the refinery. It is recommended these changes be made in addition to those listed below. Proposed changes were outlined in detail in a sketch given to the refinery by the writer.

Changes recommended and not followed to date:

1. Sight glass not removed from discharge line. (Glass is now cracked, but by-pass valves were kept closed during the Mix.)

2. No swing line installed for TEL unloading.

3. Screwed standpipe still in use with no gasoline washing attachment. (Writer had supplied company with an approved, standard, standpipe -- this fitting should be utilized.)

4. Drain line and interceptor tank are installed, but the letter was not made to blue print design. However, slight recommended changes will make the tank usable. The discharge valve should be kept closed during blending.

5. The discharge line baffle arrangement has not been removed --this should be replaced by a straight through pipe.

6. Sprinkler system and fire extinguishers not installed.

7. Diluent drum not installed.

8. Building not vapor-sealed to pump house.

Other recommendations have been followed. It is still the writer's opinion that the suggested changes should be made to this plant before any further tetraethyl lead blending is permitted.

+ + + + +

TEL Blending Plant Construction
Toa Nenryo Co., Shimizu, 3 Apr 50

The subject company's plans were approved for building adequate storage space at their operating tetraethyl lead blending plant. The storage space to be built will accommodate 110 drums when completed. While this amount of storage space will be sufficient for normal refinery operations, this refinery will be receiving more than 700 drums as their allocation of existing stores. This amount of lead will exceed the storage capacity of the completed storage plant platform and the present temporary warehouse storage; therefore, it is recommended that the excess drums be stored properly out-of-doors in an isolated section of the refinery with some temporary protection from the sun pending their ultimate usage. It is particularly recommended that the TEL drums now in storage at the refinery be moved from their present dangerous

storage location in the drum loading warehouse to the outdoor storage mentioned above.

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. 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, 5/12/50, (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.

+ + + + +

Inspection Report of Lead Storage and
Blending Plant at the Showa Oil Company, Kawasaki, 4 Feb 50

This refinery had been allocated nine drums of tetraethyl lead for transfer to their plant from Ofuna. Investigation this date, 4 February 1950, showed the drums had been moved to an open field at least a mile from the refinery and that there were now 13 drums containing lead of which 7 were original containers and 6 light weight transfer drums with two end bungs. Tetraethyl lead was dripping from the bungs on three of the latter drums. In addition to the 13 drums containing lead fluid, there were ten empty regulation drums dumped at roadside. Showa men also stated "some" badly leaking drums had been buried at Ofuna. Discrepancies are apparent between the number of empty and full drums, particularly since the light weight drums are not full.

A discussion held with refinery management apparently assured that the blending plant to be built here would be of standard design and that it would be built in as safe a location as could be found at this crowded refinery.

Recommendations:

1. The drums leaking from their end bungs should be up-ended and the stains cleaned away with kerosene. To be done immediately this date, 4 February 1950.

2. The drums should be removed to within the refinery. This refers to all drums including empties. The temporary drum storage structure should

be built within the refinery as close as possible to the site of the blending plant.

3. It should be the responsibility of this refinery to move the lead drums immediately within the refinery where they will be under his direct control. This responsibility should extend to the empty drums and to the leaking drums buried at Ofuna as well as the burial area at Ofuna.

4. The lead blending plant should be built at the site selected by the writer and after the area has been cleared of oil drums. The blending plant should be built according to the drawings and specifications discussed in detail with refinery personnel this date, 4 February 1950. As mutually agreed this date, the blending area will be protected with an earthen dike. At no future date should other structures, tanks, or similar hazards be constructed adjacent to the completed blending plant. Under no circumstances should the plant be built at the site originally proposed by refinery management, i.e., between the blending tanks and seven foot concrete fire wall and workmen's shed.

+ + + + +

Activation of Tetraethyl Lead Blending Plant
Showa Oil Company, Kawasaki, 19 Apr 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 loaded 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 characteristics as follows:

Mix

Gasoline in Mix (454.155 kiloliters) = 119,978 gallons
TEL needed (1.8cc/gal x 119,978 = $\frac{215,960cc}{168,818}$ = 1278 lb (580 kg)

Operating Characteristics

Drum #	Weights kg G	T	N	TEL	Unloading 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	7.5psi	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.

+ + + + +

Inspection of Blending Facilities and TEL Drums
at Toa Nenryo, Wakayama, 10 Mar 50

The tetraethyl lead blending plant being constructed by this refinery is of the same below standard design as the plant built at their Shimizu refinery. The oil company's plan to continue construction of this type plant is in apparent disregard of the writer's previous recommendation that this plant be abandoned and a safe, standard type plant be built. The unsafe physical aspects of the sub-standard plant which cannot be remedied are as follows:

1. Location: The plant is built as an integral part of the refinery pump-house which exposes pump men to a TEL vapor and fluid hazard.

2. Fire hazard: The plant is built in the center of the refinery facilities not more than 100 to 150 feet from the furnace and topping plant.

3. Storage: Insufficient space is available for drum storage which would make it necessary to build a standard storage building in an isolated location from which drums would be moved each day for blending. This brings up an additional TEL exposure hazard with each drum transfer.

In view of the above points, and others, it is recommended that no tetraethyl lead blending be handled at this location until a standard plant is built at the isolated site selected this date by the refinery management and the writer.

