid to air will cause an oxidation reaction producing a soluble lead sludge and a secondary reaction with ethylene dibromide will form tri-ethyl lead bromide (potential sludge), if the amount of available air is limited. If the amount of air is unlimited, the potential sludge is converted to products insoluble in the fluid and actual precipitated sludge is then formed. Therefore, other variables being constant, it can be stated the extent of decomposition will depend on the amount of air available and that the fluid stored in closed drums will undergo slight decomposition from the efforts of the air.

2. Storage time and temperature increase will cause the formation of precipitated sludge in the presence of unlimited amounts of air. Where air is not available, increased temperature merely serves to accelerate the approach to a constant sludge level. In general, the factors of time and temperature (up to 60°C) contribute little to sludging if the fluid is in closed containers. Conversely, they contribute greatly to sludging if the fluid is exposed to unlimited sources of air.

3. The exposure of fluid to light in any form increases sludge formation but since the compound is stored in opaque containers there should be no sludging from this source.

In summary, the Japanese fluid should be useable within the limits of the expected storage period. However, in storage of drums, care should be taken that the drums do not breathe air unnecessarily and the leaking and half-full drums should be used first. The drums should be stored with protection from direct sunlight and the temperature should not exceed 50°C. Also, the fluid should not be transferred to rusted drums because the rust may catalyze and accelerate decomposition reactions. These recommendations of storage conditions have been followed by the Japanese refiners to date.

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CONCLUSION

The following aims were accomplished during the writer's stay in Japan.

1. Inspected 56 TEL storage depots to recommend safe handling procedures.

2. Inspected 4370 drums of tetraethyl lead compound of which 1359 drums were discovered during this period.

3. Supervised shipment of TEL and construction of proper storage at the refineries.

4. Furnished plans and specifications for blending plants at 10 refineries.

5. Supervised complete construction of 7 blending plants.

6. Started the blending of gasoline at 6 refineries.

7. Inspected the 5 plants formerly manufacturing tetraethyl lead and furnished information for handling and decontaminating the idle TEL equipment.

8. Took 20 samples of TEL for testing that proved the compound was within set specifications.

9. Furnished health and safety information to the Public Health and Welfare Section as the basis for drawing up suitable public health regulations.

10. Trained Dr. K. Akatsuka in all aspects of Safety relating to TEL so that a Japanese national will be available to carry on after the writer's departure.

11. No accidents or deaths occurred during the transportation or blending of the compound although many reported, and unreported, poisonings had occurred previously.

12. Information was furnished the Civil Transportation Section regarding the proper methods for handling the shipment of tetraethyl lead.

RECOMMENDATIONS

1. The search for additional hidden tetraethyl lead should be continued until all of the compound has been discovered and safely transferred to authorized users.

2. All blending of the compound should be confined to oil company refineries where standard approved blending plants have been built.

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3. Laboratory handling of tetraethyl lead should be limited to those labs having the proper type fume hoods.

4. As previously recommended, public health regulations should be enforced controlling the handling of the TEL compound and the leaded gasoline.

5. Consideration should be given to the medical and safety supervision of the tetraethyl lead compound during its manufacture and use. Unless the Japanese Government employs other competent supervision, the present Japanese Medical Consultant to the Ethyl Corporation, Dr. Akatsuka, will continue this duty as a public health service of the Ethyl Corporation. However, this financial burden cannot be continued indefinitely and should eventually be assumed by a domestic or exporting TEL manufacturer when present stocks of the compound are exhausted.

6. Safety can be assured in all phases of handling the compound if the recommendations are followed as outlined in the booklets listed below (Copies of these have been distributed to all refiners and other interested agencies in SCAP and the Japanese government).

a. Regulations for Handling and Mixing "Ethyl" Antiknock Compounds.

b. Specifications - Drum Blending Installation.

c. Requirements for Construction of Mixing Installations Handling "Ethyl" Antiknock Compound.

d. Ethyl Corporation drawings:

(1) Partial Drum Mixing Installation - 250B.

(2) Drum Mixing Installation - 200C.

(3) Schematic Piping Layout and Method for Adding Dye to Gasoline - 900D.

(4) Regulations Governing the Transportation of Motor Fuel Antiknock Compounds.

e. Requirements for Construction of Laboratory Hoods handling "Ethyl" Antiknock Compounds.

f. Use and Handling of Tanks That Have Contained Leaded Gasoline by Those Not Familiar with Petroleum Industry Safety Practices.

g. Hazards in Entering Tanks That Have Contained Leaded Gasoline.

h. Cleaning Petroleum Storage Tanks, Manual 1-B.

i. Plus miscellaneous information on: In-Tank Mixers, Metal Thickness Testing, and Devices for Removal of Drum Bungs, etc.

C. D. Carter

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A P P E N D I X A

Reports on Inspection of Tetraethyl Lead
Storage Locations

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Report on Inspection of Tetraethyl Lead Storage Locations

I. Sumidagawa, Tokyo.

On hand: 319 Full drums (12 gauge original containers)
326 Half full drums (light 16 gauge non-standard)
95 Empty drums (punctured containers)
650 Total drums to be moved.

Drums are double tiered without blockage and many have the bungs turned down. The light, 16 gauge, drums have two end bung holes and are stored on their sides. The drums have been repainted a black color making it difficult to detect possible leakage of the blue fluid. The empty, punctured, drums contain tetraethyl lead sludge residues which are still giving off alkyl lead odors. A lead dust hazard is also present from this source. It is probable that on warm and/or still days a lead vapor hazard exists in this vicinity.

The above conditions constitute a potential hazard to workmen in the vicinity until the sources of hazard are removed.

During September the 95 drums now empty were opened by puncturing the shell and during this operation and the hand pumping of the tetraethyl lead into new drums spills of lead fluid occurred into the soil. This area had been covered with 2 to 4 ft. of cinders to minimize lead vapor inhalations. Although an inspection at the lead spill level showed no lead hazard this date, a source of hazard may still be present under different weather conditions.

II. Kanto Motors, Tokyo

Lead on hand: 539 Full drums

Drums at this location are of both Japanese and Ethyl Gasoline Company manufacture. The drums are three tiered on their sides without regard for bung position and with no blockage between drums. The drums show same signs of outer corrosion and blue stain areas on the sides and around the inner end chimes indicate where leakage has occurred. At least 8 drums that had leaked were located by a casual scanning. Although a lead odor could be detected a few inches from leaking drums, there was no odor in the general area. It is entirely possible odors are detectable on still warm days. This will constitute a potential hazard to workmen in the vicinity until decontamination procedures are carried out.

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III. Joaco, Azuma Island
Lead on hand: 452 full drums
857 Glass ampoules 265cc each

Drums at this location are stored in a cave, open at both ends, with signs of warning in Japanese. The drums are stored on their sides with bungs up in two tiers with wooden 2 x 10 blocking between the tiers. The drums are spaced on the two sides of the cave with 9 leaking drums segregated toward one end of the cave. These drums appeared to be in fair condition although in some instances there seemed to be a bulging of the head that may be an indication of pressure build up. The glass ampoules crates are stored toward the middle of the cave and showed no visual signs of leakage. The ampoule is packed within a metal slide top round container, the ampoule being protected from breakage by excelsior and cardboard cylinders. The metal can is labelled with Japanese printed instructions concerning the mechanics of mixing the lead into a drum of gasoline and, in considerable detail, concerning correct safe handling procedure mentioning gas mask and protective clothing. Personnel on the island mentioned the presence of lead odors from the cave on still days. It is apparent decontamination will need to be carried out here after removal of the lead. Possibly this can be handled by removal of contaminated wet sand on the cave floor. In view of the small volume of TEL involved, the glass ampoules should be disposed of at sea. The probable boat method for drum transportation is by boat directly to some refinery on the coast.

