

ENERGY OIL COMMITTEE

Western Axis Subcommittee

ESTIMATED PETROLEUM REFINERY OUTPUT

IN AXIS EUROPE DURING 1943

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WESTERN AXIS OIL POSITION

ESTIMATED PETROLEUM REFINERY OUTPUT IN 1943

SUMMARY

The information in this section is based on the industry's pre-war knowledge and data concerning the European refineries and on reports of experts returning since the outbreak of hostilities, supplemented by occasional items of intelligence. These first-hand records covering the pre-war years, together with the subsequent information, have permitted an approximate appraisal of the present overall refinery situation in each of the countries involved. In certain cases assumptions have had to be made and rarely has aerial reconnaissance been available to confirm the conclusions.

In stating the probable output of products for 1943, it was assumed that the refineries would be operated for minimum gasoline production and maximum fuel oil and diesel oil production. This assumption is based upon the apparent shortage of black oils as compared to estimated consumption. In those refineries equipped for cracking, it is assumed that the cracking units are used for reforming or visbreaking if at all.

The gasoline components dealt with in this section are only those of refinery or casinghead origin, including such aviation alkylates as are made from refinery gases. Aviation gasoline from petroleum is assumed to have been produced only in Rumania although gasoline cuts from several of the European crudes could be used if necessary.

Casinghead gasoline is all assumed to find its way to the refineries for blending in motor fuel, except the butane cuts which are made in the field and bottled for sale separately. In the tables of this section which show the amount of crude handled, the casinghead production is included in the crude figure.

In connection with the separate discussions of countries which follow, are given lists of refineries showing their individual crude capacities and probable product outputs. Separate figures are given for the output of fuel oil (including asphalt, etc.) and for the fuel oil and fuel gas consumed by the refinery (including gas sold and loss.)

In Appendix "A", attached hereto, are given details concerning the type and condition of refinery equipment, covering

the refineries in all occupied countries. In the general map of Europe attached (Appendix "B") are also shown the locations of all the significant refineries. Excluded from the map and lists are numerous bulk stations with or without small naphtha rectifying stills in connection, which have been listed as refineries in previous reports. Excluded from the map but shown separately on the lists are lube blending stations, coal tar distilleries and specialty plants, such as the white oil plant at La Mailleraye, as well as a great number of refineries which are shut down and unserviceable or of such small capacity as to be inconsequential.

The European refining situation is summarized by countries in Table I following, the figures being approximate and for metric tons per year. The combinations of geographical groups were made to correspond with the present association of refineries and crude oil producing fields. For example, Rumanian oil supplies the Rumanian refineries and, by river routes, it also supplies certain Yugoslavian refineries; Hungarian oil supplies Hungarian, Austrian and Italian refineries; Yugoslavian crude oil is lumped together with that part of Hungarian crude which is refined in Italy; Austrian oil supplies Austrian refineries and also Czechoslovakian refineries. The crude production in Germany and in Poland is all refined locally.

It should be noted that there are many cases where two refineries operate together, one performing the initial distillation and sending unfinished products such as lube distillate to the other one for finishing. Examples are the Harburg and Grasbrook refineries of Rhenania-Ossag, the Deurag and Nerag refineries of Gewerkschaft Deutsche Erdoel, the Orion and Speranta refineries of Unirea, the Teleajen and Brasov refineries of Romano Americana and Vacuum respectively, and the Kolin refinery and its neighboring Czechoslovakian refineries.

Table I reproduces figures for crude production (including casinghead) which are developed elsewhere, and shows total refinery capacities, operating rates and products sold, by countries. Refinery capacity figures are only included to show the approximate order of magnitude of the installations, it being understood that capacity varies greatly with type of crude, range of products being made and inter-refinery exchanges of unfinished distillates - factors which are subject to radical change. Account is taken of demolition or dismantling where such is definitely known to have taken place.

TABLE I

ESTIMATED EUROPEAN REFINERY OUTPUT FOR 1943Operating for maximum diesel and fuel oil

(Figures in thousands of metric tons yearly)

<u>Crude Production</u>	<u>Refinery</u>	<u>Capacity</u>	<u>Handled*</u>	<u>Gasolines</u>	<u>Kerosine Gas Oil Diesel Oil</u>	<u>Lubes</u>	<u>Fuel Oil Etc.</u>	<u>Ref'y Fuel & Loss</u>
Germany	1085 → Germany	2505	1085	105	280	340	273	87
Czechoslovakia	32 → Czechoslovakia	700	700	35	192	217	193	63
Austria	1004 → Austria	800	800	134	305	114	174	73
Hungary	1413 → Hungary	400	400	96	180	16	72	36
Italy	11 → Italy	2100	873	201	366	42	187	77
Albania	264 → Italy							
Yugoslavia	49 → Yugoslavia	180	54	11	16	3	18	6
Rumania	5067 → Rumania & Bulg.	9280	5013	1135**	1363	331	1683	501
Poland	535 → Poland	800	535	107	183	64	145	36
Estonia	75 → Estonia	100	75	8	30	-	33	4
France	95 → France	7915	95	22	25	21	22	5
Belgium	0 Belgium)							
Netherlands	0 Netherlands)							
Norway	0 Norway)	1335	0	0	0	0	0	0
Denmark	0 Denmark)							
TOTAL	9630	26,215	9630	1854**	3417	1148	2323	888

* Exclusive of distillates from other refineries, but including casinghead gasoline.

** Including 125,000 metric tons of aviation base stock and 50,000 tons of alkylate.

German Crude Oil Refineries

The German refineries have a total capacity of 2,505,000 tons per year, many of them having been designed to process imported crudes. The total refinery capacity, if intact, would be more than twice the present German crude oil production but the heavy and protracted bombing of Hamburg and sporadic raids on the Hannover, Dortmund and Bremen districts have injured some of the refinery equipment. The amount of damage is unknown but it is not believed to have reduced the total operating rate below the rate of German crude production.

The Hannover and Hamburg districts contain most of the refineries of Germany and from these areas also comes about 85% of the German crude oil. The Wienhagen crude oil from the Hannover section (55% of total) is about 26°API gravity, and the Reitbrook crude (20% of total) is about 21°API gravity. The Wienhagen crude in a typical analysis showed 12.4% of 316°F EP gasoline of 54.0 O.N. The Reitbrook crude showed 5.9% of 316°F EP gasoline of 71.5 O.N. Both crudes contain a large percentage of lubricants, those from Wienhagen being of high pour and fair V.I. while those from Reitbrook are very low pour and low V.I.