TEL Drum Inspection:

There are 133 drums in storage at the refinery's most isolated warehouse. The area is fenced off and posted with warning signs. The drums are correctly stored bung up in a well ventilated clean building.

During shipment to this point three drums sprung slight leaks which caused some contamination in one box car. Although the supervisor in charge stated this leak was decontaminated, the writer asked that the box car number be secured so that the car will not be used for foodstuffs until it can be checked to insure that decontamination is complete. The writer

directed that the stains be cleaned from the leaking drums with a diluent and that a stain on the concrete floor be treated with KMnO4 solution in excess.

In spite of the comparative excellence of the storage facilities, it is recommended that as many drums as possible be moved to the storage platform of the blending plant when it is completed.

+ + + + +

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

This is the third TEL blending plant to be placed in service in Japan since the war. The plant was inspected 4/26/50 and some basic changes were recommended in piping and construction. After these changes had been made, the examined blenders, and management were instructed 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 changes 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.

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 operations.

+ + + + +

Inspection of TEL Blending Plant Construction
at Nippon Oil Company, Yokohama, 31 Jan 50

Refinery personnel here have built the only standard type blending plant inspected to date. The plant was built from drawings of Associated Ethyl, Ltd., and provides storage space for more than 125 large drums. Although the refinery improvised their own eductor, standpipe, and swing joints, it is probable plant operation will still be satisfactory. However, should the packing-ring-ammonia-fitting swing joints show signs of leakage they should be replaced by the standard type. Some omissions and errors in construction on which the writer recommended changes were as follows:

Recommendations:

1. Install a curb at all doors where openings now exist around the drum storage platform. Construct concrete ramps at these points.

2. Install drain line from operating platform to an interceptor tank with pump out line and valves.

3. Place check valve in by-pass to protect circulating pump from high TEL concentrations.

4. Build sprinkler system over drum storage area.

5. Install kerosene storage drum and run solvent and water lines to operating area.

Tetraethyl Lead Drums:

While driving through the general refinery area, the writer noticed 21 empty tetraethyl lead drums mostly of Ethyl Gasoline Company manufacture. The drums appeared to be in fair condition with no sign of leakage. Refinery officials had no knowledge regarding the origin or original contents of the

drums. It is recommended these drums be kept under the direct control of the refinery and eventually be disposed of at sea.

+ + + + +

Tetraethyl Lead Blending Plant Operation
Nippon Oil Company, Yokohama, 25 May 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, 5/25/50. 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 deadend 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 ÷ 221,838 gal. = 0.579cc TEL/gal.

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 not resume TEL blending until the recommended changes have been made and the plant found safe for continued operation.

+ + + + +

Inspection of TEL Blending Plant
Construction

1. Koa Oil Company, Marifu, 8 Mar 50

The drawings for blending plant construction were revised by the writer according to the requirements of the refinery. A major point of difference involved Koa's proposal to locate the blending plant on the property of the nearby Iwakuni ex-Army Arsenal and to use the arsenal tanks for the refinery's gasoline blending. Since the arsenal is subject to reparations, and the property may not always be available, the writer feels Koa would be wiser to construct their blending plant and tanks on their own property adjacent to their own refining facilities and at the location mutually inspected this date, 3/8/50. The blending plant drawing revisions should be carried out as recommended by the writer regardless of the final location of the plant. The refinery expects to start building the TEL plant facilities in April with the work to be completed by the start of refining in June.

The TEL shipping supervisor was instructed regarding movement of their lead allocations from Arao and Sasebo.

2. Nippon Oil Company, Kudamatsu, 7 Mar 50

The blending plant construction at this location is practically complete and the building has been built according to recommendations as proposed by the writer at Nippon Oil's Yokohama refinery 1/31/50. Both refineries of this company have built excellent plants, well engineered, and with sufficient storage space.

3. Maruzen Oil Company, Shimotsu, 10 Mar 50

A blending plant site was selected at this refinery and suggestions made for safety in plant construction. Work will be started on this plant within 30 days. With an excellent engineering staff following the revised Ethyl plant drawings, this refinery should complete a good standard plant in plenty of time to permit blending gasoline when their refinery gets on stream.

4. Toa Nenryo Company, Shimizu, 14 Mar 50

Reference the writer's previous reports on this plant; the plant changes recommended in these reports have now been made with the exception of the drum storage platform which has been reported as "planning". The building has now been made as near "standard" as is possible considering the unorthodox plant on which it was based. With the removal of the old gasoline-wash hose and repainting of the blue-painted manifold all minor objections made in the reports previously submitted will have been answered. However, the present "temporary" storage warehouse still presents a hazard from the standpoint of lead odors in the building and potential fire from leaks in the tanks mounted on top of the building. It is recommended that the refinery start immediate construction of standard drum storage facilities as a part of the present blending plant. If this construction cannot be started, the writer feels the present hazardous storage location is so dangerous as to make it imperative the present blending plant be permanently abandoned in favor of a new and standard plant, with adequate storage space, to be built remote from refining facilities and adjacent to the blending tanks. In the event the refinery can start storage construction immediately on the present plant, and keep the area free of other buildings in the future, the present plant can probably be utilized and safely operated.