IV. Yosisawa (Yokosuka) Yukakogyo
Lead on hand: 96 full (apparently) drums
1 empty drum (sides broken)
97 total drums

The drums at this location are scattered haphazardly and they show signs of rough handling such as dents and bulges. At least two drums showed signs of leakage, others appeared to be not quite shell full, while others had a solid echo upon sounding as though they might contain some solids. Some of the Japanese-made drums had had their outer bungs removed and the inner bung showed seepage of fluid. Some of the Ethyl Corporation drums had pieces broken from the round outer bung as though an attempt had been made to open them with a pipe wrench. Concerning the empty broken drums, the overseer stated his employer had opened a leaking drum intending to use the contents for the manufacture of paint, but upon opening, and mixing, there was an evolution of yellow, orange, and blue, powder or smoke and the tetraethyl lead disappeared. The broken drum and other drums should be handled with care during transfer with the former being disposed

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of at sea while avoiding the rust and sludge residues remaining within the shell. The area then should be checked for contamination and if any is found appropriate procedures should be followed.

Recommendations:

1. All carriers used in transportation should be checked for leakage prior to release.

2. That decontamination of soil be carried to completion immediately after the drums have been moved from the storage depot.

3. That leaking containers be given special handling and if moving is too hazardous, they be disposed of at sea.

4. That the drums at these locations be handled only by instructed personnel under the supervision of individuals familiar with the lead hazard and capable of handling any emergencies that might arise.

5. That the shipments be made by rail or water, but not by contractors' truck unless each truck load of drums is followed from shipping point to destination by the competent supervisor familiar with TEL.

6. That every reasonable precaution be taken in handling so that the drums are not dropped, crushed by hooks, pierced by sharp objects (such as drum skids), or allowed to slide or roll in transit

7. That the personnel handling be equipped with ropes for moving and lashing drums and dunnage and blockage to prevent rolling of drums.

8. That gas masks containing activated charcoal be available in case of a spill of lead. Also, rubber boots and gloves and suitable clothing for this purpose.

9. That kerosene or similar diluent be available in case of leakage, or a decontaminant such as $KMnO_4$.

10. Under no circumstances should the drums be shipped in the same car with other material and particularly not with foodstuffs.

11. That the punctures in empty drums be temporarily plugged, or covered, during handling and shipment to prevent lead dusts from escaping. It is recommended these drums be disposed of by sinking in deep sea water.

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12. It is recommended that Ethyl Corporation's booklet be followed, "Regulations Governing the Transportation of Motor Fuel Anti-knock Compounds" dated December 1948.

13. Any future indication of lead odor at these locations should be reported so that a check may be made with an Ethyl Lead-in-air Analyzer to determine whether decontamination of the lead spill area should be carried out.

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Inspection of TEL Drums

Sakaare (Kofu)

On hand: 170 full and half-full drums
16 empty (punctured) drums

On this date (2/2/50) transfer operations were in progress under the supervision of a Toa Nenryo representative. Two box car loads of 16 drums each had already been shipped the Toa Nenryo, Shimizu refinery and were due to arrive at that point this date. The supervisor of loading apparently had basic knowledge on the shipping problem as the workmen were equipped with rubber aprons and gloves and with gas masks and new canisters dated December 1949. (The fact that this safety equipment was very apparently donned just prior to our arrival should not detract from the fact that the supervisor was at least aware of the lead hazard.) Although the drums had been loaded in the box cars so that movement forward or backward would tend to cause the drums to roll, this effect was mitigated by blocking both runners of each drum and by placing wooden dunnage between the two drum sections. To further decrease shock in shipment, each drum had been wrapped and rope-tied with straw matting. Prior to shipment, the drums had been stored in an unfenced area next to the roadway and about 150 feet from the railroad station. The contents of 16 leaking empty drums had been transferred to new drums at this location and these empty drums, some with gaping holes, were still at roadside where they constitute a hazard to children who play among them and to the general public passing by. A patch of ground may have been contaminated at this point by leaking drums and it was recommended to the shipment supervisor that this ground be decontaminated by the use of the chlorinated lime he had at hand.

Although it was recommended, to the shipment supervisor, that the 16 leaking drums be moved at the same time as the full ones,

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Inspection of TEL Drums, cont'd

it was later discovered this had not been done and it was necessary to make another shipment before this handling was safely concluded.

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Inspection of TEL Drum Storage at Nagamachi, Sendai

On hand at this point: 242 drums of Japanese and Ethyl Gasoline Corporation manufacture, also one empty Ethyl drum whose contents due to leakage had been transferred to a light weight oil drum in December.

Drums here were in good condition and had recently been painted black. The drums were correctly stored bung up in single tiers on 4 x 4 blocking except for eight drums left haphazardly at the bottom of the sloping ground. Drums are under control of Closed Institution Liquidation Corporation.

Hazards in Case of Leakage:

1. Workmen in an adjacent brickyard.
2. A field of grain planted immediately next to the drums.
3. Sloping storage ground that will make loading difficult.

Recommendations:

1. That drums be moved with care from ground level to carrying vehicle using a drum skid and ropes.

2. That the area be inspected for leaks after drum removal.

3. Recommendations were made in person to Mr. Kayanoki, drum handling supervisor of Toa Nenryo Co., Shimizu, whose refinery has been allocated these drums.

4. The booklet should be followed: "Regulations Governing the Transportation of Motor Fuel Anti-Knock Compounds."

Sampling:

The bungs could not be removed from any of the standard drums using a combination bung wrench or a 36" pipe wrench and helper. Two fluid samples were then taken from the drum placed in service in December. This drum was under some pressure which escaped as the bung was loosened. The liquid level was about 6" below the

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top of the drum. Floating atop the fluid was a thin skin of liquid that was probably water containing same sludge-like emulsion, the first sample taken contained some of this material. The second sample showed a visually good blue color and appeared in clear condition. The density was taken as 1,7830 at 5°C which gives a corrected density of 1,7565.

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Inspection of TEL Drum Storage
Otaru, Hokkaido

A total of 65 drums of tetraethyl lead are stored here in the warehouse custody of Standard Vacuum Oil Company. There were 28 drums of 200 liter size and 37 of 288 liter size. Four of the latter size drums sprung leaks and the contents were transferred to four 50 gallon standard drums. This leads to the assumption that there may have been TEL leakage to the extent of 352 liters (88 x 4). The leakage could have been greater since the 50 gal. drums were not filled shell-full. However, the leakage may well have been much less since it was frequently the practice of the Japanese not to fill the 288 l. drums shell-full. The Akikoro godown in which the drums are stored "on end" has a wooden slat floor placed above the soil so that whatever TEL leakage occurred was certainly into absorptive material.

Samples:

An air sample taken at minus 2°C showed 1 microgram of Pb/cu ft. of air although this reading could probably be doubled due to an imperfect development of color.

