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PETROLEUM FACILITIES OF
YUGOSLAVIA

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CONFIDENTIAL
ARMY SERVICE FORCES
OFFICE OF THE COMMANDING GENERAL
WASHINGTON 25, D. C.

8 - JUL 1944

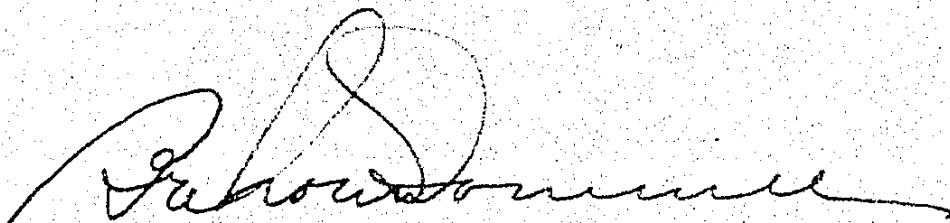
SUBJECT: Report on Petroleum Facilities of Yugoslavia.

TO: Commanding General, U. S. Strategic Air Forces of
Europe, APO 633, c/o Postmaster, New York, New York.

1. I am forwarding herewith one copy of a report entitled, "Petroleum Facilities of Yugoslavia", prepared by the Enemy Oil Committee pursuant to suggestions originating with the Fuels and Lubricants Division, Office of The Quartermaster General.

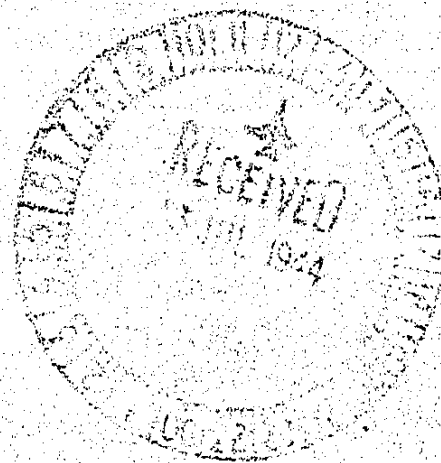
2. A volume on Italy has already been published and distributed. Several other volumes are in advanced stages of preparation and will be distributed in the near future.

3. All available information that is considered reliable and useful for this report has been incorporated in it. Suggestions for the improvement of the petroleum facilities reports are solicited. If any errors or important omissions in the Yugoslavian report are known to you or come to your notice in the future, request is made that corrections or additions be sent to this office.



BREHON SOMERVELL
Lieutenant General
Commanding

1 Incl.
Rpt on Pet. Fac. of
Yugoslavia



W-463.7

PETROLEUM FACILITIES OF

Y U G O S L A V I A

Prepared by

The Enemy Oil Committee

for the

Division of Fuels and Lubricants
Office of The Quartermaster General

May, 1944

P L A C E N A M E S

The names of cities, towns, and other geographic features used in this report are those currently shown on official maps published in Yugoslavia. The following list shows place names referred to in the report that have different English designations.

Beograd

Belgrade

Medjimurje

Mur Island

R E V I S I O N

Arrangements for the preparation and distribution of supplementary information pertinent to this report are contemplated. Request is made that advices concerning corrections and useful addenda for the report be sent to the:

Director, Division of Fuels and Lubricants,
Office of the Quartermaster General,
Washington, D. C.

C O N T E N T S

	Page
1.0 INTRODUCTION	7
Scope; Producing; Refining; Supplies; Distributing; Domestic supplies; Imports; Operating companies; Key personnel.	
2.0 PRODUCING	13
.1 Summary	13
.2 Strategic considerations	14
.3 History of oil operations	16
.4 Oil possibilities in Yugoslavia	16
General statement	16
Oil in the Flysch of the Pannonian (lower Pliocene) basin	17
Indications in other areas	17
.5 Oil occurrences of the Medjimarje (Mir Island), Yugoslavia	17
Historical sketch	20
Geological summary	21
Crude oil production	22
.6 Gas production and exploitation	25
3.0 REFINING	25
.1 Introduction	25
.2 Strategic considerations	29
.3 Brod refinery	29
.4 Caprag (Sisak) refinery	29
.5 Osijek refinery	34
.6 Dravograd refinery	39
4.0 DISTRIBUTING	39
.1 General	39
.2 Consumption	40
Industrial and civilian consumption of liquid petroleum products in Serbia and Croatia during 1943.	42
.3 Substitute fuels	42
Use of substitute fuels in Yugoslavia during 1943	42
Alcohol	43
.4 Transportation	44
.5 Storage	44
.6 Retail marketing	46
.7 Strategic considerations	46
.8 Ocean terminals	48
Sušak (Port Baroš).	48
Šibenik	48
Split	51
Dubrovnik	57
Kotor area	58
Other possible storage	60
.9 Inland storage facilities	60
Beograd (Čukarica) Shell company bulk plant	60
Dravograd Shell company bulk plant	61
Zagreb.	73
5.0 APPENDICES	73
Appendix 1 - Conversion factors	73
Appendix 2 - Sources of port and harbor maps for Yugoslavia	75