The increased production of Reitbrook crude is thought to have relieved any shortage of ordinary lubes that might have existed. Available lube oil facilities now include solvent extraction, propane deasphalting and solvent dewaxing so that high grade lubes are also obtainable from the German crudes. Cracking and reforming units exist and a catalytic cracker was at least projected in 1939 at the modern Ebano asphalt refinery. There is little doubt that modern equipment has now been installed to the extent that it was lacking, for maximum yield of important products.

In stating the probable product output it has been assumed that the large and well-equipped refineries are operating at capacity and the minor ones are either operating at reduced capacities or standing by as alternates for damaged units. This implies the most efficient use of facilities available. Based on a knowledge of the process units and on a few reports that have been received, it is believed that Europaische Tanklager at Hamburg and Deurag at Hannover-Misburg are in full operation. Between them and the Rhenania plant at Harburg all the German crude is easily given its initial distillation and the low octane naphthas reformed. These refineries would produce about 40% of lube distillates from the German crudes. The Rhenania plant at Grasbrook and the Werag plant at Misburg would presumably get about half of these distillates in order to keep the modern equipment

at both plants working at capacity. The remainder of the distillate is apparently, from freight movement reports, distributed among a number of the smaller plants, some of which are capable of good grade lube production although depending on older processing methods.

Table II which follows indicates the estimated product output for the German refineries for the year 1943, assuming operation for minimum gasoline and maximum black oils.

TABLE II

OUTPUT FROM GERMAN REFINERIES IN 1943Operating for maximum diesel and fuel oil

(Figures in thousands of metric tons per year)

	Crude Capacity	Crude Handled	Gasoline	Kerosine Gas Oil Diesel Oil	Lubes	Fuel Asphalt Etc.	Ref'y Fuel & Loss
<u>HAMBURG DISTRICT</u>							
Europäische Tanklager (Petroleumhafen)	400	400	40	85	*	83	24
Rhenania-Ossag (Harburg)	550	385	36	81	**	78	23
Rhenania-Ossag (Grasbrook)	130	(Dist. 121)	0	17	86	12	6
Ebano Asphaltwerke (Harburg)	400	Standby	-	-	-	-	-
Mineralöl and Asphaltwerke (Ostermoor)	150	Standby	-	-	-	-	-
Deutsche Petroleum (Wilhelmsburg)	65	(Dist. 29)	0	3	22	4	1
Julius Schindler (Wilhelmsburg)	40	(Dist. 16)	0	2	11	2	1
Ernest Schliemann (Hamburg)	65	(Dist. 29)	0	3	22	3	1
Albrecht (Hamburg)	30	Standby	-	-	-	-	-
<u>HANNOVER DISTRICT</u>							
Deurag and Nerag (Misburg)	300	300	29	77	94	76	24
Julius Schindler (Peine)	20	(Dist. 10)	0	1	7	1	1
Deutsche Gasolin (Dollbergen)	40	(Dist. 16)	0	1	12	2	1
Niedersachsen-Norddeutsche (Dollbergen)	10	Standby	-	-	-	-	-
<u>BREMEN</u>							
Vacuum Oil Co. (Oslebshausen)	80	(Dist. 33)	0	3	25	3	2
<u>EMMERICH</u>							
Deutsche Gasolin	60	(Dist. 26)	0	2	20	3	1
<u>SALZBERGEN</u>							
Ersag-Wintershall	30	(Dist. 13)	0	1	9	2	1
<u>DORTMUND</u>							
Schmitz-Westfälische	20	Standby	-	-	-	-	-
<u>MOMHEIM</u>							
Rhenania-Ossag	115	(Dist. 41)	0	4	32	4	1
TOTAL	2505	185	105	280	340	273	87

* 168 metric tons per year unfinished lube distillates.

** 167 metric tons per year unfinished lube distillates.

Note: Omitted from the above list are (1) bulk stations with small naphtha rectifying equipment (2) lube blending and grease compounding plants; (3) plants for working up lignite oil and coal tar, and (4) specialty plants for white oil and for Voltol. Such units are as follows:

TEMPELHOF	SCHULAU - Vacuum - lubes	ROSITZ-ELBE - coal tar
REGENSBURG	LICHTENBERG	KRUMPA - lignite oil
REISHOLZ	EISLINGEN-ZELLER & GMEIN	DURCHSATZ - lignite oil
COLOGNE - Kolner Benzin	FIRMA - Mexas	NORDATERN
BERLIN - Brenntag-Muehsam	BREMEN - Korff	FREITAL-DRESDEN - Voltol

Austrian and Czechoslovakian Refineries

The Austrian and Czechoslovakian refineries now in operation have a total capacity of 1,500,000 tons per year. This takes account of the new refinery at Lobau near Vienna, which has a rated capacity of 500,000 tons. This unit was probably installed to handle excess Hungarian production since refinery capacity without it is practically in balance with local crude production as presently estimated.

The local crude comes almost entirely from the Zistersdorf and contiguous fields of the Vienna Basin. The Zistersdorf crude is of mixed base, about 25°API gravity and is characterized by a very small virgin gasoline content (3% of 300 EP, 67½ O. M. from one sample) and a good percentage of high pour lubricating stock.

It is understood that the Kolin refinery in Bohemia has installed complete solvent extraction and dewaxing facilities which were removed from the Oslebshausen refinery in Germany. This equipment can treat about one half the lube distillate produced from Austrian crude and it is therefore assumed that the Kolin refinery is handling lube distillates from the other refineries. The Bratislava and Lobau refineries have Skoda cracking coils but under present conditions they are assumed to be operating for minimum gasoline output and using the coils for reforming or visbreaking if at all.

Under former conditions these Austrian and Czechoslovakian refineries had access to Rumanian and enriched Rumanian crudes as well as Austrian. At present it appears that there is no capacity for Rumanian and that Hungarian crude has over flowed into the Vienna district, thus crowding Austrian crude into the small and remote refineries. It is probable that, as soon as refining capacity is built up in Hungary, the Lobau refinery will start running Austrian crude and some of the Czechoslovakian plants will be shut down.

Table III, which follows, sets forth the probable state of the refining industry in Austria and Czechoslovakia and shows all refineries operating to capacity.