A sample of moss like soil was extracted with CCl_4 and precipitated with bromine. Since this sample showed only a trace of turbidity, it is probable it was not secured from an area where leakage had occurred.

A sample of lead taken from a drum to which fluid had been transferred had a good color, showed no visual precipitation and had a density of 1.782 at -20°C (corrected 1.744). Average yearly temperature for the city of Otaru is 7.7°C according to the weather station. Sample will be analyzed for total lead and ammonia soluble salts.

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Inspection of TEL Drum Storage, cont'd

Recommendations:

1. In spite of low lead tests on the air and soil samples, the warehouse area (in which other petroleum products are stored) should be considered as hazardous due to the fact that it is certain some fluid leakage occurred. Therefore, future work in the warehouse should be kept to a minimum until the drums can be moved and the wood flooring and soil beneath the drums can be removed and destroyed by burning (wood) and dumping (soil) in the sea which is immediately adjacent. If this work cannot be carried out in the near future, and lead odors become apparent, recommended safety equipment should be worn by workmen in the godown pending the removal of contaminated materials.

2. The 4 empty drums, whose whereabouts are unknown, should be traced and recovered for disposal by sinking at sea.

3. The drums should be removed and the warehouse checked for lead hazard by the informed supervisor of the refinery to whom the lead has been allocated.

4. The above recommendations were discussed in detail with the warehouse supervisor of Standard Vacuum.

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Inspection of TEL Drums at Akita
Chuo Trucking Co.

Fifteen tetraethyl lead drums not previously listed were discovered at this location by the Economic Investigation Board. Upon learning of the existence of the drums a special stop was scheduled to permit this inspection. It was learned the 15 drums had been in storage at this trucking company's garage for about four years. The drums are of Japanese manufacture; they are stored "on end" along the back wall of a garage which has one wall open to the air at all times. In the writer's opinion 13 of the drums containing TEL have probably leaked. While there were some trace stains at the bungs, the principal source of leakage appeared to be from the drum ends and around the seams. There were signs of leakage in the dirt above the concrete floor and on the top of the drums. In one corner, earth had been thrown up around the drum bottoms almost a foot high - possibly to blanket leakage odors. As one drum was placed on its side to enable the writer to take a sample, TEL fluid oozed from the "top" end and leaked to the floor. Without taking a sample the drum was immediately up-ended which caused a hiss of vapors to bubble through the

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corroded porous end. Two other TEL drums at this point are segregated and said to contain a mixture of TEL, alcohol, and gasoline. These drums were not observed to be leaking, but inspection was difficult as they were frozen to the ground.

Company officials stated there had been no illness among their employees, but admitted some men had been discharged in the past year and recently. There is a further source of health hazard due to the fact that sleeping quarters for workers are directly behind the drum area with an open door and window opening to the source of possible lead vapors.

Sampling:

An air sample was taken adjacent to the area which showed 3 mcgms pb/cu ft. air at a minus 2°C. Also, a sample of soil was scraped from the concrete to be tested later for TEL by the CCl_4 extraction, bromine precipitation method. Determination of the amount of lead in the soil sample showed more than 1%, indicating a hazard exists and that safety measures should be taken. While the comparatively low lead-in-air sample tends to bear out the story of no lead poisoning to workers, it is the writer's opinion the lead vapor concentration will be greater when temperatures rise and that since there is a possibility workers could spend more than 8 hours per day in lead contaminated atmospheres (due to sleeping quarter proximity), a poisoning hazard exists at the present time. Therefore, the following recommendations:

The following points were covered fully in conversations with trucking officials this date.

1. Drums should be removed from this location at the earliest possible date either by sinking in the sea (some 5 kilometers away) or by transferring to new drums under informed oil company supervision and while following approved handling procedures. Following the transfer to new drums, the TEL drums should then be disposed of at sea near Akita and not carried in box cars, or other vehicles, which may be contaminated by leakage.

2. The soil and concrete already contaminated by TEL leakage should be treated with $KMnO_4$ crystals or chlorinated lime. After allowing several days contact time with the reagent used, the area should be thoroughly flushed with diluent and water.

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3. Should TEL vapors become apparent after the above chemical treatment, the contaminated concrete should be dug out and disposed of by burying or at sea. The vehicle used in transporting the concrete should be protected from contamination. The workmen should be protected during handling.

The above recommendations are for the purpose of protecting the health of workers and the public who may be exposed to hazard through ignorance of the potential danger.

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Inspection of TEL Drum Storage
Showa Oil Co.,
Niigata

The inside, warehouse, storage of 102 drums of TEL at this location was in the best storage condition of any inspected to date. The drums had been repainted red but showed few dents and no signs of leaks. Further, the refinery management and workmen showed an acquaintance with the lead hazard and ability to handle correctly.

Inspection was also made of the pump building and area used during the war for blending. There was no indication of TEL leakage in evidence on this date.

Samples:

Two samples were secured from drums by the refinery lab technician correctly attired in safety equipment from the refinery storeroom. Samples had good color, no visual sign of sludge and had a corrected specific gravity of 1.734.

Recommendation:

Normal Safe Handling Procedures should be followed during the shipment of the drums to the refinery receiving the allocation.

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Inspection of TEL Drum Storage,
Nippon Oil Co.
Kashiwazaki

On hand in this refinery's warehouse stored bung up are 58 drums of tetraethyl lead of which one is nearly empty due to the making of small blends of from 4 to 20 liters size. There was no

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visual evidence of fluid leakage, but a slight musty odor in the air caused the writer to take an air sample which showed 4 mcgms pb/cu ft air, or just within the safe breathing limits for a single 8-hour exposure. It is probable trace stain-leaks and leaking bungs plus inadequate ventilation are responsible for the lead vapors in the air.

Recommendations:

1. The drums should be moved from this location at the earliest possible date in order to avoid exposure of workmen to TEL vapors. Safe Handling Procedures should be followed.

2. Exposure of workmen within the warehouse should be kept to less than a continuous 8 hours per day.

Samples:

Fluid samples, top and bottom, had corrected densities of 1.725 (lowest taken to date). A one liter sample was taken to be shipped to Ethyl Corporation's Detroit laboratory for analysis.

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Inspection of TEL Storage
Motomura Island, Misumi

Full drums	(2001.)	23
" "	(2881.)	9
Empty drums	(leaked)	11
Total		43

The TEL had been transferred from the leaking drums to new light weight drums. From the appearance of one empty drum considerable TEL leakage must have gone into the soil. The exact area of lead contamination could not be determined at this late date so it was recommended the small area, where the drums were stored, be roped off and not be used for growing vegetables.

Empty drums should be sunk at sea. The light weight drums with end bungs should be handled with care and stored "on end" during shipment.

Sample:

A fluid sample was of good color with no visible sludge; density was 1.760 at 12.5°C giving a corrected reading of 1.746.

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Inspection of TEL Storage
Mitsui Chemical Co.
Arao

Full drums: 35

Drums in relatively good condition, stored bung up and blocked. The enclosed warehouse in which the drums were stored showed a lead-in-air content of 8 mcgm per cubic foot of air indicating same vapor leakage was probably escaping from the drums which in some cases had the outer bung removed. The boards should be removed from the store room windows to further ventilate the building during the removal of the drums.

Sample:

1. A one liter fluid sample was secured to be shipped to the Ethyl Corporation for a complete analysis to determine the extent of decomposition that has occurred during storage.