LIST OF ILLUSTRATIONS

Maps, figures and sketches

Page

6	Petroleum facilities of Yugoslavia
12	Geological map of northern Yugoslavia
14	Map of Mur Island
15	Political divisions, Yugoslavia
16	Folded structures in the southern border zone of the Pannonian basin
20	Selnica oil field
20	Selnica oil region, east-west cross-section (axial direction)
21	Peklenica oil field
21	Cross-section of the Petroliferous Valenciennessia-Marl (lower Pliocene) in the Raky No. 2 Selnica well
21	Stratigraphic cross-section of the Petroliferous middle Pannonian (lower Pliocene) in Peklenica well No. 55.
21	Cross-section through the shallow wells at Peklenica in the direction of the axial incline.
22	Natural gas fields in Croatia
26	Bosanski-Brod, Standard-Vacuum refinery
32	Caprag, Shell refinery (detail)
33	Caprag, Shell refinery (enlargement)
47	Susak (Port Baroš) bulk storage facilities
49	Fiume petroleum facilities
50	Split, Jugoslovensko Shell, location sketch
52	Dubrovnik (Gruž), Jugoslovensko Shell, ocean terminal
58	Kotor area, petroleum facilities
64	Čukarika, Jugoslovensko Shell river bulk terminal
66	Dravograd, Jugoslovensko Shell bulk plant and refinery
67	Zagreb (Vrapce district), Astra bulk plant
68	Zagreb, Jugoslovensko Shell bulk plant
71	Zagreb, Standard-Vacuum bulk plant