TABLE III

OUTPUT FROM AUSTRIAN & CZECHOSLOVAKIAN REFINERIES IN 1943Operating for maximum diesel and fuel oil

(Figures in thousands of metric tons per year)

	Crude Capacity and Operating Rate	Gasolines	Kerosine Gas Oil Diesel Oil	Lubes	Fuel Oil Etc.	Ref'y Fuel & Loss
<u>VIENNA DISTRICT</u>						
Snell Floridsdorfer (Floridsdorf)	100	5	25	31	30	9
Credital Minier (Korneuberg)	50	2	13	16	14	5
Vacuum Oil Co. (Kagran)	60	3	16	19	17	5
Osterreichische Fanto (Vosendorf)	40	2	10	12	12	4
Nova Cel und Brenns. (Schwechat)	50	2	13	16	14	5
Wintershall-Elwerath-I.G. (Lobau)	500*	120	228	20	87	45
TOTAL	800	134	305	114	174	73
<u>DUBOWA, SLOVAKIA</u>						
Government Refinery	90	4	27	19	30	10
<u>BRATISLAVA, SLOVAKIA</u>						
Apollo-I.G.	150	8	39	32	51	20
<u>KRALUPY, BOHEMIA</u>						
Lederer-Benzol Verband	60	3	15	12	23	7
<u>KOLIN, BOHEMIA</u>						
Vacuum Oil Co.	90 (+ Dist. 48)	5	21	90	17	5
<u>PARDUBICE, BOHEMIA</u>						
Fanto Werke	200	10	60	42**	32	8
<u>NOVY BOHUMIN (ODERBERG), MORAVIA</u>						
Fanto Werke	60	3	15	12	23	7
<u>PRIVOZ (MORAVSKA OSTRAVA), MORAVIA</u>						
Privozer Mineralol	50	2	15	10	17	6
TOTAL	700	35	192	217	193	63

* Hungarian Crude.

** In addition 48,000 T lube distillate produced for finishing at Kolin.

This list ignores the usual bulk stations, with or without small fractionating stills. Furthermore it takes no account of the following unimportant installations:

DROESING - Credit Minier - dismantled for Schwechat
 SIMMER - in-Gerlande - Vienna Oil Works
 SUMPERK (Schonberg or Weikersdorf) - shut down
 MORAVSKA - Himmelbauer
 STRASZKE - Ehrenberg
 TRSTENA - Vesta (Fanto)

Hungarian Refineries

The total capacity of the Hungarian refineries is 400,000 tons per year which is less than one third of the greatly increased Hungarian crude production expected in 1943. This local shortage of refining capacity probably implies that northeastern Italian refineries, as well as one Austrian refinery, are operating on Hungarian crude. There have been reports of the construction of a refinery at Lispe by MAORT but it is assumed that this unit is not yet in operation.

The bulk of the Hungarian crude is from the Budafapuszta (Lispe) and Lovaszi fields. These crudes are about 42° and 39°API gravity respectively and contain 30 to 40% of low sulfur gasoline. For a typical example, Eurogasco (Fuzito) crude shows 28% of 300 EP gasoline (65 O.N.) or 43% of 400 EP naphtha (56 O.N.). The diesel oil is of moderately high index but rather high pour. A small amount of high pour lube stock is obtainable and only a very small percentage of heavy residuum is contained. There is no commercial cracking equipment in Hungary except a small unit at Pet, and it would be of no great utility under present conditions except for reforming, due to the high percentage of virgin naphtha in the crude.

In the following list of Hungarian refineries the small and remote plants at Nyirbogdany, Szoreg, and Munkacs are included. This is because of reliable reports of continuing operations, as late as 1942, at a number of such installations. It is believed that some of them at least are in service and the choice of those shown herewith on the inactive list is arbitrary.

TABLE IV

OUTPUT FROM HUNGARIAN REFINERIES IN 1943
Operating for maximum diesel and fuel oil
 (Figures in thousands of metric tons per year)

	Capacity and Operating Rate	Gasolines	Kerosine Gas Oil Diesel Oil	Lubes	Fuel Oil Etc.	Ref'y Fuel & Loss
<u>BUDAPEST REGION</u>						
Shell Koolaz (Czepel)	150	36	68	6	27	13
Maygar Petroleum-Dr. Freund	60	14	27	3	12	5
Budapesti Asvanyolajgyarak-Fanto	40	10	19	2	6	4
<u>ALMAS FUZITO</u>						
Vacuum Oil Company	90	22	38	5	19	8
<u>NYIRBOGDANY</u>						
Nyirbogdanyi Petroleum	20	5	10	-	2	2
<u>SZOREG</u>						
Szoregi Petroleum	10	2	5	-	2	1
<u>MUNKKACS (MUKACEVO)</u>						
Del-Karpati Petroleum	30	7	13	-	4	3
TOTAL	400	96	180	16	72	36

Not shown on the above list are plants at the following locations:

- LISPE - Maort refinery under construction.
- PET. - Small government refinery, may be operating.
- BUDAPEST - Hazai Koolajipar reported shut down.
- BUDAPEST - Fanto (Hungarian Oil Refinery) reported shut down.
- CSAP - Small Schonberg refinery, may be operating.
- ALSONIHALYI - Small Weinberger refinery, may be operating.
- TACHED - Refinery status unknown.

Italian Refineries

The Italian refining industry was created to deal with imported crudes and Italian-owned Albanian crude plus a small amount of indigenous crude and some heavy oil from asphaltic rock. The total refining capacity is 2,100,000 tons per year which is more than twice the present rate of operation. Hydrogenation equipment was installed at both the Bari and Leghorn refineries in order to deal properly with the heavy and sulfurous Albanian crude and the asphaltic oil to be distilled from Sicilian and Italian bituminous rock.

The Albanian crude (Devoli) which constitutes 30% of the total Italian refinery feed stock, is about 16° API gravity. The Italian crude is 42-45° API—largely gasoline and kerosine—but insignificant in amount. As shown in the previous section, the Hungarian crude which Italy is called upon to refine has a high gasoline content and also a certain percentage of lube oil. This crude, plus the small amount of Yugoslavian, is thought to represent 63% of the total Italian refinery feed stock. In a laboratory work-up of Budafapustza crude, 3.6% of light lube plus 2.3% of bright stock — both better than 95 V.I. — were obtained by propane dewaxing and deresining, phenol treating and clay finishing. It is believed that the lube refining equipment now available in Italy would produce lubes in amounts and qualities only slightly inferior to those from the laboratory.

For this high grade lube production there is solvent extraction and dewaxing equipment available in the Aquila refinery at Trieste, in the ANIC refinery at Leghorn and in the Vacuum refinery at Naples. There is less modern lube equipment available in the SIAP refinery at Trieste and the AGIP refinery at Fiume. The assumption is that crude oil from Hungary is processed in the relatively nearby Italian refineries at Fiume, Trieste, and Venice and that lube distillates from these refineries, rather than from Rumania, are sent to Naples or Leghorn for finishing.