5. Showa Oil Company, Kawasaki, 21 Mar 50

Reference the writer's report previously submitted. The subject company has pushed construction of their blending plant based on drawings of Ethyl Corporation and Associated Ethyl, Ltd. and the revisions suggested by the writer. Construction this date, 2/11/50, had progressed to the point where the plant can be completed in another week of work. No major objections existed in the plant this date except the original, and basic, objection to its being necessarily within the crowded refinery area.

The refinery has completed a new, and comparatively safe, temporary lead storage area "open warehouse" at the location previously recommended by the writer. This storage area has a curbed, concrete floor, is roofed and has storage space 54.6m x 9.1m, which in combination with the permanent storage platform of 6m. x 15m. at the blending plant will handle all the drum allocation for the refinery.

6. Mitsubishi Oil Company, Kawasaki, 27 Feb 50

This refinery operated a small drum type blending plant during the war which has inadequate storage space, too small an operating room, small blending tanks, and is situated too close to refinery operations for safety. The writer approved the refinery's new blending plant plans and selected a site for the construction of the blending plant, tankage and temporary drum storage.

7. Toa Nenryo Oil Co., Wakayama, 10 Mar 50

Since the writer's previous report, this refinery has submitted new plans for a standard blending plant to be constructed at the location selected by the writer. If the plant is constructed according to the approved plans, the refinery TEL blending can be handled efficiently and safely.

+ + + + +

Tetraethyl Lead Blending Plant Operation
Nippon Oil Company, Yokohama, 21 June 50

This is the fourth TEL blending plant in Japan to be completed and approved for operation. Although a one-drum blend was made at the plant 5/25/50, operations were subsequently suspended until plant changes could be made as follows:

1. Changed eductor manifold location to conform to standard.
2. Repiped completely, installing new swing joints and PDM standpipe.
3. Installed correct interceptor tank in drain line.
4. Moved dye pot to correct location and installed block valves in discharge line piping.
5. Improved washroom and eductor pump.
6. Calculated mix as previously recommended.

After the above plant changes the plant was approved and operated this date as follows:

Mix

Gasoline in Mix = 223,003 gallons (844.07 kl.)

TEL Fluid used (266 kg) = 99,085cc TEL / 223,003 gal. = 0.404cc TEL/gal.

Plant Operation

Inlet	Outlet	Closed Vac.	Op. Vac.	Unloading Time
82 psig	11 psig	19.5"Hg	15.6" Hg.	10 min. 52 sec.(thru 1/2" standpipe)

The clear octane of the gasoline was 67.5 (Motor method); with the addition of 0.404cc TEL, the octane was expected to be approximately 72.5.

This plant is now complete in all details and can be expected to give safe and satisfactory operation assuming the recommended procedures continue to be followed.

+ + + + +

Tetraethyl Lead Blending Plant Operation
Nippon Oil Co., Ltd., Kudamatsu, 23 June 50

This is the fifth TEL blending plant to be completed in Japan. The plant was given qualified approval this date, 25 Jun 50, with the understanding it would not be operated again until the following changes had been made.

1. Change the size of the eductor jet from 9 mm diameter to 8 mm or 7.6 mm.
2. Extend curbs around washroom and pump room doors.
3. Extend the kerosene wash line to the shower.
4. Build ramps for drums at storage area entrances.
5. Increase piping size to eductor from 3/4" to 2".

Mix calculations and plant operation characteristics were as follows:

Mix

Gasoline in Mix (720 kl) = 190,000 gallons
TEL Fluid used (412 kg) = 153,470cc TEL / 190,000 gal. = 0.808 cc TEL/gal.

Plant Operation

Inlet	Outlet	Vacuum	Operating Vacuum	Unloading Time
41.5 psig.	11 psig.	4" Hg	0-2" Hg.	62 minutes

It had been calculated 0.43cc TEL/gal would be sufficient to raise the clear gasoline octane from 66.7 to 74 Motor octane. Therefore, the above blend will be cut back to the desired octane with unleaded gasoline.

The finished gasoline was dyed for sale as premium using 0.6 grams of "Oil Red B" dye/100 U. S. gallons.

It is expected that the change in the size of the eductor jet and the increase in piping size to the eductor will increase vacuum at this plant to about 20" Hg. (based on operation of Nippon's Yokohama plant). With the increase in vacuum unloading time should be decreased from 62 to about 10 minutes. After this change, and the others mentioned above, this plant can be considered as approved for future safe operations providing the management and blending personnel operate the plant according to the safety procedures outlined this date by the writer.

The storage of the excess drum inventory was found to be unsatisfactory and this should be changed as recommended to the refinery 6/23/50.

+ + + + +

Tetraethyl Lead Blending Plant Construction
Maruzen Oil Co., Ltd., Shimotsu, 26 June 50

This is the sixth TEL blending plant to be completed in Japan. The plant operated satisfactorily this date circulating water as follows: inlet pressure 138 psig; outlet, 38 psig; closed valve vacuum, 29" Hg. Although it is probable the vacuum will be lower when gasoline is used for circulation, the plant operation will probably still be satisfactory. However, before the plant is used with TEL and gasoline the following changes should be made:

1. Make up TEL piping with litharge and glycerine and welding.
2. If PDM standpipe is used, triple and double swing joints should be installed in the recommended positions.
3. The kerosene wash line should be extended to the shower.
4. The curb should be built up at the washroom door.
5. The discharge line from the blending plant should be changed so that it does not connect into the suction of the circulating pump--this is of primary importance.
6. A check valve should be installed in the circulating pump discharge piping before it meets the blending plant discharge line.