2. A sample of fluid was taken from the bottom of the drum to be checked for possible sludge-like decomposition products. A portion of this sample will also be sent to the Ethyl Corporation for analysis.

3. An average sample had a good color with no visible evidence of precipitation. This sample had a specific gravity of 1.764 at 13.5°C, or a temperature corrected reading of 1.752.

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Inspection of TEL Drums at Izozaki (Sasebo)

#1 Cave	53 Drums	(1-½ full, some leaking)
#2 Cave	78 Drums	(some leaking)
Stolen from #1 Cave	15 Drums	(Recovered and held by police at Uku-shima, Goto Islands)
Stolen from #1 Cave	3 Drums	(Last offshore, visible below water)
At blending Plant	1 Drum	(Approx. 1/3 full)
Total	150 Drums	
Stored, warehouse	6 Drums	(Empty)

Drums stored in #1 Cave included 3 leaking drums; one, with five holes corroded through the shell, was approximately half full. The holes in this drum, and one other leaking drum have been plugged with corks, but a distinct odor of TEL was apparent

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upon entering the cave. Although the cave was ventilated by an air duct running from the back of the cave, an air sample taken inside the cave showed 10-12 mcgms pb/cu. foot of air. Since the drums were double tiered, and the cave was dark, other leaking drums also may have leaked part of their contents into the floor. After an hour's effort failed to remove the inner bung from any of the drums, a fluid sample was taken by inserting the sampling pipette through one of the holes in the most corroded drum. This fluid sample had a corrected density of 1.730.

The number 2 cave also contained leaking drums and handling will be complicated by a cave-in of the earth from the roof and sides. Care should be taken that the broken roof beams do not puncture drums during removal. Two inches of water on the cave floor will also hamper drum handling. It is probable this flowing water also tended to blanket some TEL leaks because an air sample from the cave showed 10-12 mcgms Pb/cu.ft. of air although an even higher reading might be expected. The drums at this location are double tiered and badly tumbled about by the cave-in. The writer was unable to inspect drums at the extreme back of the cave because of the danger of the roof collapsing. The condition of these drums is, therefore, unknown.

It is recommended that the removal of drums from both caves be handled while wearing gas masks and protective clothing. The contents of leaking drums should be transferred to full drums before loading aboard ship for transshipment by rail. Empty drums should be disposed of at sea.

During the past year, thieves broke into the #1 Cave and stole 18 drums of TEL. Upon being surprised by a guard, they apparently pushed off hurriedly from shore during which maneuver they lost 3 drums overboard in the sea just off shore. Although these 3 drums are visible from shore at low tide, it is the writer's opinion the drums should be left in their present position rather than risk the hazard of leakage that would be incurred with their raising. The thieves escaped with the remaining 15 drums but were later apprehended on Uku-shima of the Goto Island group. The drums are now in the open-air custody of the island police and may be inspected by the writer at a later date.

On this visit an unreported TEL gasoline blending plant was discovered. The plant was of a comparatively safe design using an eductor, weighing scale, and swing line. A part full drum on the operating platform was apparently abandoned at the end of the war. This drum also should be moved at the time of moving

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Inspection of TEL Drums at Izozaki, cont'd

other drums from this location. It was recommended that the contaminated blending plant piping be disposed of at sea.

Any empty drums at this location should be disposed of at sea. The caves should be inspected for TEL contamination after removal of the drums and appropriate decontamination procedures followed.

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Inspection of TEL Drums at Saitozaki

On hand 3/5/50:

236 Drums	(200 liter drums of which 229 are full and the remainder contain variously, 36 l, 55 l, 72 l, 90 l, 108 l, 2 of 126 l.)
6 Drums	of 250 l. size, (1 containing 130 l.)
242 Drums	Total. (47, 792 liters)
26 Drums	Empty, broken, and punctured.

The drums here include 26 new light weight drums which should be shipped and stored "on end, bung up." The soil at this open air storage location has absorbed considerable TEL fluid from the badly broken and leaking drums. Also leakage occurred during the transfer of fluid to new drums. Appropriate decontamination should be carried out on the soil after the removal of the lead drums. The empty drums and the broken drum sections should be disposed of at sea while wearing safety equipment and dust respirators. Any lead dusts should be wetted down during this handling.

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Inspection of TEL Drums at Kokura

On hand 3/6/50:

39 Drums	(250 liter size)
4 Drums	(288 liter size)
2 Drums	(200 liter size)
1 Container	(54 liter size)
9 Drums	(250 liter size)

Total 54 Drums plus one empty

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Inspection of TEL Drums at Kokura, cont'd

The drums are stored, single-tiered, along one side of a warehouse building. Eleven drums showed signs of leakage at this time. It was decided that one drum might contain sludge because of its bulged appearance and solid sound. This drum was up-ended for sampling but upon opening the bung, about a gallon of fluid overflowed onto the top of the drum. Apparently it was the shell-full condition of the drum that caused the solid sound rather than sludge because a fluid sample had a good color with no signs of excess precipitation and with a density of 1.743 at 18°C (1.728 corrected, 0.002 off specification limits, but not too bad). The excess fluid was transferred to a bucket containing kerosene and the whole disposed of at sea. The drum was then decontaminated with copious quantities of $KMnO_4$ solution.

It was recommended the contents of leaking drums be transferred to new drums before shipment. The empty drums should be disposed of at sea. The contaminated soil should be buried and decontaminated with chlorinated lime slurry.

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Inspection of TEL Drums
Hikoshima

On Hand 3/7/50:

502	drums (Standard type)
158	drums (New, light weight, with two end bungs)
660	drums Total
167	empty drums (including broken and part drums)
827	Total empty and full drums

This is the largest quantity of TEL stored at any location in Japan. It is also the location at which the greatest danger exists due to past leakage of TEL into the soil, numbers of broken drums, and present number of leaking drums. At least 75% of the 158 light weight drums were leaking from one or more of the bungs. The writer directed that these drums be stored on end without delay, subsequently lead stains should be removed with a diluent and all bungs made tighter.

A definite TEL odor pervaded the entire area in spite of the cool weather and a good wind off the sea. Blue stains from TEL spills are evident at many points as well as heavy stains on many of the wood 4 x 4's on which the drums are stored. A strong lead odor persists around the corroded, empty, and broken drums.

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Inspection of TEL Drums, Hikoshima, cont'd

It was recommended that all contaminated wood be destroyed by burning. Wherever possible the contaminated soil should be removed and thrown into the sea. If this is not possible, the soil should be decontaminated with one of the common reagents on hand. The empty drums should be disposed of at sea. Great care should be exersized in all handling of these drums during shipment.

A fluid sample taken from one drum had a specific gravity of 1.743 at 12°C (1.728 corrected).

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Inspection of TEL Drums at Nippon Oil Co.,
Kudamatsu

On hand 3/7/50:
84 Drums

Drums stored here are outside of the refinery area, but otherwise correctly stored bung up in an open roofed warehouse. One light weight drum appeared to be under considerable pressure with its ends bulged beyond the drum rims. One other drum had leaked a small amount of fluid into the soil. It is recommended that the contents of the leaking drum and bulged drum be transferred to new drums before movement from this location. The contaminated soil should be decontaminated by removing it to the adjacent field and burning with an excess of kerosene.

A fluid sample taken from one of the light weight drums had good color, no evidence of sludge, and a specific gravity of 1.743 at 18°C (1.738 corrected).