The Forno refinery handles the entire production of Italian crude oil. The full production of Albanian oil, plus Italian and Sicilian oil from asphaltic rock, is assumed to be divided between the Bari and Leghorn refineries, although aerial reconnaissance has indicated that Bari may be shut down. Alkylation equipment was also reported to have been installed at Leghorn, and account is taken of this probability in the following Table V, which shows the estimated refinery outputs for 1943.

TABLE V

OUTPUT FROM ITALIAN REFINERIES IN 1943Operating for maximum diesel and fuel oil

(Figures in thousands of metric tons per year)

	Capacity	Operating Rate	Gasoline	Kerosine Gas Oil Diesel Oil	Lubes	Fuel Oil Etc.	Ref'y Fuel & Loss
<u>TRIESTE</u>							
Aquila	300	200 (a)	48	88	8	38	18
SIAP-SOCONJ	150	100 (a)	24	44	4	19	9
<u>FIUME</u>							
AGIP-Romsa	150	100 (a)	24	44	4	19	9
<u>VENICE (Marghera)</u>							
AGIP	350	198 (a)	48	63	(40 Dist)	31	16
<u>FORNOVO TARGO</u>							
Petrolifera-SOCONJ	50	11 (b)	5	5	0	0	1
<u>NAPLES</u>							
Raff. Napoli-Vacuum	200	20 Dist	0	4	13	2	1
<u>SPEZIA (Migliarina)</u>							
Nafta-Shell	400	Standby	-	-	-	-	-
<u>BARI</u>							
ANIC	250	132 (c)	26	58	0	37	11
<u>LEGHORN (LIVORNO)</u>							
ANIC	250	132 (c)+20 Dist	26 (d)	60	13	41	12
TOTAL	2100	873	201	366	42	187	77

(a) Hungarian and Yugoslav crude

(b) Italian crude

(c) Albanian crude (plus minor amounts of rock oil from Sicily)

(d) 10,000 metric tons of aviation alkylate included.

There are additional installations at the following points but they are considered to be unimportant:

VADO LIGURE - Very small white oil plant.

NAPLES - Benit refinery, shut down and abandoned for Raff. di Napoli.

GENOA - Small shut down Carbol asphalt plant. Also RIOC white oil plant.

RAGUSA - Very small plant to distill ABCD rock oil.

FIORENZUOLA - Small shut down skimming plant.

MILAN - Permolio, lube blending and naphtha rectifying. Another, shut down, unit.

Rumanian, Yugoslavian and Bulgarian Refineries

The Rumanian refineries have a total crude capacity of 9,280,000 tons per year - double the present crude oil production - but much of the equipment is old and rudimentary. In connection with the Rumanian refineries are listed herewith the Yugoslavian refineries, since they are still believed to be supplied, by river barge, with Rumanian crude. The full capacity of the Yugoslavian refineries is 180,000 tons per year, but they are probably operating at a fraction of this rate simply to take care of essential local requirements. The three small refineries at Rustchuk (Rousse) just across the Rumanian border in Bulgaria are included in the present list of shut-down plants for the sake of completeness.

The smaller Rumanian refineries consist of shell still batteries but the larger refineries in general have the advantage of some fairly modern pipe still and cracking equipment. Cracking coils are available in most of the principal refineries but there is no evidence of catalytic cracking or isomerization. Reports received indicate that alkylation equipment has been installed at the Astra Romana refinery, capable of producing 60,000 tons per year of alkylate. One report has been received to the effect that two iso-octane plants are operating in Rumania, which implies both polymerization and small hydrogenation facilities. It can reasonably be expected that reports will eventually be received to indicate the presence of catalytic cracking equipment at Astra Romana in view of its obvious advantages at this point.

About 80% of the crude oil to be produced in Rumania in 1943 is of the paraffinous or semi-paraffinous types from which high grade lubricating oil can be manufactured only with considerable difficulty on account of the high wax content and poor natural viscosity characteristics. The dewaxed oil requires solvent extraction, to about the same extent as the stocks from non-paraffinous crude, for improvement of viscosity index. The paraffinous and semi-paraffinous crudes are about 35° API gravity and show 10-12% off at 300°F. They yield in simple distillation, 21-25% of 56 O.N. gasoline plus white spirit, 28-29% kerosine and gas oil and 46-49% residuum.

Solvent dewaxing and extraction facilities, which were lacking at last report, may possibly have been installed to produce, from the paraffinous crude, lube oils of ordinary motor quality or even high grade lubes. This method is followed in a small way at Brasov and is more economical than the manufacture of lube oil from wax. With relaxation of the restrictions against new installations outside of Germany, it seems reasonable that modern refining methods may have been extended, although there is no direct evidence at hand. It is assumed that a small percentage of lubes are obtained from the paraffinous crude in any case.

The non-paraffinous crude, about 20% of the total crude production, may be the source of a considerable tonnage of ordinary low pour lubes, using only the acid treating methods formerly employed. This non-paraffinous crude is about 35°API gravity and yields 26-35% gasoline including 15-17% of 73 O.N. aviation base, 25-30% kerosine and gas oil and 35-49% residuum.

It is assumed that the refineries which formerly produced aviation base stock from non-paraffinous crude are continuing to do so and the figure of 125,000 metric tons per year is therefore included for this product. Also 50,000 tons of aviation alkylate are assumed to be produced by the Astra Romana refinery from the butanes available there and in the neighboring refineries.

The probable list of products from the Rumanian refineries is shown in Table VI below. In estimating the operating rates account was taken of the type and condition of equipment available. For greater efficiency several of the plants would normally be shut down and the largest and best equipped ones would operate at full capacity. There is reason to believe that this is not the case, however, and the crude oil is shown prorated among the stronger units more or less in accordance with their capacities. Most of the major oil companies are reported to have passed into German hands.

It is to be noted that certain plants are without lube equipment and certain others without cracking equipment. The product output is shown in accordance with such conditions and with the assumption that operations are directed toward maximum black oil production under present conditions. The refineries known to be shut down are shown separately. Of those on the active list four are definitely inferior as regards quality of equipment, namely, Concordia Vega, Unirea Speranta, Xenia and Prahova.