The above changes were discussed with the refinery personnel and are being handled as recommended. When completed this plant can be considered as safe and approved for blending, however, it is recommended that the plant make its first mix of tetraethyl lead under the safety and medical supervision of Dr. K. Akatsuka as an assistance to its TEL blenders.

Tetraethyl Lead Mixing Plant Construction
Mitsubishi Oil Company, Kawasaki
Koa Oil Company, Marifu
7 Jul 50

Mitsubishi Oil Co.:

This plant was reported completed and ready for TEL mixing July 1st; it will be given a final inspection for approval July 7th. Since no crude oil is being run at this refinery at present, the PDM mixing plant will be started at a later date at which time it is recommended the services of Dr. Akatsuka be accepted so that the men he has already approved medically can be properly trained in the safe operation of the plant. This will be the 7th TEL mixing plant to be completed in Japan.

Koa Oil Co.:

The subject company will complete their half-finished PDM-type mixing plant about the end of July. With the exception of changes to be made in discharge line piping to the mixing tanks and a changed interceptor drain tank, this plant was following details of construction very well on the last date of inspection, June 23rd. This will be the 8th, and last, of the TEL mixing plants to be built at the Pacific Coast refineries. Since this company has had but little experience with handling TEL, it is recommended the services of Dr. Akatsuka be utilized in the medical examination of blenders and the safe start and operation of the plant.

A P P E N D I X C

Reports on Former Manufacturers of Tetraethyl Lead

Former Japanese Manufacturers of Tetraethyl Lead

Tetraethyl lead was formerly produced in Japan at the following locations:

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 breathing 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:

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

Former Japanese Manufacturers of Tetraethyl Lead, cont'd

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

Hodagaya 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 Receivers; 2 - 3000 liter Storage Tanks; 4 - 1000 liter Stills; 4 - 160 liter Separators; 4 - 1600 liter Receivers; and 2 - 6000 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 reactions 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

Former Japanese Manufacturers of Tetraethyl Lead, cont'd

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 Chugoku

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 is ignorant of the exact number of TEL contaminated vessels and so some 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.

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 gives 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.

+ + + + + + + + +

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

Hodagaya Chemical Company, Koriyama

The subject company operated 88 autoclaves (plus 10 unused) and attendant 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
	Total at the end of the war	1,620

Former Japanese Manufacturers of Tetraethyl Lead, cont'd

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.

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 decontaminated.

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 a previous report by the writer.

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

A P P E N D I X D

Reports on the Use and Transportation of Tetraethyl Lead

Use of Tetraethyl Lead in Japan

With the activation of blending plants for adding tetraethyl lead to gasoline, certain problems have arisen with respect to the possible poisoning of workers handling the product at refineries, or the use of the leaded gasoline by the general public.

The problem of handling TEL at refineries can be controlled by building blending plants of safe design and making certain they are correctly operated by workmen who have been approved for TEL handling by a competent medical man. The writer is handling the first aspect of the problem as a Consultant for GHQ, ESS/IND; however, the medical examinations have been handled by Dr. Keiji Akatsuka, Medical Consultant to the Ethyl Corporation, on an unofficial basis. Although Dr. Akatsuka formerly acted as Medical Director for the Japanese tetraethyl lead manufacturers, he has no official standing with respect to his present recommendation or rejection of workmen for handling of TEL at refineries. For example, of the 30 men who have received medical examinations at five refineries, 7 men have been rejected as unfit (for various reasons) for handling TEL. It would seem apparent that Dr. Akatsuka's recommendations should have some official standing in order to assure recognition of their validity by the oil companies. Also, some consideration should be given to the problem of the future and continuing safety and medical supervision of blending plants after the writer's return to the U.S.

Other public health and welfare problems relate to the writing of specifications limiting the maximum quantity of tetraethyl lead in gasoline to 3.0 cc/gallon; to setting a minimum dye standard for leaded gasoline; and to the placing of proper warning signs on pumps, tanks and containers for gasoline.

1. TEL Content in Gasoline

The U.S. Public Health Service recommends a maximum TEL content of 3cc/gallon of motor gasoline. From a hygienic point of view the handling of higher lead concentrations in gasoline might result in poisonings at filling stations or to the general public.

2. Color in Gasoline

The U.S. Public Health Service recommends the dyeing of leaded gasoline to certain minimum color concentrations in order that the product may be recognized as containing TEL and proper handling precautions taken.

3. Notices on Pumps and Containers

The U.S. Public Health Bulletin No. 163,1926 -- Series III recommends in part that each pump dispensing leaded gasoline or container for same, be labelled as follows:

a. "Contains lead (tetraethyl) and is to be used as a motor fuel only. Not for cleaning or any other use. Avoid spilling."

Or

b. "For use as a motor fuel only contains lead (tetraethyl)."

At the present time tetraethyl lead is already being used at four refineries in Japan and will shortly be handled and sold by eight or more refineries. It seems apparent that some immediate action should be taken by the Japanese Government to protect the workmen at refineries by providing adequate medical supervision and to protect the general public by writing specifications for leaded gasoline similar to those of the U.S. Public Health Service. At the present time such recommendations have been made by SCAP's Public Health and Welfare Department but action on the matter is still pending with the Japanese who are possibly not aware that leaded gasoline is already being made and marketed in Japan.

