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HEADQUARTERS
U. S. STRATEGIC BOMBING SURVEY
(Pacific)
APO #234
C/O POSTMASTER, SAN FRANCISCO

Oil and Chemical Division #96

INTERROGATION No. 406 USSBS

PLACE: Tokyo
DATE: 21 November 1945

Division of Origin: Oil Chemical and Rubber

Subject: Control and Manufacture of Tetra Ethyl Lead (T.E.L.)

Personnel interrogated and background of each:

HIRAI, Lt. Comdr., IJN - Graduated in Applied Chemistry from the Hiroshima Higher Technical College in 1929 and immediately went to work as a laborer in the refinery at the Tokuyama Naval Fuel Depot advancing in 1933 to a post as civilian engineer. In 1939 he was commissioned a Lt (jg) in the Engineer Corps and continued along with his specialty (refineries) at Tokuyama. In 1943 he was ordered to the IJN Munitions Bureau for duty as a technical advisor. He has been engaged in this assignment ever since.

Interrogator: Lt. Comdr. W. H. Evans, USNF

Interpreter: Mr. J. Taji

Allied Officers Present: Mr. James Keyes (recorder)

SUMMARY:-

(1) Hirai gives a detailed account of the bomb damage at three of the plants producing T.E.L. for the IJN. Although bombing reduced production considerably in the spring of 1945, it did not play an important part in rendering Japan's air defenses ineffective since AvGas stores were reduced at a greater rate.

(2) He gives an interesting account of the operation of production installations by both the IJN and the IJA under the same roof at the Hodogaya Chemical Works at Koriyama.

(3) Statistical data was delivered to Major Takahashi, IJA on 20 November for its inclusion in a joint T.E.L. report by the IJA for this Division. Material turned over to Major Takahashi includes production figures for all T.E.L. ingredients by months for each of the four plants producing for the IJN.

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1. Q: When did the IJN first use T.E.L. in their AvGas?
A: In 1933-34.
2. Q: What was the source of the T.E.L. at that time?
A: It was imported from America.
3. Q: Did you import the finished product, or did you buy the T.E.L. and compound it?
A: We bought the T.E.L. and mixed it with our own fuel.
4. Q: Did you buy Ethyl Fluid?
A: Yes.
5. Q: Do you know the composition of the T.E.L. Fluid at that time?
A: The ingredients were Ethyl Di-bromide, Analine dye, Sodium-Lead amalgam and stabilizer.
6. Q: Have you any data on the actual composition?
A: Not for the Fluid used then.
7. Q: When did the Japanese - either the IJN, IJA, or private industry - first produce T.E.L.?
A: April 1941.
8. Q: Where?
A: At Hodagaya Kogaku Kogyo K.K. at Koriyama and at the #3 Naval Fuel Depot at Tokuyama. Both started operations about the end of 1940. IJN operations only amounted to a pilot plant.
9. Q: When did the IJN first manufacture it on a production basis?
A: In October 1941.
10. Q: What records are available on the IJN operations for the production of T.E.L.?
A: Records covering production at the four IJN plants were given yesterday to Major Takahashi, IJA, for submission in a joint IJN-IJA report to USSBS, Oil Chemical and Rubber Division.
11. Q: What periods were covered by this report?
A: Quarterly for each plant from the beginning through the second quarter 1945.
12. Q: Is it possible to get this data on a monthly basis?
A: Only by rough estimate.
13. Q: What information is available on the production processes, yields, raw materials and reactions involved?
A: All this data corresponds with that given in the report of Major Takahashi.
14. Q: Do you mean to infer that the integrated manufacturing processes for the IJN and the IJA coincided exactly?
A: Yes.
15. Q: Did the IJN Munition Bureau exercise complete control over the manufacture of T.E.L.?
A: 100%.
16. Q: Was there a shortage of T.E.L. at any time during the war?
A: At the beginning of the war we lacked T.E.L., but the government encouraged production in order to attain capacity. At the start of the war T.E.L. was a bigger bottleneck than AvGas. The shortage was felt until July 1942 but effort was made to gear production of T.E.L. to that of AvGas. Except for the latter part of 1945 T.E.L. was always below total AvGas stores but was enough for immediate consumption. Only in the last part of the war was there an excess of T.E.L.
17. Q: Was this because less and less T.E.L. was required for available AvGas?
A: Yes.