TABLE VI

OUTPUT FROM RUMANIAN, YUGOSLAVIAN, AND BULGARIAN REFINERIES IN 1943

Operating for maximum diesel and fuel oil
(Capacities in thousands of metric tons yearly)

	Capac- ity	Oper- ating Rate	Gosolines Avia.	Motor	Kerosine Gas Oil Diesel Oil	Lubes	Fuel Oil Etc.	Ref'y Fuel & Loss
<u>PLOESTI</u>								
Astra Romana	1750	1100	90*	163	302	77	358	110
Concordia "Vega"	1450	1000	30	200	275	70	325	100
Romana Americana	1170	800	15	169	216	56	261	80
Unirea Orion	730	300	10	59	83	21	97	30
Unirea Speranta	410	100		20	25	7	38	10
Colombia	535	200		40	50	0	90	20
Petrol Block	485	200		40	50	14	76	20
Xenia	290	Standby		-	-	-	-	-
<u>BUCAREST</u>								
Frahova	200	100		20	30	-	40	10
<u>CAMPINA</u>								
Steaua Romana	1500	1000	30	200	275	70	325	100
<u>BRAZI</u>								
Credit Minier	535	200		46	53	14	67	20
<u>BRASOV</u>								
Photogen (Vacuum)	35	13		3	4	2	3	1
TOTAL	9280	5013	175	960	1363	331	1683	501

* Including 50,000 metric tons of alkylate.

BROD (YUGOSLAVIA)

Vacuum Oil Company	100	30		6	9	2	10	3
<u>CAPRAG-SISAK (YUGOSLAVIA)</u>								
Anglo-Yugoslav-Shell	80	24		5	7	1	8	3
TOTAL	180	54		11	16	3	18	6

There are additional plants at the following locations, all shut down:

<u>PLOESTI</u>		<u>DOICESTI</u>	
Dacia	120	Credit Minier	90
Redeventa	dism.	<u>BUZAU</u>	
Petrolmina-Lumina	150	Petrol Block "Saturn"	180
Noris	60?	<u>ORSOVA</u>	
Fratia	dism.	Fanto-Credit Minier	60?
Cometa	dism.	<u>OSIJEK (YUGOSLAVIA)</u>	
<u>BUCAREST</u>		Ipoil	20
Petrol Block	55?	<u>DRAVOGRAD (YUGOSLAVIA)</u>	
<u>BAICOI</u>		Gall	10
Credit Minier-Aurora	dism.	<u>SMEDEREVO (YUGOSLAVIA)</u>	
<u>TARGOVISTE</u>		Gov't	under const.
Carmen	dism.	<u>RUSTCHUK (BULGARIA)</u>	
Grigorescu	dism.	Vacuum	22
<u>MOINESTI</u>		Bulg. Pet. Ind.	20
Steaua Romana	60?	Svetlina	19
<u>RAMNICU SARAT</u>			
Rom. Belg. "Venus"	40?		

Ignored are the very small specialty plants, 3 at Bucarest, 8 at Baicoi, 2 at Targoviste, and 12 in scattered localities.

Polish Refineries

There was pre-war refining capacity in Poland for 800,000 tons per year of oil distributed among nine small refineries. In addition, there was capacity for a total of perhaps 200,000 tons per year in twenty-five very minor refineries scattered throughout southern Poland, making a total capacity of about 1,000,000 tons. This is nearly twice the Polish crude production and it may be assumed that the very small and inefficient plants are out of commission under present conditions. No direct reports of demolition have come to hand and it is probable that whatever damage may have been done to the important units has been repaired.

The Polish crude oil is in two main parts, namely that west of the San River, (Gorlice-Jaslo-Krosno), amounting to about 35% of the total, and that east of the San, (Boryslaw-Drohobycz-Bitkov), amounting to about 65% of the total. The main districts in both parts produce oil of 33° API gravity but several smaller districts in both cases contribute lighter crudes so that the average for the west is about 36° API and for the east about 34° API. The largest producing region, Boryslaw, contains 11% of 300EP gasoline of 57.5 O.N. whereas a typical light Jaslo crude yields of 27% of 66 O.N. light gasoline. On the average, 20% of virgin gasoline is produced from the Polish crude. About 65% of the Polish crude is waxy and its large lube stock content, in addition to being very high pour, is naphthenic. The remaining 35% is of low pour point and good V.I. Acid treating and cold settling equipment is available in three of the refineries and solvent dewaxing equipment was being installed in a fourth. Cracking coils exist in three plants.

The following list, Table VII, separates the operating refineries from those shut down. It ignores the numerous very minor installations. It is to be noted that the total percentage of products made from a given amount of crude is higher in Poland than in other countries due to the fact that natural gas and coal are used as fuel for the refinery operations, instead of fuel oil. As in previous sections, cracking is assumed to be minimized in favor of black oil production.

TABLE VII

OUTPUT FROM POLISH REFINERIES IN 1943Operating for maximum diesel and fuel oil

(Figures in thousands of metric tons per year)

	Capacity	Operating Rate	Gasoline	Kerosine Gas Oil Diesel Oil	Lubes	Fuel Oil Etc.	Ref'y Fuel & Loss
<u>CZECHOWICE (DEIEDZICE)</u>							
Vacuum Oil Co. (1) (2)	75	50	10	17	6	14	3
<u>JEDLICZE</u>							
Galicja-Malopolska (2)	75	50	10	17	6	14	3
<u>TRZEBINJA</u>							
Polski-Zwiazkowe Malopolska	100	67	13	22	8	19	5
<u>NIEGLOWICE</u>							
Jaslo-Gartenberg & Schreyer	70	47	9	17	6	12	3
<u>DROHOBYCZ</u>							
Polmin	160	107	22	35	13	30	7
Galicja (1)	140	93	19	32	11	24	7
Nafta-Malopolska	60	40	8	15	5	9	3
<u>GLINIK-MARIAMPOLSKI</u>							
Galicja-Malopolska (1)	80	54	11	18	6	16	3
<u>ZNIESIENIE</u>							
Przemyslu Nafta-Gazy-Ziemne	40	27	5	10	3	7	2
TOTAL	800	535	107	183	64	145	36

(1) Cracking equipment available.

(2) Lube equipment available.

In addition the following refineries are known to have been shut down:

<u>LIMANOWA</u>	
Limanowa	100
<u>LIBUSZA</u>	
Standard-Nobel-Vacuum	60 dismantled
<u>USTRZYKI DOLNE</u>	
Fanto-Malopolska	50
<u>KROKNO</u>	
Stawiarski	20
<u>DROHOBYCZ</u>	
Polski Zwiazkowe-Malopolska-DROS	30

Twenty-four smaller units (less than 10,000 tons per year capacity each) existed in pre-war times at KATOWICE, SKAWINA, TARGOWISKA, STROZE, KLECZANY, GORLICE, ROPICA, MYKIETYNCE, LIGATA, STANISLAWCU, NADWORNIA, GRABOWIEC, DEREZYCE, LESKO, HUBICZE, WIERBLAZ, BORISLAW, DROHOBYCZ, GLEBOKA, and BOLECHOU.