+ + + + + + + +

Tetraethyl Lead Medical Consultant

Effective April 15, 1950, Dr. Keiji Akatsuka was appointed Medical Consultant to the Ethyl Corporation. In this capacity he will make quarterly medical examinations of personnel handling tetraethyl lead for blending into gasoline at the approved blending plants of the Pacific Coast refineries. At the same time he will inspect the blending plants and make any recommendations necessary to insure safe handling of the fluid. He will be available to advise oil refiners, SCAP, Public Health and Welfare, the Japanese Government, and the general public, on medical and health problems relating to tetraethyl lead.

Since the Ethyl Corporation does not market its product in this country, Dr. Akatsuka has been hired as an unprejudiced adviser on tetraethyl lead solely in order to protect the health of the public. At present he is Professor of Hygiene and Public Health at the Tokyo Medical College and he has previously taken a degree, on a Rockefeller Foundation scholarship, at Harvard University in the U.S., studying

Industrial Health and Hygiene. He served as Chief Medical Adviser to the Japanese TEL manufacturing plants during the war and he is a recognized authority on the subject.

As a service to the oil industry, Dr. Akatsuka has already examined prospective blender personnel (unofficially), at Maruzen Oil Co., Shimotsu and Toa Nenryo Oil Co., Wakayama. The Public Health and Welfare Section is now working to implement his position by having him appointed as an advisor on tetraethyl lead to the Japanese Welfare Dept. in order that his recommendations relating to public health will have official weight.

Dr. Akatsuka will be trained in other aspects of Safety, in addition to the medical, so that he can carry on as a replacement after the writer's return to the U.S. Within the next week blending personnel will be examined at the two refineries already using tetraethyl lead and other prospective users will receive medical examinations before starting blending, probably within 30 days.

Transportation of Tetraethyl Lead

Leaks have occurred during the current movement of tetraethyl lead from storage points to refineries. Where this leakage occurs into absorbent materials, such as the wood flooring of box cars, trucks, and ships, it is extremely difficult to decontaminate the vehicle so that it can be used for subsequent shipment of other materials, particularly foodstuffs, without the danger of poisoning the ultimate consumer.

It has been difficult to secure prompt information regarding such TEL leaks and recently railroad cars have been returned to service in shipment of foodstuffs without having been tested and found safe for such service. A report "Movement of TEL Drums to Refineries", 4/21/50 requested that leak information should be furnished the writer. Subsequently oil companies submitted reports of leaks as follows:

Company	Date Shipped	Date Reported	Remarks
Maruzen Oil Co.	5/2/50	5/22/50	+ Leak was cleaned up.
Toa Nenryo, Wakayama	2/10/50	5/22/50	" " " "
Nippon Oil, Yokohama	2/27/50	5/8/50	Truck-leak " "

+In the case of the Maruzen Oil Company the car number in which the leak occurred was not immediately available and it was arranged to bring the three cars used to Tokyo for testing. It was found the cars already had been used for shipment of food (seaweed and onions) and although all visible evidence of the TEL leak had been removed, the car in which onions had been shipped

still showed a trace of lead in the air (2 micrograms Pb/cu. ft. air). Since the onions had already been consumed and the TEL reading was low, the matter was concluded by completely decontaminating the car in the Tokyo yards before returning to service.

The attention of oil refiners is directed again to the booklet they have received entitled "Regulations Governing the Transportation of Motor Fuel Antiknock Compounds", item 6, "In case of a leak", (e)--"If a spill occurs in a box car or truck, or on any material which might absorb the fluid, it should be cleaned up following the procedure under (b) and (c) until all outward evidence of the spill has been satisfactorily removed. Experience has shown this may not be satisfactory to protect future lading. It is recommended, therefore, that any absorbent material that has been in contact with the fluid be removed, destroyed by burning, and replaced." "f (3) Under no circumstances should a contaminated car be returned to the railroad until after inspection and release by the Ethyl Corporation Representative."+ "(g) Inspection should be made after the removal of the drums and before the freight car is released."

+(Since Ethyl has no representative here authorized to handle this work, the Japanese Government should give some consideration to the future appointment of such an individual in the interest of public health.)

A P P E N D I X E

Regulations Governing the Transportation of Motor Fuel Antiknock Compound

REGULATIONS

Governing the Transportation of Motor
Fuel Antiknock Compounds

("ETHYL" AVIATION AND MOTOR FLUIDS)
(Issued by Ethyl Corporation, New
York 17, N.Y., December, 1948)

1. Information of Direct Concern to Forwarding Agents and Responsible Personnel of Railroads, Docks, Vessels, and Trucking Concerns.

a. Motor Fuel Antiknock Compounds ("Ethyl" aviation and motor fluids) are poisonous liquids containing tetraethyl lead. The fluid must not be allowed to come in contact with the hands of any other part of the body or clothing. Should any of the fluid accidentally get on the hands or body or clothing, work should be stopped immediately, stained clothing should be removed, and all traces of the fluid should be washed from the skin with kerosene, after which the kerosene should be removed with soap and water. Clothing that has been wetted with the fluid must be cleaned by repeated rinsing in naphtha or in non-inflammable dry-cleaning fluids. Contaminated shoes and other leather articles must be destroyed, preferably by burning, since the fluid cannot be removed from them.

b. "Ethyl" aviation and motor fluids are non-inflammable and have a flash point above 222 ° F. (105° C.).

c. Drums must not be stowed with other materials at any time.