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Inspection of TEL Drums at Osaka

Storage locations in Osaka:

1.	Osaka Prefectural Office	2 drums (1-½ full)
2.	Higashinari-ku (Taisho-Sangyo K.K.)	10 drums (1 open, ½ full)
3.	Miyakojima-ku (Nippon-Taiyo K.K.)	15 drums (1 leaking)
4.	Fuku-machi	19 drums (3-½ full, 1 bad leak
5.	Taisho-ku	225 drums (2 leaking)
	Total	271 Drums

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Inspection of TEL Drums at Osaka, cont'd

1. Prefectural Office: the 2 drums stored "on end" in the police garage were confiscated after an investigation into four deaths at an Osaka car repair shop showed the deaths had been caused by using tetraethyl lead, diluted with gasoline for washing car parts. The poisonings occurred during May or June of 1949. It is thought the TEL was procured by an oil jobber from the Tokuyama Arsenal and it was purchased by the repair shop for washing car parts because it was cheaper than gasoline.

2. Higashinari-ku: the 10 drums at this location were stored "bung up" along the side of a dwelling place and adjacent to a residential street. The drums are passed daily by adults and are within the play area for children. The drums had been brought to this location from Nagoya about two years ago and, although under the nominal surveillance of the police, the bungs had been removed from one drum a month ago and about half of the fluid removed. A very strong TEL odor was apparent in the vicinity and the writer directed that the drum be plugged and capped immediately to protect the public (at least 35 people were gathered around the drums during this inspection). It is recommended that the police maintain a close guard over these drums and that they be moved at the earliest possible time.

3. Miyakojima-ku: 15 drums at this location are under police supervision having been formerly handled by the Muki Oil Co. who had intended to use the TEL for makingpaint. The drums are stored inside an enclosed yard in which a storeroom and family dwelling exist. At the time of inspection the family's bedding was spread on top of 6 TEL drums where it was airing. The writer checked the bedding and requested the drums no longer be used for this purpose. One drum showed stain leaks at the runners and it was directed that the contents be transferred to a new drum before shipment.

4. Fuku-machi: the 19 drums at this outdoor location include 2 part-full drums recently moved from Kobe of which one has a bad end leak. According to Maruzen Oil Company who handled the transfer, no leak occurred in transit. Three other drums at this location showed leak indications around the drum runners. It was recommended the fluid be transferred from leaking drums to new drums before transshipment.

5. Taisho-ku: The 225 drums stored here are roped off and posted with warning signs. Drums are double tiered, bung up, nine have broken runners and two have stain-leak indications. There were no signs of TEL leakage into soil at this date, but the supervisor in charge of subsequent shipment should make a visual inspection for signs of TEL in soil contamination after the drums have been moved. The contents of leaking drums should be

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Inspection of TEL Drums at Osaka, cont'd

transferred to new drums before re-shipment. Empty drums should be kept under the control of the shipping company and eventually destroyed at sea.

The apparent mishandling of TEL, through ignorance, at some of the above locations is an indication of the dangers that may exist at other locations where the tetraethyl lead has not been reported to the Japanese Government and where its potential hazard is not recognized.

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Inspection of TEL Drums at Nippon Oil Co., Nagoya

On hand 3/13/50:

29 full drums (6 new, light weight drums)
7 empty drums
36 total

Storage at this location represents a potential hazard to operating personnel due to lead vapors from leaks into the soil. There is a possibility one full drum was lost through leakage since there are 7 empty drums and only 6 new drums to which the contents were transferred. On this cool, wet day the odor of TEL was very noticeable but may have been due partly to odors from holes in the empty, punctured, drums. It is recommended all of the soil in the storage area be regarded as contaminated and that the top soil be picked up and buried at sea. The remaining soil suspected of contamination should be treated with one of the available reagents after the removal of the drums.

A sample of sludge was scraped from within one of the punctured drums. This will be sent to Ethyl Corporation's laboratory for analysis. (The TEL was transferred from the leaking drums 1/14/50.)

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Inspection of TEL Drums at Daikyo Oil Co.
Yokkaichi

On hand 3/12/50:

10 drums (200 liter size)
9 " (250 " ")
3 empty drums (plus approx. 40 empty drums discovered at the railroad depot)
22 total

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Inspection of TEL Drums at Daikyo Oil Co., cont'd

This refinery has told conflicting stories about the source from which they secured their lead drums. In February they had on hand 17 drums (correctly stored outside and bung up), three of these drums were reported to be empty. This date the refinery had a total of 22 drums stored on end and in addition 5 extra drums of which one was approximately half full. The latter drum had recently had two patches welded over leaks on its top end, a very dangerous procedure particularly in view of the refinery statement that the patches had been "flame welded."

In addition to the drums at the refinery, about 40 empty TEL drums were discovered at the railroad station. The refinery disclaimed any direct knowledge concerning the origin of these drums which they intended to use for asphalt service. From shaking the "empty" drums it was apparent some liquid residues still remained and a TEL odor from a corroded drum left no doubt as to the original contents. The refinery was directed to maintain control over the empty drums and to dispose of same at sea. However, having paid 400 yen per empty drum, this method of handling will work a hardship on the oil company so that some method of reimbursement probably should be considered in this, and other similar cases where drums are purchased in good faith.

Since this refinery will not be making gasoline, their TEL will be shipped to another location and it was recommended that there be no further handling of the drums (such as welding) until the transfer from the refinery.

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Inspection of TEL Drums Storage in the Tokyo Area

The drums of TEL inspected this date were reported by Mr. Mizukami of the Advisory Board of Medicine, Pharmaceutical Section, Ministry of Welfare, Tokyo. The drums will be allocated by MITI and distributed to the refiner or disposed of, per the recommendations of the writer this date.

1. Yamanaka Denki K.K., Ota-ku, Omori, 2 chome #198; 16 drums are stored here plus one badly leaking drum that was buried 3 feet beneath a coke pile in 1947. The 16 drums are stored on the ground next to the road way and are apparently in good condition although it is evident from some broken bungs that an attempt has been made to open some of the drums. The

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Inspection of TEL Drums Storage in the Tokyo Area, cont'd

drums were originally purchased from a broker under the impression they contained gasoline. The odors from the leaking drum had been an annoyance to the neighborhood and it had leaked so badly at the ends that it was thought to be nearly empty when buried. There was no evidence of contaminated soil at this late date and it was recommended the buried drum be left untouched and the full drums be allocated and moved in the usual manner.

2. Suginami-ku, Wada Honcho #880 Banchi: although three drums had been reported at this location four were discovered of which one was half full, the contents of the latter having been transferred from a leaking drum. The TEL had been bought from a broker under the impression it was gas-oil and could be used for solvent, washing, purposes. However, the strong odor prevented its use for this purpose and it was simply stored next to the workshop. It is recommended the 4 drums containing TEL be allocated and moved in the approved manner and that the empty drum accompany the shipment and be disposed of at sea.

3. Tachikawa Shibazaki cho, 4 chome #44 banchi: the one drum has been stored in the open, untouched, at this location since 1945. No definite information was available as to the original owner of the TEL.