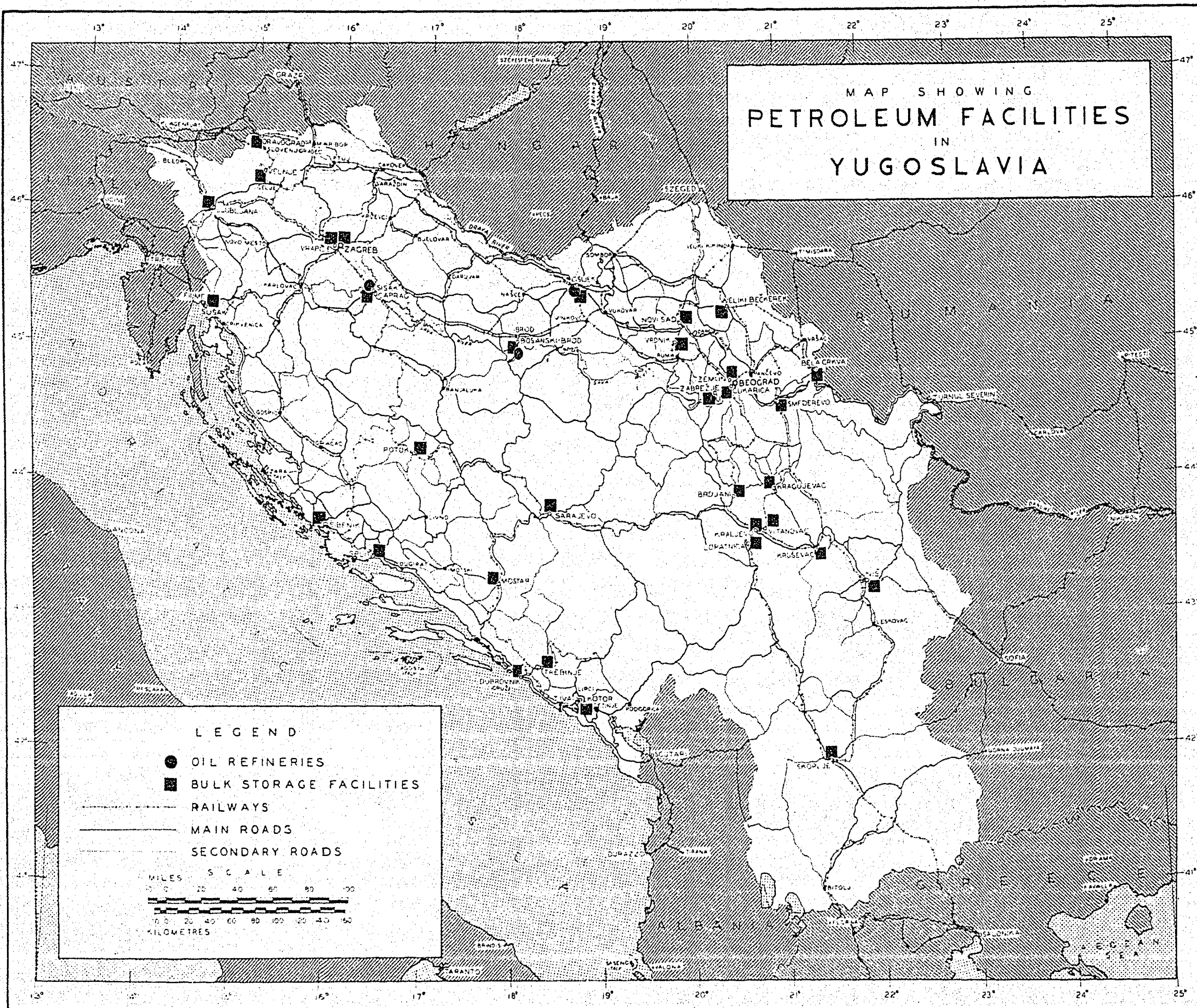
Tables

8	Domestic petroleum supplies
9	Imports of crude and products, Yugoslavia, 1938
10	Identification of principal companies operating in Yugoslavia
18	Drilling and producing results of Singer wells
19	Results of the drillings of the Raky wells
21	Stratigraphic section in Northern Yugoslavia
24	Statistical summary of data on Yugoslav refineries, 1943
25	Status of refineries operating in Yugoslavia on January 1, 1937
30	Caprag, Shell refinery tankage
40	Marketing position of various marketing companies in Yugoslavia, 1938
41	Number of motor vehicles in use in Yugoslavia, 1941
41	Estimated industrial and civilian consumption of liquid fuels and lubricants in Serbia and Croatia, 1943
41	Estimated industrial and civilian consumption of liquid fuels and lubricants in Yugoslavia, 1938
45	Statistical summary of data on ocean and river terminals at Dubrovnik, Split, Sibenik, Susak (Port Baroš)
53	Dubrovnik (Gruž), Jugoslovensko Shell tankage
59	Statistical summary of data on ocean and river terminals at Kotor area
62	Statistical summary of storage facilities, Yugoslavia
63	Statistical summary of storage facilities, Yugoslavia
65	Čukarika, Jugoslovensko Shell tankage

Photographs

Page

27	Bosanski-Brod refinery
35	Caprag, Shell refinery
37	Osiijek, Ipoil refinery
55	Dubrovnik (Gruž), Shell ocean terminal
69	Zagreb (Vrapče), Astra bulk plant



PETROLEUM FACILITIES OF YUGOSLAVIA1.0 INTRODUCTION1.1 General

Scope.- The purpose of this report is to present all significant aspects of the Yugoslav petroleum economy and facilities pertaining thereto. The brevity of the report may be ascribed to the relatively unimportant nature of all branches of the petroleum industry in Yugoslavia.

Producing.- While a large area of central and northern Yugoslavia is a Tertiary basin filled with strata comparable to those producing oil in Austria and Hungary, fifty years of sporadic exploration, prior to the outbreak of the present war, had failed to develop crude production of significance. However, it should be noted that until about 1938-1939 petroleum exploration in Yugoslavia was in the hands of local companies, all of which lacked adequate technical background, capitalization and equipment.