2. Stowage of Drums at Terminal Points.

a. Drums of "Ethyl" aviation and motor fluids at terminal points should be handled under the supervision of a responsible and properly informed foreman. Men handling drums should be equipped with heavy rubber or approved impermeable gloves, stout canvas gloves, or clean leather gloves. Remove at once rubber gloves which have been wetted with the fluid, and clean with kerosene, and follow with soap and water. Remove stained canvas and leather gloves at once and destroy by burning, cleansing the hands with kerosene and then with soap and water, if there has been any contact with the fluid.

b. Drums must be stowed on docks, or at transfer points, with the bungs up. 55-gallon drums must not be tiered.

c. Whenever possible, drums should be stowed in well ventilated, segregated locations. They must be stowed well out of the way of passing traffic and properly checked to prevent their rolling.

They must also be segregated from other materials and must never be stowed near any foodstuffs.

3. Handling of Drums on Vessels.

a. 55-gallon drums are to be handled on and off of vessels two at a time using a separate three-inch (one-inch diameter) rope sling for each drum. The sling is placed around the shell of the drum outside the hoops, and it is important to see that the drum is properly balanced in the sling. Rope nets must not be used for handling 55-gallon drums. Barrel hooks or other equipment may puncture or crush drums, or fail to hold them securely, and are absolutely prohibited. In handling 10-gallon drums, six are placed on a wooden tray (plate) over which a rope net is placed. If a tray is not available, it is permissible to handle up to six 10-gallon drums in a rope net without the tray. (Note: one 55-gallon drum weights about 900 pounds, and one 10-gallon drum weights about 165 pounds.)

b. Drums must be stowed on deck in space open to the air and near water supply for thorough washing in the event of a leak. Under deck stowage is not permitted at any time. 55-gallon drums must not be tiered.

c. Drums should be stowed on end and should be securely lashed by means of steel cables and thirty-six-inch turnbuckles to sturdy parts of the ship's superstructure. A flooring of good dunnage should be laid under the drums.

4. Handling of Drums in Freight Cars.

a. Drums must be stowed in freight cars with bungs up. They should be placed side by side in units of four drums extending across the width of the car. Each unit should be secured by the generous use of wooden dunnage or steel band strapping.

5. Handling of Drums on Trucks.

a. Drums should be loaded in trucks with bungs up, when possible. Stowage of drums on ends is permitted if necessary.

b. Trucks must be of adequate size to prevent overloading, and if the body is not completely enclosed it should have sides and end gates with a minimum height above the truck floor equal to two-thirds of the long dimension of the drums. In any case, the drums must be secured with ropes or chains in such a manner as to prevent shifting in transit.

c. Trucks must have drum skids long enough to permit safe handling where the unloading platform is not of the same height as the

truck flooring. In such cases, two or more men must handle the discharge of each drum.

d. Owners and drivers of trucks used for the transportation of drums should be instructed regarding the precautions to be taken in the event of emergency and, if possible, should be provided with a copy of this booklet. Two drivers are required on every truck during the course of any transportation movement of drums of "Ethyl" aviation and motor fluids.

6. In Case of a Leak.

a. Sturdy drums made of 12 gauge metal are used to safe-guard the carriers handling this commodity. Drums are sealed with double plugs. However, the chance of leakage still remains.

b. Whenever you can smell the fluid you are breathing it. Do not stay in any place where you can smell it. The area where spillage has occurred should be roped off so as to exclude all except responsible persons who are fully protected against the inhalation of vapor from spilled material. Men assigned to clean up leaks must wear canister gas masks of an approved type, or a blower-type or positive-pressure air-line hose mask. These men should be equipped with rubber or approved impermeable gloves. Gloves which have been wetted with the fluid should be removed at once and cleaned thoroughly with kerosene and then with soap and water; if there has been any contact with the fluid the hands should also be cleaned promptly and thoroughly with kerosene and then with soap and water.

(The gas masks used for this purpose must be equipped with canisters which contain activated charcoal as the primary ingredient (label specifies protection against organic vapors) and the usual materials for the removal of acid fumes and conversion of carbon monoxide to carbon dioxide, etc., although not necessary, are not objectionable. Canisters should be replaced after use.)

c. When only a small quantity of the fluid has been spilled, the area in which the spill has occurred should be flushed with kerosene or some other suitable light oil solvent and then thoroughly washed with water. This may be followed with soap or other alkaline cleansing material working as much of a lather as possible by means of a broom, and washing thoroughly and repeatedly with water. This same procedure may be employed when the fluid has been spilled on the outside of drums.