Estonian and Latvian Refineries

The refining industry of Estonia is limited to the processing of oil distilled from the Estonian Kukersite. The total rock mined has been reported as high as 2,000,000 tons per year. One half of this amount has been reported as distilled for oil production, the other half being burned directly as fuel for locomotives, etc. This would imply that rock retort equipment is present in capacity sufficient for the production of 200,000 tons per year of crude oil, assuming the conservative figure 20% oil recovery for this rock. There have been no reports indicating the existence of refining equipment adequate to handle more than 124,000 tons per year of crude oil but there have been reports that Estonian oil is shipped to Poelitz for hydrogenation.

On the other hand information has been received to the effect that rock production has radically diminished since 1940, so that only 47,000 tons of crude oil and gasoline were estimated to have been produced in 1942. A reasonable estimate has been made that 75,000 tons of 20-25° gravity crude can be expected in 1943 of which 8300 tons would be gasoline. Of the remainder probably 30,000 tons could be used as diesel fuel and 34,000 tons as residual fuel oil. Little if any lube stock is obtainable and no proper kerosene.

A small plant, Degviela-Oelrich & Co., 15,000 tons per year, exists at Riga, Latvia, but for lack of stock it is now assumed to be dormant.

The Estonian refineries at last report were as shown in the following Table VIII.

TABLE VIII

OUTPUT FROM ESTONIAN REFINERIES IN 1943Operating for maximum diesel and fuel oil

(Figures in thousands of metric tons per year)

	<u>Capac- ity</u>	<u>Oper- ating Rate</u>	<u>Gasolines</u>	<u>Kerosine Gas Oil Diesel Oil</u>	<u>Lubes</u>	<u>Fuel Oil Etc.</u>	<u>Ref'y Loss & Fuel</u>
<u>KOHTLA</u>							
National Oil Shale Ind. (Govt)	12	10	1	4	0	4	1
New Consol. Goldfields, Ltd.	12	10	1	4	0	4	1
<u>KIVIOLI</u>							
Estonian Shale Oil Company	36	32	4	13	0	14	1
<u>VAIVARA</u>							
Olikonsortium	<u>27</u>	<u>23</u>	<u>2</u>	<u>9</u>	<u>0</u>	<u>11</u>	<u>1</u>
TOTAL	87	75	8	30	0	33	4

French Refineries

The total crude oil refining capacity in France amounts to 7,915,000 tons per year, practically all dependent upon imported crude and in consequence practically all shut down. One exception is the Pechelbronn refinery at Merckwiller in the extreme northeast corner of France which can process 120,000 tons per year and is called on to handle the local production of crude oil at Pechelbronn which is about two thirds this amount.

The Pechelbronn crude averages 26° API gravity and shows 7% off at 300°F in laboratory distillation. It contains lubricating oil of good quality. Merckwiller has complete acid and clay treating and dewaxing facilities for lube oil and a cracking coil to augment the naturally low yield of gasoline. It is assumed that cracking is practiced at this profit regardless of the overall European shortage of black oils.

There is a small production of oil from shale at Autun and at Aumance, the total amount being in the neighborhood of 15,000 tons per year. This shale oil is worked up locally for gasoline, diesel and fuel oils.

Reports have been received from several quarters regarding the destruction and dismantling of French refinery equipment. At the time of the German invasion, the northern refineries all received government orders to destroy the oil and tankage and as a result most of these tanks were burned down. Some northern refineries, such as Dunkerque have also been affected by military action. Bombing by the British caused considerable destruction of tankage in the refineries near Bordeaux.

The Germans have dismantled distillation and cracking units at several refineries, taking the equipment for installation in operating refineries out of the country. There have been no indications that the refineries near Marseille were damaged and they were reported ready to operate as late as November 1942.

The following list of refineries, Table IX, shows their probable status and their probable product output for 1943.

TABLE IX

ESTIMATED FRENCH REFINERY OUTPUT IN 1943

(Figures in thousands of metric tons per year)

	Capac- ity	Oper- ating- Rate	Gas- lines	Kerosine Gas Oil Diesel Oil	Lubes	Fuel Oil Etc.	Ref'y Fuel & Loss
<u>DUNKERQUE REGION</u>							
Raff. de Pet. du Nord - (Dunkerque)	450		Not Operating				
<u>DOUAI REGION</u>							
SGHP-Anglo-Iranian-(Courchellettes)	300		"	"			
<u>LE HAVRE REGION</u>							
Cie. Francaise de Raff.-(Gonfreville)	1600		"	"			
<u>PORT JEROME REGION</u>							
Standard Francaise-SOCONJ (Fort Jerome)	1250		"	"			
Vacuum Oil Co. (N.D. de Gravenchon)	300						
<u>ROUEN REGION</u>							
Pet. Jupiter-Shell-(Petit Couronne)	750		"	"			
<u>ST. NAZAIRE REGION</u>							
Consommateurs de Pet.-(Donges)	130		"	"			
Pechelbronn Cuest -(Donges)	250		"	"			
<u>BORDEAUX REGION</u>							
Pet. Jupiter-Shell-(Pauillac)	500		"	"			
Gironde-Texas (Bec d'Ambes)	350		"	"			
<u>SETE REGION</u>							
Socony-Vacuum (Frontignan)	300		"	"			
<u>MARSEILLES REGION</u>							
Cie. Francaise de Raff. (Martigues)	650		"	"			
Raff. de Berre (Berre)	550		"	"			
Anglo-Iranian (L'Avera)	400		"	"			
<u>SAONE ET LOIRE</u>							
Schistes Bitumineux (Autun)	15	15	1	5	1	4	1
<u>PECHELBRONN REGION</u>							
Pechelbronn (Merkwiller)*	120	80	18	20	20	18	4
TOTAL	7915	95	22	25	21	22	5

* Coal used for fuel

LA MAILLEFAYE and numerous other specialty plants are ignored, together with bulk stations and blending installations, as at BREST, PAIMBOEUX, etc.

Refineries of Belgium, Netherlands, Norway, Denmark

The refineries in these countries are all small except the Bataafsche refinery near Rotterdam. All are idle for lack of crude oil. The nominal full operating rates of these refineries are shown in Table X, following. As usual, the small specialty plants, which operate on distillates from other refineries, are omitted, together with the Elektrion plant at Ghent and the units which are very minor in size. There have been no direct reports on the damage which may have been sustained by the Belgian and Netherlands refineries.