The lack of interest of major companies in exploration in Yugoslavia may, perhaps, be ascribed to the obscure title situation, perhaps the most difficult and unsatisfactory in all Europe. However, apparently the war made the title situation of secondary interest to the Germans for early in 1939 the Gewerkschaft Elwerath of Hanover, Germany, operating under the name "Jugo-Petrol", obtained petroleum concessions in northern Yugoslavia and it has been reliably reported that they discovered commercial production on their Goilo structure (a) in 1941. It is estimated that production from the Elwerath concession currently amounts to some 1,000 barrels (b) a day.

Refining.- There were only three refineries in Yugoslavia; the skimming and lube plant of the Standard-Vacuum of Croatia, Inc., located at Bosanski-Brod, with a crude throughput capacity of 100,000 metric tons a year, 2,110 barrels (c) a day; that of the Jugoslovensko Shell dioničarsko društvo, at Caprag, affiliated with the Royal Dutch Shell group, a skimming and lube plant with a crude throughput capacity of 43,000 metric tons a year (907 barrels a day), and the skimming plant (no lube facilities) of the independent Ipoil dioničarsko društvo, located at Osijek on the lower Drava, with a crude throughput capacity of 20,000 metric tons a year (421 barrels a day). None of these plants had cracking facilities. Intelligence has reported that a fourth, a new refinery, with a capacity of about 50,000 metric tons, is located at Smederevo.

Supplies.- Supplies for the refineries, supplementing the small indigenous crude oil production, normally were obtained by barge from Rumania. These were transported up the Danube and its tributary the Sava. During a few months in winter when the rivers were frozen, and in autumn when there was low water on the Sava River, railway tank cars were used for the haul from Rumania.

Distributing.- The peace time consumption of Yugoslavia was only some 150,000 metric tons a year (1,125,000 barrels) and distributing facilities were correspondingly limited. The entire storage capacity of the country amounts only to some 200,000 M³ (1,260,000 barrels) of which some 120,000 M³ (756,000 barrels) are located at the refineries. There were no service stations and only about 250 curb pumps in the country. Products for many interior points were distributed in cases and steel drums.

Domestic supplies.- A table and graph showing domestic petroleum supplies in Yugoslavia for 1938 is shown on page 8.

(a) The Goilo field is shown on the map on page 12.

(b) Wherever the word "barrels" appears in this report, a barrel of 42 U.S. gallons is meant.

(c) A calendar day.

