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4 April 1945

463.7  
MEMORANDUM:

SUBJECT: Use of 100/150 Grade Fuel by Eighth Air Force

TO : Director of Technical Services, Air Technical Service Command in Europe, APO 633, U.S. Army

1. The following is a summary of 100/150 grade fuel experience in Eighth Air Force.

2. a. This fuel was first service tested by the Technical Operations Section, this headquarters, in October 1943, said service test lasting through until March 1944, at which time it was recommended that if extra performance from P-38, P-47 and P-51 aircraft was desired it could be secured by the use of this fuel. It was pointed out at that time that the only apparent deleterious effect of this fuel on any one of the three types was the extra lead fouling of spark plugs.

b. A decision was made in May 1944 to have all fighter units supplied with this fuel no later than 1 June. As of that date operations with this fuel continued until approximately 1 February 1945 when all fighter units switched to "Pep" (100/150 plus 1.5 T's ethylene dibromide). As of 1 April 1945 all units switched back to the 100/150 fuel containing 1.0 T ethylene dibromide.

3. At the time the 150 grade fuel was first used all three fighter types listed above were in operational use by this Air Force. Shortly after June 1 P-38 units were re-equipped with P-51 type aircraft so that the experience with 150 grade fuel in P-38 type aircraft is limited. Gradually, conversion of P-47 outfits to P-51's took place during the Summer and Fall of 1944, and as of approximately 1 November only one P-47 group remained in this Air Force.

4. Maintenance difficulties can be summarized as follows:

a. P-38 (V-1710 Engine).

Spark plug leading was increased. The extent of this leading was such that plug change was required after approximately 15 hours of flying. This condition was aggravated considerably by the low cruising powers used to and from target areas, while trying to get the maximum range possible. It was found, however, that regular periods of high power running for a minute or two in most cases smoothed out any rough running engines unless the cause was other than leading.

b. P-47 (R-2800 Engine).

Spark plug fouling was the only maintenance difficulty encountered during the period in which 150 grade fuel was used. Spark plug life was re-

duced about 50%, the same low power cruising as described above being the principle cause for the extra fouling. No deleterious effects on diaphragms, fuel hose or any other rubber or synthetic rubber materials were noted.

g. P-51 (V-1650 Engines).

The same type of lead fouling as described in a and b above happened in the case of P-51 except that it was probably more serious than in either of the other two types. Using 130 grade fuel with  $4\frac{1}{2}$  cc. of lead, the average operational P-51 could last 5 missions (roughly 25 hours) before the fouling required plug change. With 150 grade fuel containing 6 cc. of lead, 10 to 12 hours, or normally 2 missions, was the average length of time between spark plug changes or cleaning. At various times in the six months of operation of P-51 aircraft on 150 grade fuel many other maintenance difficulties were attributed to the fuel, but final analysis proved that the only real effect of the fuel was the lead fouling. Some units maintained they had some deterioration of seals, but this was not borne out throughout the command, nor was there any concrete evidence that it existed in the units.

The excessive fouling of spark plugs usually exhibited itself in roughing up of engines after a couple of hours of low power cruising. Periodic bursts of high power in most cases smoothed the engine out. However, if the engine was allowed to go too long a period without being cleaned out, the accumulation of lead bromide globules successfully withstood any attempts to blow them out. In some instances, long periods of idling while waiting for take-off and a failure to use high power on take off resulted in loss of power during the take-off run and in some cases caused complete cutting out with subsequent belly landing. The cases of cutting-out on take-off definitely attributed to excessive fouling were comparatively few, although numerous enough to list it as an effect of the extra lead.

As a result of several months operational use with the fuel, an SOP - designed to reduce power failures on take-off, leading troubles in flight, and other things which were causing early returns and abortive aircraft - was published. This is inclosure no. 1. Almost immediately after this section published this SOP practically all of the troubles then existing ceased, although it still was necessary to change plugs after each two missions or thereabouts.

5. In an effort to reduce the lead fouling, tests were conducted by this section with 150 grade fuel containing 1.5 T's of ethylene dibromide. A total of about 200 hours was run by this section and the three squadrons given the "Pop" fuel for accelerated service tests. The results of these service tests showed a considerable reduction in lead fouling with no apparent effects otherwise. As a result, all fighter units of the Air Force were put on Pop fuel late in January 1945. About thirty days thereafter a sharp increase in valve trouble was experienced with the V-1650 engine. Inspection of engines at overhaul revealed that the hydrobromic acid was eroding the silchrom valve seat inserts to such an extent that after approximately 100 hours of operation all the valve clearance was gone. This 100-hours is the minimum life, some engines going 170 to 180 hours before this condition prevailed. There are no other deleterious effects of this fuel noted. As of 1 April 1945 fighter units of this Air Force returned to the use of 100/150 grade fuel containing 1.0 T of ethylene dibromide.

GASS S. HOUGH  
Colonel, AG  
Director of Technical Operations