TABLE X

REFINERY CAPACITIES-BELGIUM, NETHERLANDS, NORWAY, DENMARK

(Figures in thousands of metric tons per year)

BELGIUM

Redeventza (Antwerp-Kiel)	140
Atlas-SOCONJ (Antwerp-Eoboken)	100
Raff. & Dist. Anversoises "Radian" (Antwerp-Kiel)	50
Belgo-Petroleum (Ghent-Terdonck)	100
Belgian Shell (Ghent-Langerbrugge)	85
Belgian Cracking (Ghent-Langerbrugge)	20
Raffinerie Belge-Lianosoff (Antwerp)	70

NETHERLANDS

Bataafsche-Shell (Rotterdam-Pernis)	660
Vlissingsche Asphalt (Flushing)	40

NORWAY

Norsk Amerikansk (Vallo)	50
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DENMARK

Kalundborg-SOCONJ (Kalundborg)	20
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TOTAL	1335
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Omitted from consideration are the Purfina lube specialty plant at ERTVELDE-RIEME, a small, so-called refinery at SELZAETE, Belgium, and two others at COENHAGEN.

APPENDIX "A"

WESTERN ATIS-BUILT REFINERIES (FIGURES IN THOUSANDS OF METRIC TONS PER YEAR)

6145

LOCATION	NO.	NAME OF COMPANY	RATED CAP'Y	DISTILLATION FACILITIES	CRACKING FACILITIES	LUBES FACILITIES	TANKAGE CAP'Y 1000 T.	DAMAGE AND DEMOLITION	REMARKS
HAMBURG (Petroleumhafen) (Harburg) (Grasbrook) (Harburg) (Ostermoor) (Wilhelmsburg) (Wilhelmsburg) (Grasbrook) (Grasbrook) (Hannover) (Miesburg-Elzwerath) (Faina) (Dollbergen) (Dollbergen) (Oslebehausen)	1	Europäische Tanklager	400	PS - Vac.	100 W-K		1	Tanks bombed	F.W. & K. (Designed to skin, crack & reform) Poly plant
	2	Rhenania-Ossag	550	2PS			272	Tanks bombed	
	3	Rhenania-Ossag	130	No distill.		60 BA Dewax. 60 Edelsam.	121	Slight damage	
	4	Ebano Asphaltwerke	400	2PS A&V			100	Damaged ?	McKee PS. Cat cracker for 300 designed in '39
	5	Mineralol & Asphaltwerke	150	SS			64	Slight damage	Asphalt equipment
	6	Deutsche Petroleum	65	SS			95	Tanks bombed	No lubes
	7	Julius Schindler	40	SS Vac.			40	Damaged ?	White Oils
	8	Ernst Schliemann	65	No distill.			40	Damaged ?	White Oils
	9	Albrecht	30	No distill.			40	Damaged ?	
HANNOVER (Miesburg-Elzwerath) (Faina) (Dollbergen) (Dollbergen) (Oslebehausen)	10	Deurag-Werag	300	2PS Vac.	150 Dubbs	100 BA Dewax. 120 Petrolur.	235	Severely bombed	McKee KR PS. W-K PS. Poly. Deasphalt.
	11	Julius Schindler	20	SS			5	Slight damage	Asphalt equipment
	12	Deutsche Gasolin	40	SS					
	13	Niedersachsen-Woriddeutsche	10	SS					
	14	Vacuum Oil Company	80	2PS A&V		Moved to Kollin	152	Damaged	K.W. pipe still
	15	Deutsche Gasolin	60	PS	35			Bombed	
	16	Erzag-Winterhall	30	SS	25		36	Unknown damage	Underground storage tanks
	17	Schmitts-Westfälische	20	SS				Damaged ?	
	18	Rhenania-Ossag	115	SS Vac.	100			Slight damage	
VIENNA (Floridsdorf) (Korneuberg) (Klagen) (Vasendorf) (Schwechat) (Lobau)	19	Shell Floridsdorfer	100	PS			15		F.W. PS (Plans in '39 for cracking & hydro)
	20	Creditul Miner	50	PS			10		
	21	Vacuum Oil Company	60	PS A&V			20		
	22	Oesterreichische Panto	40	PS			10		Drossing dismantled for Schweschat
DUBONA, SLOVAKIA BRATISLAVA, SLOVAKIA ERALUPY, BOHEMIA KOLIN, BOHEMIA (CZECHO) PARDUBICE, BOHEMIA NOVA BOHEMIA (ODERBERG), MORAVIA PRYVOZ (MORAVSKA OSTRAVA), MOR. BUDAPEST (Csepel)	23	Nova Gel und Brenns	50	PS			28		
	24	Winterhall-Elzwerath-I.G.	500	PS	200				
	25	Government Refinery	90	PS			60		McKee cracking furnace and pipe still
	26	Apollo-I.G.	150	PS A&V	55 Dubbs				
	27	Lederer-Benzol Verband	60	SS		100 BA Dewax. 100 Duesol	50		F.W. pipe still, Lummus dewax
	28	Vacuum Oil Company	90	PS A&V					
	29	Panto Werks	200	SS		Filter, Acid			
	30	Panto Werks	60	SS					
	31	Privyger Mineralol	50	SS					
ALMAS FUZITO NYIRBOGDANY SZEGED MUNKACS (MUNKACSVÓ) TRIESTE	32	Shell Koolas	150	PS Vac.			30		Basal dismantled for Csepel. F.W. PS
	33	Magyar Petroleum Ipar - Freund	60	SS					
	34	Budapesti Asvanyolaj - Panto	40	SS		Centrifuge	73		F.W. pipe still
	35	Vacuum Oil Company	90	PS					
	36	Wyrbozdany Petrolum	20	SS					
	37	Scregi Petrolum	10	SS					
	38	Dal-Karpati Petrolum	30	SS					
	39	Aquila	300	PS A&V		60 BA Dewax. 60 Edelsam. 30 Petrolur.	120		F.W. pipe still
FIUME VENEZIA (Marghera) FORNOVIO IARNO NAPLES SPEZIA (Migliarina) BARI LEGHORN (LIYORHO) PLOESTI (South) (North) (Teleajen) (South) (Southeast) (Southwest) (Southeast) (Northwest)	40	Siap SOCOB	150	SS			60		
	41	Agip-Romma	150	PS	30		50		
	42	Agip	350	PS	175		200		F.W. PS. McKee heater and rerun unit
	43	Petrolifera-SOCOB	50	SS		60 BA Dewax. 60 Duesol	2	Damaged ?	Cat cracker, Lummus dewax, Propane deasphalt