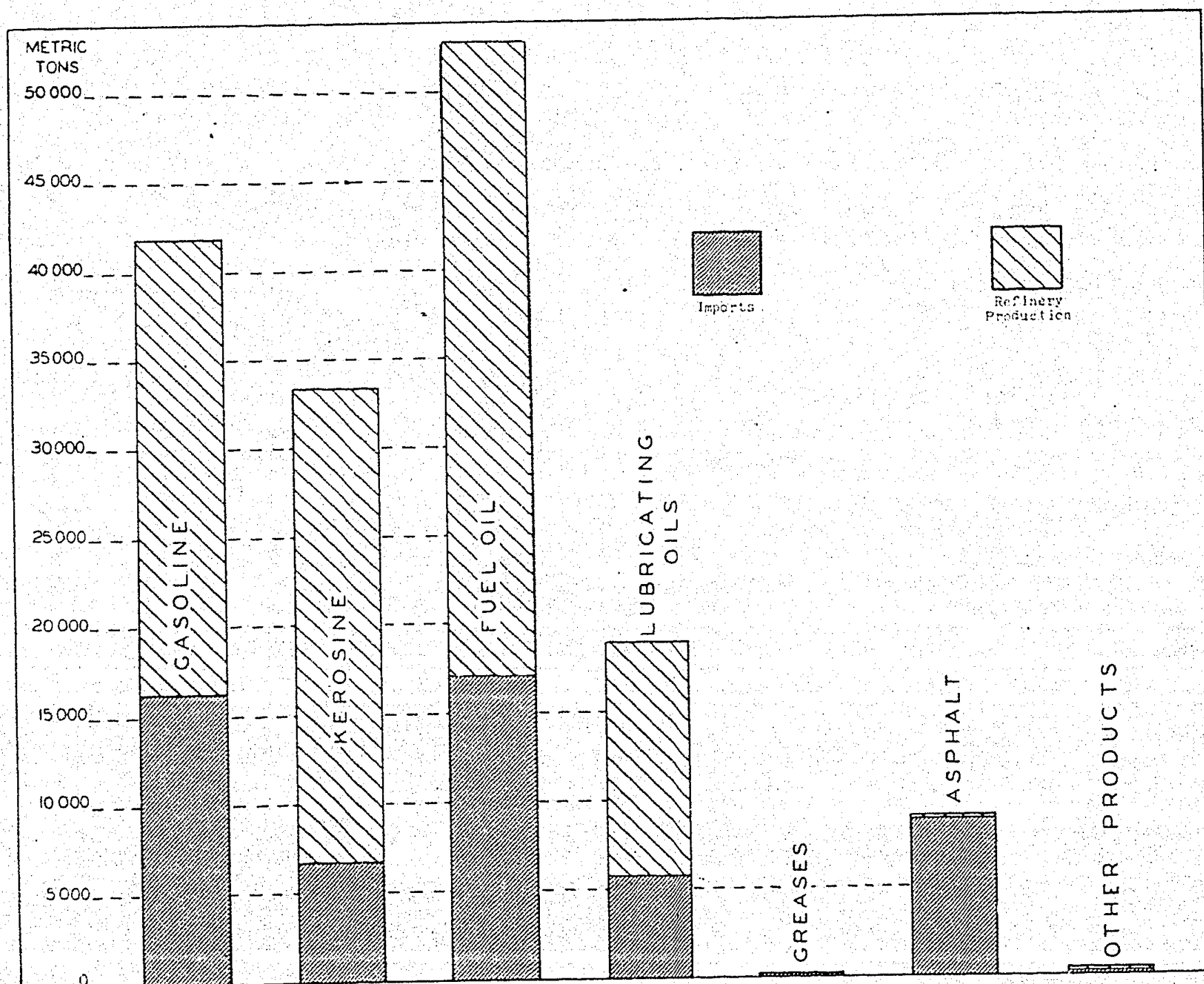
8 - INTRODUCTION
Petroleum supplies

Domestic Petroleum Supplies, Yugoslavia, Year 1938

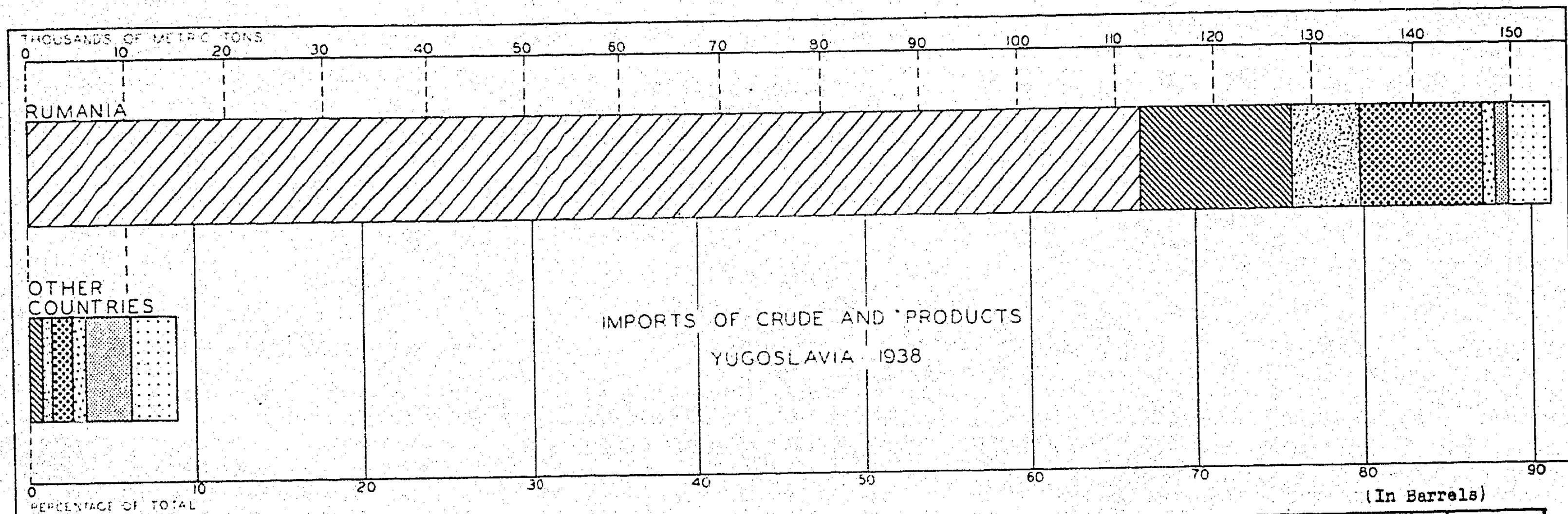
Finished Products (a)