A method of cleaning which is likely to be more satisfactory when larger quantities of the fluid are involved is that of using a 5 percent aqueous solution of potassium permanganate (approximately two pounds per five gallons of water), applied in great excess. This has

been found to be highly useful under all circumstances except those involving the presence of materials (oils, etc.) with which water will not mix. The area on which this is used is to be hosed out freely with water afterward.

d. In case of leaks on vessels, procedures under (b) and (c) may be followed.

e. In case of spills or leaks on absorbent materials, additional procedures may be necessary. The fluid contaminates and is absorbed by wood, leather, rope, textiles, and many other materials including foodstuff for animals and man, but normally not by metal. If a spill occurs in a box car or in a truck, or on any material which might absorb the fluid, it should be cleaned up by following the procedures outlined under (b) and (c), until all outward evidence of the spill has been satisfactorily removed. Experience has shown that this may not be satisfactory to protect future ladings. It is recommended, therefore, that any absorbent material that has been in contact with the fluid be removed, destroyed by burning, and replaced. This work must be done by the carrier (railroad or transportation company), and therefore the local agent must be notified and definite information obtained from him as to where the work is to be done. The matter must be followed through to see that it is done in a proper manner. In case of doubt as to the procedure to be followed, Ethyl Corporation should be consulted by telephone or telegram.

f. The foreman in charge must be present when a freight car containing drums of this fluid is opened. He must first inspect the car to see whether there are any leaking drums. If there are no leaks, unloading may begin. If there are leaks, then:

(1) Every precaution should be taken to prevent contact or inhalation of toxic fumes by any person. (See 6b for protective measures.)

(2) Ethyl Corporation (attention Traffic Manager) is to be notified immediately by telephone or telegram, collect, and furnished with car initial and number as well as other pertinent information. Prompt advice will be supplied and an Ethyl Corporation representative dispatched to give additional assistance.

(3) Under no circumstances should a contaminated car be returned to the railroad until after inspection and release by the Ethyl Corporation representative. He will supervise preliminary decontamination and will arrange with the railroad for the application of a "Bad Order" card and for proper disposal of the car.

g. Inspection should be made after the removal of the drums and before the freight car is released.

A P P E N D I X F

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

Chapter I
General Rule

Art. 1 This Ministerial Ordinance shall prescribe the necessary matters concerning the manufacture of tetraethyl lead and mixing the ethyl fluid in gasoline, and handling of ethyl gasoline in order to prevent the hazard caused by the provisions nature of tetraethyl lead to the human body.

Art. 2 By the term "tetraethyl lead" as herein used is meant the chemical substance which is transacted as tetraethyl lead irrespective of the grade of purity.

In the term "ethyl gasoline" as herein used are included all gasoline containing tetraethyl lead.

Art. 3 Any person who will handle tetraethyl lead and ethyl gasoline must be always careful in handling of them in order to prevent the hazard caused by the poisonous nature of tetraethyl lead.

Chapter II
Manufacture

Art. 4 The manufacturer of tetraethyl lead (hereinafter called as manufacturer) shall have his plant constructed and furnished with the apparatus, as shown in the following items:

1. Complete ventilation system shall be provided for the air of the plant.

2. Manufacturing apparatus shall be arranged so as to prevent leaks completely.

3. Washing facilities and means of preventing skin absorption of tetraethyl lead shall be provided so as to prevent workers employed from lead poisoning.

Art. 5 Manufacturers shall observe each of the following matters in the manufacture of tetraethyl lead.

1. Daily inspection shall cover efficiency of ventilating systems and manufacturing apparatus for prevention of hazard caused by leakage.

2. Each worker employed shall be instructed as to the poisonous of tetraethyl lead and the precautions to be taken in its handling.

Chapter II - Manufacture, cont'd

3. No other than employees of the plant shall be admitted to get in the manufacturing room during operation excepting authorized personnel.

Art. 6 The manufacturer shall have workers employed take a physical examination which shall consist of such physical and other tests as include the following items, and exact records of these examinations shall be kept.

1. Bimonthly weight.

2. Bimonthly systolic and diatolic blood pressure estimation while sitting.

3. Bimonthly hemoglobin estimation.

4. Stippling of blood.

Art. 7 The manufacturer shall add a dye into tetraethyl lead manufactured whose color will be decided separately to ethyl fluid in sufficient amounts to give staining qualities to the ethyl gasoline.

Art. 8 The manufacturer shall put manufactured tetraethyl lead into the container which is solid and has no leaks and shall keep it air tight. The container mentioned in the preceding paragraph shall bear a label stating the following matters other than those provided in Art. 8 of the Law.

1. Exact content.

2. Statement in the effect "This is to be closed tight immediately when emptied, without cleaning, and sent back to the plant."

Art. 9 In the case when the manufacturer transports tetraethyl lead manufactured, he shall have a person who has technical knowledge of tetraethyl administered it for prevention of hazard caused by the poisonous nature of tetraethyl lead and shipment shall be in carload lots by box car only.

Art. 10 The manufacturer shall report the following matters to the prefectural governor under whose jurisdiction his plant is located up to tenth of every month.

1. Number of workers employed at beginning of previous month.

2. Number of workers employed at close of previous month.

3. Number of workers separated from tetraethyl lead work on account of results of examination.

4. Number of definite cases of poisoning of tetraethyl lead.

Chapter III
Mixing

Art. 11 A person who is engaging in mixing tetraethyl lead in gasoline (hereinafter called as mixing conductor) shall report his name (in the case of juridical person, its title) and location of mixing place to the prefectural governor under whose jurisdiction the mixing place is located.

Art. 12 Mixing shall not be conducted at any other place than mixing place.

Art. 13 The mixing conductor shall have his mixing place constructed and furnished with the apparatus, as shown in the following items:

1. Complete ventilation system shall be provided for the air of the mixing place.

2. Proper facilities for making possible a complete flushing out of all spilled fluid of tetraethyl lead and for neutralizing its spillage shall be provided.