4. Hachiogi shi, Naganomachi Nishi 30: the local police had reported two drums of TEL here dumped from a trimobile onto the dry river bed adjacent to a school house. The drums had been leaking badly and were probably jettisoned by the owner in order to dispose of an annoyance and hazard. It was recommended the fuller drum be turned on end to stop leakage from the sides; this caused heavier leakage from other points. Upon being returned to its original position, fresh leaks developed, so it was arranged with the police to bury the drums at least 3 feet deep on the spot. It is recommended an attempt be made to discover the original owner of these drums so that any other TEL in his possession can be controlled so that the hazard of future leaking drums will not be scattered, as in this case where lead poisonings can occur to uninformed individuals such as school children.

The police at this location reported another TEL drum which was investigated this date. The drum was found empty except for residue and abandoned in a vegetable patch. The top had been partly removed with the probable intention of using the drum to dispense fertilizer onto vegetables (an

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excellent way to distribute the lead hazard). It is probable the drum was abandoned due to the obnoxious odors encountered during the removal of the top. It was recommended the police bury the drum; to be handled immediately.

The widespread distribution of the TEL drums investigated this date is an indication of the potential poisonings of innocent persons from ignorance in handling. It was recommended to MITI and the police that every attempt be made to trace the jobbers who may still hold TEL drums so that proper handling can be arranged.

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Inspection of TEL Facilities, Naval Fuel Research Depot, Ofuna

TEL Plant

The tetraethyl lead pilot plant at this location is intact and has apparently never been operated. Further information will be requested from the prefectural government and from former laboratory workers as to whether the plant was ever operated. If the subsequent investigation shows the equipment was never contaminated it may be used "as is" for any purpose to which it can be adapted as far as safety is concerned.

TEL Drum Storage

Some confusion still exists about the amount of TEL that was stored or moved from this location. This date, Ofuna personnel were unable to agree on the amount of TEL stored here or even to locate the former storage area. The figures on the fluid inventory of the agencies involved here are as follows:

MITI	1,260 l	99 drums (revised to 9 drums 4/1/50)
Ofuna	1,260 kiloliters	30 drums (including 10 empty and 19 glass ampoules)
Showa Oil Co. (Receiver)	-	16 drums (9 leaking - Showa transferred to new drums ending with 13 full drums and 10 empties at their refinery; 1 drum left at Ofuna.)

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It is recommended a further investigation be made by MITI that will reconcile the above discrepancies and trace any TEL shipped to unauthorized receivers or still held at Ofuna. It is recommended the former drum storage area be located and appropriate decontamination be carried out on any spill area. Any empty drums remaining should be picked up by Showa Oil Co. for proper disposal.

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Movement of TEL Drums to Refineries

On April 21, 1950, the Mitsubishi Oil Company moved its tetraethyl lead allocations of 65 drums from the Nippon Oil Co. depot, Sumidagawa to their refinery at Kawasaki. The movement from the depot was correctly handled by loading no more than 10 drums per truck , bung up, blocked and lashed. The seven trucks moved to Kawasaki in a single caravan with red danger flags, two men per truck, 14 gas masks, rubber gloves, and aprons available. Also on hand on one truck was a 50-gallon supply of kerosene, $KMnO_4$ and chloride of lime in case of a leak or spill in transit. Loading operations were by drum skid and winch lift. The entire operation was well organized and safely handled under the direct supervision of Mr. Fujio Sumitani of the Mitsubishi Oil Company.

It is recommended other oil companies follow the same safe procedure during TEL movement.

Other TEL shipments reported to date are as follows:

From	To	Carrier	Drums	Date
Kanto Motors, Tokyo	Mitsubishi, Kawasaki	Truck	539	4/24-4/30/5(
Standard Vacuum, Otaru	Maruzen, Shimotsu	R.R.	65	4/25-4/26
Kizugawa (Shell), Osaka	"	Boat	225	4/25
Funamachi, Osaka	"	Boat	19	4/25

It is recommended the oil companies move their TEL allocations at an early date per the writer's Conference Report and Recommendation of March 31, stating the lead should be moved within 30 days, if possible. At an early date MITI should secure a report from each refiner giving the following information:

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Movement of TEL Drums to Refineries, cont'd

1. Has their allocation been moved.
2. Condition of the storage depot after movement.
3. Disposal of empty drums.
4. Did any leaks occur during handling - if leaks occurred in transit give box car number, etc.
5. How are drums stored at the refinery.

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Inspection of TEL Drums at the Nagashima Chemical Company, Shimizu

Seventy-six drums of tetraethyl lead had been sent to this company from eight locations in Tokyo. This TEL had been reported to the Advisory Board of Medicine, Pharmaceutical Section, of the Tokyo Ministry of Welfare, who recommended the drums be shipped to Nagashima Chemical to be tested for use in making paint. The chemical company stated they expected to receive 1,000 drums but actually were shipped only 76 of which one was empty. There being a market shortage of ethyl acetate as a solvent and lead chromate as pigment (and the TEL being nearly free), they decided to utilize the ethyl radical for the acetate and the lead for lead chromate after the decomposition of the fluid. First attempts at decomposition with iodine proved too expensive so all subsequent testing was carried out with chlorine "in large bombs", a total of about 80 being used. The chlorination was carried out in half-drum tests and while the "reaction was fairly violent, no explosion occurred." They had hoped to get "ethyl acetate by absorption of ethyl chloride into acetic acid, and lead chloride in the sludge", but the products were not pure enough for their purpose (probably due to the bromine in the fluid) and the former compound was thrown away and the latter "burnt up in a storeroom fire."

Some of the workers participating in the work "experienced headaches sometimes, but no severe symptoms resulted."

Drum Storage

Eleven drums of fluid were used completely in testing and the remaining 64 are stored in the company yard. One drum was "on end" leaking at the bung, while two others had their outer bungs removed and the inner broken from the threads and patched with tar. The emptied drums "were used or sold after decomposition of the remaining fluid by the action of bleaching powder."

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It was recommended the drums remaining be allocated to the Toa Nenryo refinery in Shimizu and transferred by truck after safely capping the drums with broken, or leaking, bungs. Any boards stained with fluid should be burned; stained soil should be decontaminated.

Conclusion

The recommendation of the Advisory Board that shipped drums to this point for use as paint instead of using the TEL for the purpose intended should be discouraged wherever it is encountered. It is felt the chemical company was fortunate in avoiding serious accidents during their testing.

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Inspection of TEL Drums
Yokosuka City Government

The twenty-eight drums of tetraethyl lead at this location were reported by Lt. Commander John H. Holtom of the Civil Affairs Section, Yokosuka. At present the drums are in the custody of the Yokosuka City Government, Bureau of Construction, to which location they were shipped only one month ago from the City Hall. Eight of the drums are leaking and the soil is now so contaminated that the lead odor could be detected 20 feet from the drums in spite of a steady rain. Fortunately the drums are stored in a remote location and fenced off from the general public. The past history of this lead is vague, but it has been stated they were thought to contain potable ethyl alcohol until the contents were sampled and tested.

Recommendation:

The contents of the badly leaking drums should be transferred to new drums before shipment by the refiner receiving the allocation. The contaminated soil should be removed and dumped in the ocean only 100 feet away.

Since these drums were located by the Civil Affairs Section, and were moved to this city government depot only one month ago, it is suggested that possibly the Petroleum Advisory Section of MITI has not successfully informed their people regarding the TEL hazard and the reporting of same. It is recommended this program be sponsored more vigorously in the future before some tetraethyl lead is disposed of as ethyl alcohol and results in poisonings to the people handling or receiving.