Products	In Metric Tons			In Barrels		
	Imports	Refinery Production*	Total	Imports	Refinery Production*	Total
Gasoline	16,304	25,510	41,814	122,230	191,325	313,605
Kerosine	7,825	25,410	33,235	58,687	190,575	249,262
Gas/Diesel Oil	14,422)	38,524	52,702	108,165	266,430	395,265
Fuel Oil	2,756)			20,670		
Lubricating Oils	5,779	13,116	18,895	43,342	98,370	141,712
Greases	118	-	118	885	-	885
Paraffin Wax	-	-	-	-	-	-
Asphalt	3,930	30	9,010	66,975	600	67,575
Other Products	5	438	443	37	3,235	3,322
Total	56,139	100,078	156,217	421,042	750,535	1,171,623

* From artificial crude and indigenous crude. Of the latter, production in 1938 was, gross--1,033 metric tons (7,748 barrels), net--1,011 metric tons (7,582 barrels)



(a) From Socony-Vacuum Oil Co., Inc.



LEGEND

	ARTIFICIAL CRUDE
	MOTOR FUEL
	KEROSENE
	CASOIL & DIESEL OIL
	RESIDUAL FUEL OIL
	LUBRICANTS
	OTHER PRODUCTS

	Artificial Crude	Motor Fuel	Kerosine	Gas Oil & Diesel Oil	Residual Fuel Oil	Lubricants	Other Products	Total	Per Cent Of Total
Imports - Including Re-Exports									
Rumania	846 675	129 684	53 949	89 524	8 281	8 302	31 778	1 168 193	91.17
U. S. A.	-	178	-	-	254	20 923	6 968	28 323	2.35
Italy	-	8 560	7 868	14 098	9 080	553	15 922	56 081	4.47
Albania	-	-	-	-	-	-	75	75	0.01
Belgium	-	-	-	-	-	203	-	203	0.02
Czechoslovakia	-	-	-	-	-	-	38	38	-
England	-	60	-	-	-	700	30	790	0.07
France	-	-	-	-	-	-	7	7	-
Germany	-	-	-	-	-	10 318	11 422	21 740	1.77
Holland	-	102	-	-	-	-	503	605	0.05
Hungary	-	-	-	-	-	-	45	45	-
India (British)	-	-	-	-	-	-	113	113	0.01
Mexico	-	-	-	-	-	-	113	113	0.01
Poland	-	-	-	216	299	70	-	585	0.05
Other Countries	-	-	-	-	-	210	-	210	0.02
Total	846 675	138 584	61 817	103 838	17 914	41 279	67 014	1 277 121	100.00

IDENTIFICATION OF PRINCIPAL COMPANIES OPERATING IN YUGOSLAVIA

C O M P A N Y		AFFILIATIONS OF COMPANY	
Name of Company	Address of Head Office of Company	Names of Owner Firms Majority Interests or Control	Address of Owner Firms
"Astra" dioničarsko društvo	Beograd, Knežev Spomenik 5	Phoenix Oil & Transport Co., Ltd.	London
"Bitumen", Hrvatsko Dioničko Društvo Za Is- korišćavanje Zemnog Plina i Ulja	Zagreb, Ilica 5	"Bitumen", Hrvatsko Dioničko Društvo Za Iskorišćavanje Zemnog Plina i Ulja	Zagreb
Gewerkschaft Raky-Danubia	Wien, Gusshausstrasse 28	Gewerkschaft Raky-Danubia	Wien
Ipoil dioničarsko društvo	Osijek	Ivanović & Co. and Astra d.d.	Osijek Beograd
Jugoslovensko Istraživačko, Akionarsko društvo	Beograd	Standard Oil Company (N.J.)	New York
Jugoslovensko Shell dioničarsko društvo	Zagreb, Gajeva ulica 5	The Royal Dutch Shell group	London
Medjumursko Petrolejsko dioničarsko društvo	Selnica	Medjumursko Petrolejsko dioničarsko društvo	Selnica
"Methan" dioničarsko društvo (a)	Zagreb, Ilica 5	"Methan" dioničarsko društvo	Zagreb
Panonia, društvo za zemljino ulje	Beograd	Panonia, društvo za zemljino ulje	Beograd
Standard-Vacuum of Croatia, Inc. (b)	Zagreb, Kumičićeva ulica 5 Beograd, Palata Akademije Nauka	Socony-Vacuum Oil Co.	New York
Sumadiska Kreditna Banka	Beograd	Sumadiska Kreditna Banka	Beograd
Uljanik Petroleum dioničarsko društvo	Zagreb, Ilica 5	Uljanik Petroleum dioničarsko društvo	Zagreb