3. Washing facilities and means of preventing skin absorption of tetraethyl lead shall be provided in order to prevent workers employed from lead poisoning.

Art. 14 The mixing conductor shall observe each of the following matters in pursuing his work.

1. Operation shall be instantly stopped at the appearance of a leak of tetraethyl lead on other defect.

2. No attempt shall be made to repair or disconnect the system of the apparatus except by a qualified man.

3. Each worker employed shall be instructed as to the poisonous nature of tetraethyl lead and the precautions to be taken in its handling.

Art 15 The mixing conductor shall have workers take a physical examination which shall consist of such physical and other tests as include the following items, and exact records of these examinations shall be kept.

1. Bimonthly weight.

2. Bimonthly systolic and diastolic blood pressure estimation while sitting.

3. Bimonthly hemoglobin estimation.

4. Stippling of blood.

Art 16 The maximum content of tetraethyl lead in gasoline shall be in the proportion of 3 cc for gasoline of one gallon.

Art 17 The mixing conductor shall store tetraethyl lead in a solid warehouse or other place which shall be locked.

Art 18 The mixing conductor shall send back to the manufacturer of tetraethyl lead the container immediately when emptied.

Chapter IV
Label of Ethyl Gasoline

Art 19 The container of ethyl gasoline shall bear the label stating the following matters:

1. In the effect that it is the gasoline containing tetraethyl lead.

2. In the effect that it is to be used as motor fuel only.

Art 20 Each filling station which delivers ethyl gasoline shall keep prominently displayed on filling station the notice stating the matters provided in the preceding article.

Supplementary Provisions

The provision of Art. 9 shall be applied to the case when mixing conductor transports tetraethyl lead manufactured being not conformed with this Ministerial Ordinance.

In the case when the mixing conductor adds tetraethyl lead manufactured being not conformed with this Ministerial Ordinance in gasoline, gasoline mixed up shall be colored with conspicuous color to the specified intensity.

The container emptied of tetraethyl lead manufactured being not conformed with this Ministerial Ordinance shall be rejected by the mixing conductor in a safe way.

Revision of the Control Law on the Business of Poison or Powerful Agent

Note: Rev. - the revised provision
New. - the additional provision

1. Art. 3. The person who wishes to engage in manufacture or import of poison or powerful agent shall be registered by the Governor of Metropolis, district or urban or local prefecture where he has his plant (in the case of the import, his leading business office, hereinafter the same) for each plant. Rev.

The person who wishes to engage in the sale of poison or powerful agent shall be registered by the Governor of Metropolis, district or urban or local prefecture where he has his shop for his each shop.

The registration of the manufacture, import or sale of poison or powerful agent shall become invalid unless it is renewed annually before the thirty-first day of December.

The procedure for registration and renewal of registrations provided in the foregoing three paragraphs and the fee required for them shall be established by the Minister of Welfare under authority of this Law.

2. Art. 4. The person who is engaging in the business of poison or powerful agent shall employ the business manager in every plant or shop who shall handle poison or powerful agent provided that it shall not apply to the following cases: Rev.

a. In the case when the person registered to make the business of poison or powerful agent is a business manager himself, and handles poison or powerful agent in his plant or his shop.

b. In the case when the person registered as a manufacturer or an importer of poison or powerful agent has been registered as a seller at the same place and the Governor of Metropolis, district or urban or local prefecture, has recognized that the business manager can handle poison or powerful agent by himself.

3. Art. 5, Par. 2. The person who is engaging in the business of poison or powerful agent shall be registered by the Governor of Metropolis, district or urban or local prefecture where his address is located. Rev.

Par. 2 of Art. 5 shall be moved down to Par. 3.

4. Art. 6. In case the person who is engaging in the business of poison or powerful agent, or a business manager has changed matters to be registered, or closed his business, he shall apply for changes on matters registered or report the fact of closing to the Governor of Metropolis, district or urban or local prefecture where he has his plant, or business place, or his residence. Rev.

5. Art. 11, Par. 2. The Minister of Welfare shall be authorized, as to handling of poison or powerful agent, to place some limitations on handling of some specific poisons or powerful agents when he deemed necessary. New

6. Art. 12, Par. 2. In order to perform duties concerning poison or powerful agent provided in Par. 1 of the preceding Article, inspectors of poison or powerful agent shall be appointed in the prefectural government. New

Inspectors of poison or powerful agent shall be appointed from among the officials of the prefecture by the governor of prefecture.

Fixed number of the inspector of poison or powerful agent, its qualifications and other necessary matters than those provided in the foregoing two paragraphs shall be provided by the Ministerial Ordinance.

7. Art. 13. The Minister of Welfare may order to manufacturers, importers, sellers of poison or powerful agent to make repair or rebuild the arrangements of facilities of plant or business office or to put some limitations on its use or using he deems necessary from the standpoint of public health. Rev

In case the manufacturer, importer, seller, or business manager of poison or powerful agent violated this Law or the Ministerial Ordinance issued under authority of this Law, the Minister of Welfare, the Governor of Metropolis, district or urban or local prefecture may cancel his registration, prohibit the business, or suspend it for the period which he may fix.

The governor of metropolis , district, urban or local prefecture shall cancel the registration when a business manager came to all under any one of the items of Art. 5, Par. 1.