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Inspection of Tetraethyl Lead Shipment, Kanto Motors

The movement of 539 drums of TEL started from the above location by barge for the Kawasaki refinery of the Mitsubishi Oil Company. Nineteen leaking drums were punctured with an axe and the contents transferred to new drums filled only one half full because of their light gauge. At the time of inspection all of the leaking drums had been broached in which process lead fluid had been splashed on the ground and on the workmen handling. The TEL spills were ordered decontaminated with $KMnO_4$ solution and the workmen instructed to wear gas masks and protective clothing. The strong TEL odor in the vicinity was decreased by the decontamination and by moving the emptied drums to windward and plugging with waste. After this handling the drum movement was resumed in a relatively fresh atmosphere. It is felt that had work continued in the TEL contaminated air without gas masks that certain lead poisonings would have occurred among the workmen.

It is recommended again that all transfers of TEL fluid be handled by workmen who are completely equipped with full protective clothing. All oil company supervisors of TEL transfers should be acquainted with and enforce proper handling procedures.

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Inspection of TEL Drum Storage

1. Nippon Mining Company, Funakawa
2. Nippon Oil Company, Akita
3. Inoue-Sangyo K.K., Takasaki — Yamma

1. Nippon Mining Co., Funakawa

This refinery blended tetraethyl lead into its straight run gasoline during the war. The blending system was a simple gravity feed from a drum into which the TEL was poured and measured by sight glass into the gasoline discharging to a tank car. This equipment is no longer on hand having been scrapped. The TEL inventory left on hand was originally reported as 75 drums but subsequently 5 more drums were discovered and reported on the date of inspection. All drums were found in good condition except for 2 with broken end chimes which should be handled with care during shipment. The refinery warehouse was appropriately placarded and well ventilated and since no leaks had occurred, movement from this point should be handled without difficulty by box car or ship.

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Inspection of TEL Drum Storage, cont'd

The refinery is now considering blending TEL again in the future and requested assistance with their plans for a standard type blending plant. Accordingly, their plans were revised for construction of a Partial Drum Mixing plant with a storage space for 20 drums based on an estimated usage of from one to three drums per month.

2. Nippon Oil Company, Akita

The fifteen drums previously inspected at the Akita Central Trucking Company have been moved to storage at the Nippon Oil refinery. Prior to movement the contents of leaking drums were transferred to sound drums and the empty drums properly disposed of per instructions. The drums are now stored in good condition in an isolated warehouse from which point they will be shipped to Nippon's Yokohama refinery for use. The Akita Central Trucking Company garage where the drums were previously stored had been decontaminated by the removal of contaminated soil and the treatment of the concrete floor with 1kg. of $KMnO_4$ crystals. A check for lead vapors at this location showed no trace of TEL so it may be presumed the decontamination was complete and the area can now be used without fear of future poisonings.

The Nippon Oil Akita refinery is now considering the possible future use of TEL in its straight run gasoline and requested that their blending plant construction plans be reviewed and a plant site be recommended. This was handled in an unofficial capacity with an excellent site being finally selected in an isolated part of the refinery at the end of the railroad siding.

3. Inoue-Sangyo K.K., Takasaki

This company had purchased 8 drums of TEL from a trucker with the understanding they were buying gasoline. The drums are now in outdoor storage in good shape with the exception of one drum which has a one-inch wooden plug driven into its side to stop leakage. Since these drums are to be trucked to Nippon Oil's Yokohama refinery, it was recommended the drum be handled with care and placed in a metal pan to avoid contaminating the truck during shipment. Appropriate safety clothing and decontaminants should be on hand during movement.

It is recommended the past history of the drums originally secured by the trucker (mentioned above) be secured. Information this date stated that the trucker found 20 TEL drums buried at

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Nagano and that he sold these drums throughout Gumma Prefecture representing the contents to be gasoline or cutting oil. After several poisonings had occurred notably at the Oki Electric Company, Tamioka where the TEL was used for cutting oil, the trucker was apprehended by the police and the majority of the drums were located and allocated to the Nippon Oil Company who has transported same to their refinery. An attempt should be made by the Nagano prefectural government to trace any drums still at large, or in the custody of Shimizu Tayadashi at Nagano, or any drums that might still be buried at Nagano.

In connection with past inspections the former storage areas for TEL were investigated at Showa Oil Company and Nippon Oil Company, Niigata. These locations were found to be safe for other use from a TEL standpoint.

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Sources of Information on Additional TEL Depots

I. Ichio Imai, Industrial Reconstruction Corp., Tokyo

II. Messrs. Mizukami & Ito, Advisory Board of Medicine, Pharmaceutical Section. (Sugiyama, Ministry Welfare)

III. Petroleum Distribution Corp. (Mr. Hikoseke) & PDK.

I. 2 drums	(a)	IRC found 2 TEL drums among a number of methyl alcohol drums received. At the direction of Mr. Sugiyama of the Business Section of Sanitary Dept., Ministry of Welfare, Tokyo, the TEL was shipped to Nagashima Chemical Co., Shimizu to be used for making paint.
92 drums	(b)	Took custody of 92 drums of TEL that had been picked up by Kobe C.I.C. and given to Kobe police. All 92 drums were buried at sea 90 knots east of Wakayama during January 1949.
11 drums	(c)	Picked up 10½ drums of TEL from the former Army Aircraft Depot and the Nagano Prefectural Government 6/7/49. The drums were delivered to Daikyo Oil Co., Yokkaichi 9/10/49, Tokyo Kogyo KK Co., handling.
10 drums 115 drums (23 on hand)	(d)	Received report from PDC of 10 drums of TEL at the liaison office of Prefectural Government at Yokosuka; drums stored next to PDC Branch office at Hinode cho in Yokosuka.
II. 76 drums (including 36, 500 g. containers)	(a)	At Nagashima Chemical Co., Shimizu-shigai, Sodeshimura agamini, 72 drums of TEL still on hand from original shipments (from 8 Tokyo locations) of 76 drums. Some drums of TEL already used in testing for suitability for use in making paint.
17 drums	(b)	At Ota ku, Omori 2 chome #198 c/o Yamanaka Denki KK, 17 drums of TEL.
3 drums	(c)	At Suginami Ku, Wada Honcho #880 banchi, 3 drums.
1 drum	(d)	At Tachikawa Shibazaki Cho 4 chome #344 banchi, 1 drum.

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Sources of Information on Additional TEL Depots

2 drums		Also, 2 drums of TEL at Hachioji Shi Naganomachi Nishi 30, were thrown away, now supposedly held by the police, Nov. 25, 1949.
99 drums	Total	

III. Messrs. Kawada and Kasuga of Petroleum Distribution Corporation Report.

3 drums	(a)	Three stolen drums now recovered by the police at Misumi (Kyushu). The drums are leaking badly and 2 new drums have been requested to which the remaining TEL will be transferred by the Misumi Shoji Co., alleged to be familiar with such handling.
120 drums	(b)	During the period April to June of 1947, 120 drums of TEL were stolen from the storage location at Hiroshima. Although reported to the police the drums have never been recovered. It is suggested another vigorous attempt be made to trace these drums.
123 drums		
	(c)	Mention was made of newspaper accounts from Shikoku in the summer of 1947 of alleged TEL poisonings from the use of paint containing tetra-ethyl lead. This is the first mention to date of any TEL being in existence on this island. It is suggested this rumor of TEL be investigated further.