(a) Distribution of butane gas.

(b) Changed to this name April 1941 by order of Croatian government. Formerly Standard-Vacuum Oil Co. of Yugoslavia, Inc.

Companies operating in Yugoslavia.- The main companies operating in Yugoslavia were the Standard-Vacuum of Croatia, Inc., affiliated with the Socony-Vacuum Oil Co.; Jugoslovensko Shell dioničarsko društvo, affiliated with the Royal Dutch Shell group; and the Gewerkschaft Elwerath of Hanover, Germany, operating under the name of "Jugo-Petrol", and owner of the large petroleum concession in northern Yugoslavia. A table identifying the main companies which operated in Yugoslavia is shown on page 10. The available information covering key personnel as well as more detailed identification of the Socony-Vacuum Oil Co., Inc., and the Royal Dutch Shell group affiliates follows (a):

Standard-Vacuum of Croatia, Inc.

Office address: Kumičićeva Ul 5, Zagreb

Ownership: Socony-Vacuum Oil Company, Inc.

Pre-war operations: Petroleum refinery producing gasoline (aviation and motor), solvents, kerosine, gas and diesel oil, low grade lubricating oils, fuel oil and asphalts. The company owned and operated refinery was located at Bosanski-Brod, on the Sava River. Storage, distribution and marketing of finished petroleum products which were obtained in greater part from the Brod refinery. Bulk plants were located at Ljubljane, Novi Sad, Sarajevo and Zagreb.