	44	Raff. di Napoli-Vacuum	200	PS A&V	240 Rudy		205		
	45	Nafta-Shell	400	PS & SS	200 Dubbs		90		Operating at 7-8000 B/D in March 1940
	46	Anic	250	PS		60 Petrolur	150	Damaged ?	F.W. rerun units etc. Underground tanks.
	47	Anic	250	PS			150		McKee Pipe still, Alkylation
	48	Astra Romana	1750	PS & SS A&V	150	Filter, Acid	400		
BUCHARST CAMPINA BRAZI ERASOY EROD CAPRAZ CZECHOWICE (CZIRIZICE) JEDLICZE TRZEBINIA WIEGLOWICE DROBOCYZ OLIVIA-KARIANPOLSKI LNW (Zlisciste) KOHVA KIVIOLI VAJYARA DUNKERQUE COUCHELLETES LE HAVRE (Confreville) PORT JEROME (Port Jerome) (N.D.deGravenchon) ROUEN (Petit Couronne) ST. MAZAKE (Douges) (Douges) BORDEAUX (Pauillac) (Bec d'Ambs) SENE MARSEILLES (Martique) (Barre) (L'Avera) AUTUN FRECHERBOEN (Mackeller) BELGIUM (Antwerp-Kiel) (Antwerp-Hoboken) (Antwerp-Kiel) (Ghent-Terconck) (Ghent-Langerbrugge) (Ghent-Langerbrugge) (Antwerp) NETHERLANDS (Rotterdam-Fernis) (Flushing) NORWAY (Valla-Tonstang) DENMARK (Kalundborg)	49	Concordia "Vega"	1450	PS & SS Vac.	260	Acid	147		
	50	Romar American	1170	PS & SS A&V	445	Acid	110		F.W. pipe still
	51	Unirea Orion	730	PS Vac.	155 Comb.	Acid & Press	90		McKee pipe still. Asphalt equip.
	52	Unirea Speranta	440	PS & SS		No lubes	30		McKee pipe still
	53	Colombia "Aquila"	535	PS	260 W-K		65		W-K PS
	54	Petrol Block "Standard"	485	SS Vac.	155 Dubbs		96		
	55	Ienia	290	PS & SS			49		
	56	Prahova-Petrolul Bucuresti	200	PS A&V		Acid	32		McKee pipe still. Asphalt equip.
	57	Steam - Romana	1500	PS & SS Vac.	305 Dubbs	Filter Duesol	208		Dubbs rerun unit; F.W. Dubbs; McKee PS . Wax
	58	Credit Miner	535	PS	160 Dubbs	4 BA Dewax. 4 Petrolur.	61		
	59	Photogen-Vacuum	35	PS & SS Vac.			19		
60	Vacuum Oil Company	100	PSA SS V		Acid	80			
61	Anglo-Ingerlay-Shell	80	SS						
62	Vacuum Oil Company	75	PS	25 Kellogg	28 Dewax. Acid	116		F.W. rerun pipe still	
63	Galicja-Malopolska	75	SS						
64	Polaki-Zwiazkowe-Malopolska	100	SS Vac.						
65	Jaslo-Gartenberg & Schleyer	70	PS Vac.					F.W. pipe still	
66	Polain	160	SS Vac.					F.W. pipe still	
67	Galicja	140	PS Vac.	50					
68	Nafta-Malopolska	60	SS		Acid				
69	Galicja-Malopolska	80	SS Vac.	20					
70	Przemysl Nafta-Ogny Ziggas	40	PS A&V		Acid			F.W. pipe still	
71	National Oil Shale Ind.	12		5					
72	New Consolidated Goldfields	12		5					
73	Estonian Shale Oil Company	36		17					
74	Oilkomercium	27		10					
75	R.P. du Nord-Petrofina	450	PS	100	BA Dewax. 20 Edelsam	150	Destroyed	Lummus dewaxer. F.W. rerun still	
76	SGHP-Anglo-Iranian	300	PS	100 Kellogg		75	Destroyed	Kellogg pipe still (Some dismantling)	
77	Cie. Francaise de Raff.	1600	2PS A&V	320 Kellogg		400	Tanks destroyed	F.W. PS. Lummus polyhydro (McKee PS)	
78	Standard Francaise SOCOB	1250	2PS A&V	300 Kellogg	65 Trichlor 170 Phenol	240	Tanks destroyed	Some dismantling	
79	Vacuum Oil Company	300	2PS A&V	170 Kellogg	48 Duesol	80	Tanks destroyed	F.W. pipe still	
80	Petrolas Jupiter-Shell	750	2PS	160	Edelsam	210	Tanks destroyed	F.W. Dubbs heater	
81	Consommateurs de Petrolas	130	2PS			45	Tanks destroyed	Some dismantling. F.W. pipe still	
82	Pecheletrum Ouest	250	PS	50		60	Tanks destroyed		
83	Petrolas Jupiter-Shell	500	PS	350		180	Tanks bombed	McKee furnace. F.W. Dubbs heater	
84	Gironde-Texas	350	PS	250 Kellogg		120			
85	Socony Vacuum	300	PS	170 Kellogg		106			
86	Cie Francaise de Raff.	650	PS A&V	300		150	V.S. damage	F.W. pipe still. Kellogg rerun still	
87	Raff. de Berre	550	PS	550 Kellogg		170		McKee rerun PS. Poly plant design. F.W. PS	
88	SGHP-Anglo-Iranian	400	PS	150 Kellogg		150		Boundry unit partly completed '42 (Kellogg)	
89	Lyonnaise, Schistes Bitumineux	15	PS					Kellogg catalytic reformer	
90	Pecheletrum	120	SS	25		60		McKee PS good for 100; F.W. Dubbs heater	
91	Redeventza	140	PS	50		46	Tank damaged	F.W. Topper. No lubes. Part destroyed.	
92	Atlas-SOCOB	100	SS			16	Damaged ?		
93	Raff & Dist Anversoise "Radian"	50	PS			200		Connected with T & T bulk station	
94	Belgo-Petrolum	100		100 Jenkins					
95	Belgian Shell	85	SS					Moved from Rouen	
96	Belgian Cracking	20	No distill.	17 Dubbs				Asphalt	
97	Lianos - Raff. Belge	70	SS	50		70			
98	Bataafsche-Shell	660		500 Dubbs		800	Part destroyed	Lummus cracking furnace. Iso-octane	
99	Vlissingche Asphalt	40	SS			80	Destroyed		
100	Norsk Amerikanak	50	SS A&V			25	Damaged ?		
101	Kalundborg-SOCOB	20	St. S						

NOTE: PS - pipe still
BA - benzol-acetone

W-K - Winkler Koch
F.W. - Foster Wheeler

A&V - Atmospheric and Vacuum
SS - Shell stills