It is suggested the Medical Section of each Prefecture's Special Commodity Section be requested to institute a search for, and report, any tetraethyl lead discovered.

Additional TEL discovered by these conferences:

	Reported	On Hand
Industrial Reconstruction Corp.	115 drums	23
Tokyo Ministry Welfare (advisory medicine)	99 "	95
Petroleum Distribution Corp.	123 "	3
	337 "	121 drums

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Inspection of TEL Storage in Tochigi Prefecture

A personal inspection was made at 13 locations in Tochigi Prefecture where tetraethyl lead had been stored. The history of this TEL is confused, but the original inventory in 1946 seems to have consisted of 189 drums of which 65 were alleged to have been destroyed by burning in November 1949. The remaining 124 drums were left in the woods at Fubasami, Ochiai-mura, Kamitsuga-gun in the custody of Ryutaro Kobayashi, who reported drums were stolen from time to time. The Civil Affairs Section through the prefectural government discovered the above storage points and three additional depots were discovered in the course of this personal investigation. The tetraethyl lead was represented to be gasoline in most cases of sale and this exposed the many purchasers to the potential hazard of fatal poisoning. In several cases the TEL was actually transferred to car gasoline tanks where it failed to function as gasoline and necessitated handling back to the original container. In view of these potential hazards, it is recommended that a vigorous effort be made to discover all of the remaining inventory that is still at large. The prefectural government is cooperating in this effort by a series of radio broadcasts on the subject.

All drums of TEL were found to be in good condition with the exception of one small leak at the Kekuchi Motors Garage. The correct method of handling all drums was discussed in person with the Nippon Oil Company representative who will handle most of the TEL allocation from this district.

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A P P E N D I X B

Reports on Blending Plant Construction and Operation

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Inspection of TEL Drums and TEL Blending Facilities
Toa Nenryo Co., Shimizu, February 6, 1950

Drum Storage:

The 170 drums transferred from Sakaore (Kofu) 2/1/50 are now at this refinery in storage for ultimate use. The storage area is not all that could be desired from a safety standpoint. The drums are stored inside a concrete warehouse building on whose roof are bulk storage tanks for petroleum products. Immediately outside the warehouse are two platform scale drum loading racks. The transfer from Kofu caused one drum to leak and the concrete floor was stained to the extent of about a 3-foot spread from this source although the drum was no longer leaking. At the time of inspection a workman was sampling those drums with end outlets using a 100 ml pipette and suction bulb to remove the tetraethyl lead from the drums. He was not equipped with any protective clothing except some light rubber gloves. The top end of one drum was stained with blue fluid apparently spilled during sampling. The writer suspended sampling until a gas mask and new rubber gloves of his own were supplied and the sampling was concluded by securing a density reading and two samples for the writer. Kerosene was secured to flush the pipette and gloves and it was directed that all stain areas be thoroughly cleaned up. In the meantime a 4 cu foot air sample was taken with the Ethyl lead-in-air analyzer. This showed a minus four micrograms of lead per cubic foot of air, or just within the safe breathing limits for an 8-hour exposure.

Recommendations:

1. Although the temporary drum storage area may be used for the present, the drums should eventually be moved to a standard, well ventilated area to be constructed adjacent to the blending plant.

2. Gas masks and protective clothing should be worn within the present drum storage building during drum handling periods.

3. Warning signs should be placed about the building.

4. Tetraethyl lead stained matting should be removed from drums and disposed of by burning.

5. All other lead stains should be cleaned up with copious amounts of kerosene and soap and water.

6. A check should be kept for lead odors on warm still days and appropriate measures taken to prevent exposure.

Samples:

Samples appeared to be of good clear blue color and the two densities secured were 1.7352 and 1.7343(corrected). Samples are to be analyzed for total lead and ammonia soluble salts.

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Blending Plant Construction

A preliminary discussion was held on details of handling tetraethyl lead.

An inspection was made of the nearly completed unorthodox blending plant constructed by the refinery. The only improvements to the plant since an unofficial first visit was to install a curb on the fourth side of the building and replace a few of the small windows with wire screen. The refinery has promised to change the plant according to the writer's recommendations, among which were the following:

Recommendations:

1. Remove sight glass from TEL discharge line and blank off line.

2. Remove fixed TEL unloading line and install a swing line.

3. Install orthodox standpipe and gasoline line for flushing drums.

4. Extend drain line from scale pit and install interceptor tank before permitting discharge to refinery sewer.

5. Remove entire baffle-TEL-mixing device from discharge line and replace with straight through piping.

6. Install compound gauge and two pressure gauges correctly in manifold.

7. Install sprinkler system and fire extinguishers.

8. Install kerosene diluent drum with gravity feed to platform.

9. Permanently vapor-seal door leading to refinery pump room and also vapor-seal roof and wall openings to the pump house.

10. Construct a permanent storage platform immediately adjacent to the blending plant.

11. Complete the construction of the blenders' change and washroom as planned.

12. Install swing lines on discharge lines in blending tanks.

The above recommendations are made for the purpose of protecting the health of refinery personnel.

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Observation of TEL Mix at Toa Nenryo Co.,
Shimizu 22 Feb 50

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The subject company urgently requested assistance in making a three drum mix of tetraethyl lead into 237,336 gallons of clear gasoline. According to Toa, the purpose of the mix was to permit the shipment of the finished gasoline in four tankers waiting at the refinery. The writer had previously cited this blending plant as sub-standard and the mix was permitted due to the urgent necessity, as presented by the refiner, and with the understanding that the writer would supervise from a safety standpoint and that no future mixes would be made until the plant had been brought up to standard.

Although the refinery expected to raise the octane of the gasoline to 72 by the use of 1.5cc of lead per gallon, it is probable this octane was not achieved as the amount of lead added, as calculated by the writer, was only 1.017 cc/gal.

899 kiloliters gasoline -- 237,336 gallons
627 kg. fluid (added) -- 233,309 cc TEL

$$\frac{237,336}{233,309} \text{ -- } 1.017 \text{ cc TEL/gal.}$$

Plant Operation:

Although no spills or leaks occurred during the mix, the future operation of the plant would be a definite hazard due to the unsafe procedures listed below.

1. No check valve in unloading line.

2. Use of the unloading line for a gasoline wash line. This forcibly drives gasoline against the bottom of the drum and places pressure on the unloading line.

3. Wash gasoline is forced through the eductor into the 3/4" unloading line by closing the discharge valve in the 4" pipe from the manifold. This dangerous practice places a strain on piping and pump that could result in a serious accident.

4. The door and wall section to the pump house are still unsealed and, therefore, give little protection against TEL vapors from the blending platform.

5. The practice of unscrewing and removing the unwashed standpipe from the emptied TEL drum was discouraged by the writer.

6. Although the pressure differentials across the eductor seemed adequate (high side 59.6 lb/sq, in low side 7.1 lb/sq in) the home-made eductor pulled only 12 inches Hg against closed valves. (Gauge readings, 4.2 kg/cm^2, 0.5 kg/cm^2, 300 mm Hg.) The drums, three, were emptied and washed in 45 minutes with an average fluid evacuation time of 46 lbs/min. with valves wide open.

Recommendations:

Reference the writer's report on this blending plant, previously submitted, the changes recommended at that time were not followed in full by