18. Q: Would you please take this piece of paper and draw a rough graph representing the correlation between the three curves - AvGas consumption, AvGas Availability and T.E.L. production.
A: Lt. Comdr. Hirai sketched a graph along the lines of the request.
19. Q: The production curve for T.E.L. shows quite a decline from late 1944. Can you enumerate the factors leading to this reduction in production?
A: This was the result of bombing and a lack of basic materials.
20. Q: Did you submit a report of bomb damage to Major Takahashi?
A: No.
21. Q: Which plants - both IJN Fuel Depots and private plants operating under contract - were damaged by aerial bombing?
A: The three last on this list. (Hirai indicated the following plants: IJN Fuel Depot #2 at Yokkaichi, IJN Fuel Depot #3 at Tokuyama, and the Hodogaya Chemical Co. at Koriyama)
22. Q: What was the extent of the damage at the Hodogaya plant?
A: Equipment was 50% damaged. The Navy equipment was more than 50% destroyed and almost all of the Army equipment was ruined.
23. Q: Does Comdr. Hirai infer that the IJN and the IJA had separate installations for T.E.L. at Koriyama?
A: Yes, the IJN and the IJA each had completely integrated plants under one roof at Hodogaya, processing the same raw materials and manufacturing the same specifications. Both installations had about the same capacity originally, but later the IJN erected a second installation adjoining the same building. In the attack, the IJA plant was destroyed and the IJN plant originally built was about 50% destroyed, while the recent annex installation was undamaged.
24. Q: Which operations of the manufacturing process made use of common equipment for IJN and IJA production and which operations were separate?
A: In the amalgamation process where Sodium (Na) was mixed with Lead (Pb) each had separate equipment, but frequently the plant manager made IJN and IJA amalgam in the same mixer. The bromination of ethyl alcohol was always carried out on separate basis and was mixed with T.E.L. according to individual Army and Navy requirements. The final mixing of the materials - dyestuffs, stabilizers, ethyl bromide, and T.E.L. - was always done individually. Preliminary operations were sometimes individual and sometimes in common depending upon the decision of the plant manager. Both Army and Navy installations were completely integrated.
25. Q: Wasn't this disjointed production arrangement a little awkward?
A: It was an undesirable arrangement.
26. Q: Would a joint operation have been more efficient?
A: Perhaps, but when resources and raw materials are plentiful a single control would be best. When things are scarce all interested parties grab for everything and control production to the finished product. Independence is the best way to protect your interests.
27. Q: Was the Navy installation ever put back in operation after the attack of 13 May?
A: No.
28. Q: Was the Army's?
A: They started repairs but gave up.
29. Q: What about the attack on the IJN Fuel Depot at Tokuyama?
A: The plant was attacked by H.E. just once on 10 May 1945.
30. Q: What was the extent of the damage?
A: The plant was completely wiped out.

31. Q: Was no effort made to replace it?
A: Fuel production was so low that they had an excess of Fluid.
32. Q: What was the date referred to?
A: December 1944.
33. Q: How does Comdr. Hirai explain that?
A: Although production of T.E.L. was decreased, production of AvGas went down even more.
34. Q: Did they actually, then, curtail production of T.E.L.? Was it premeditated?
A: They lacked raw materials. Lacked industrial salt. It was used in making Hydrochloric Acid.
35. Q: Did they use HCl or Chlorine Gas in the chlorination of Ethanol?
A: At the IJN plants we had no difficulty getting salt, so that we made our own HCl but at Koriyama and Niigata salt was short and it was necessary to chlorinate from Cl₂.
36. Q: The IJN, then were able to get a priority for salt when the private plants operating under contract for the military could not.
A: Correct.
37. Q: Will you make an effort to evaluate the factors leading to the decline in production of T.E.L.? It appears to be a combination of the three -- bombing, planned curtailment and shortages. Can you tell us the relative importance of each?
A: They planned to make more T.E.L. than they actually produced, but could not do it on account of a lack of materials. That was prior to December 1944. After December 1944 they prepared to curtail production because they had too much T.E.L. During that winter there was an extreme snowfall. About three meters. Transportation was very difficult, also some of the buildings were squashed under the weight of the snow. Power lines, pipes and conduits were damaged.
38. Q: Did the bombing play an important part in the war from the point of view of T.E.L. production? In other words, were the Army or Navy deprived of AvGas due to bombing?
A: Stocks of AvGas were not at all reduced because of the shortage of T.E.L. Availability did not drop off because of a shortage of T.E.L. but a shortage of AvGas resulted in the utilization of alcohol as aviation fuel. T.E.L. has no use with alcohol.
39. Q: Were adequate stocks of aviation fuel in readiness for attack by the Special Attack Corps on our invasion Fleet?
A: I do not know.