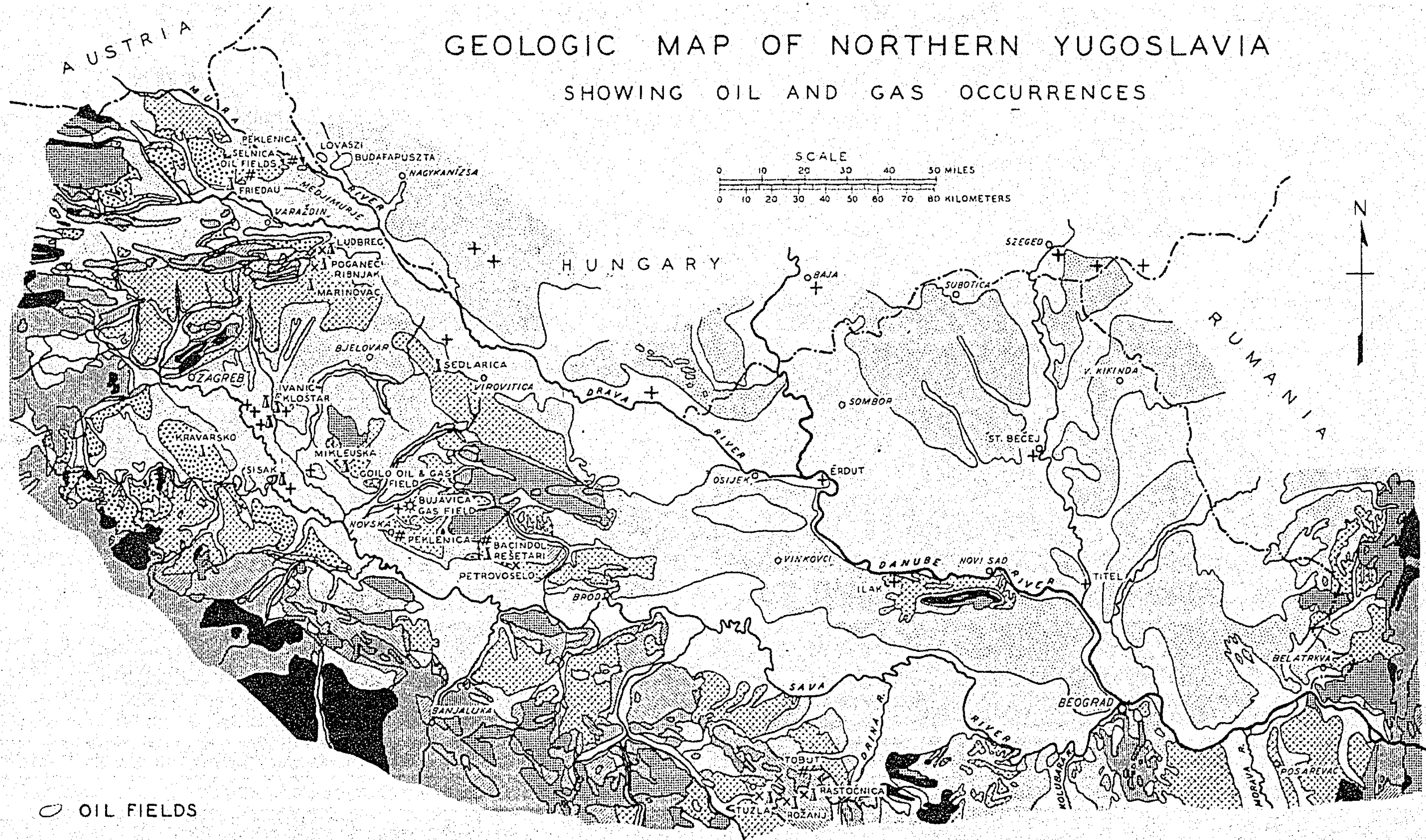
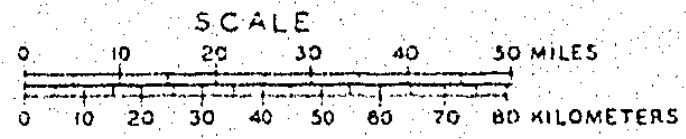
Key pre-war personnel: Americans: (1) F. M. Smith, Director and Manager, Socony-Vacuum Oil Company, Inc., 26 Broadway, New York, N. Y. (2) E. G. Glover, Assistant to Manager, U. S. Navy. Yugoslavians: (1) L. Sorger, Assistant to Manager, Yugoslavia. (2) A. Malatic, Sales Manager, Yugoslavia. (3) M. Postruznik, Assistant Sales Manager, Yugoslavia.

Jugoslovensko Shell dioničarsko društvo (b)

(a) In listing the individuals who have been associated with the various oil companies, it should be understood that these individuals may be looked to for information of possible value in their respective fields, but insofar as concerns the non-Americans no implication should be drawn as to their political sympathies or affiliations.

(b) Information requested but not yet received.

GEOLOGIC MAP OF NORTHERN YUGOSLAVIA SHOWING OIL AND GAS OCCURRENCES



○ OIL FIELDS

⊗ GAS FIELDS

⚡ WILDCAT WELLS

× OIL SEEPS

SHALLOW WELLS AND HAND-DUG SHAFTS

+ GAS SEEP

----- INTERNATIONAL BOUNDARIES

- CRYSTALLINE METAMORPHICS AND BASEMENT ROCKS
- PALEOZOICS (CHIEFLY CARBONIFEROUS)
- TRIASSIC, JURASSIC AND CRETACEOUS
- EOCENE
- OLIGOCENE (CHIEFLY FRESHWATER ORIGIN)

- MARINE MIOCENE
- SARMATIAN-PANNONIAN
- PONTIAN-LEVANTIAN
- DILUVIUM
- ALLUVIUM

NOTE: LATE TERTIARY ERUPTIVES AND LATE PLEISTOCENE TERRESTRIAL DEPOSITS ARE OMITTED

2.0 PRODUCING

2.1 SUMMARY

That part of Yugoslavia which has oil possibilities constitutes the south-westward extension of the Pannonian (lower Pliocene) Tertiary basin of Hungary. Here a series of Tertiary sediments, ranging in character from fresh-water to marine, and in age from Recent to Eocene, overlap the Mesozoics and crystalline Paleozoics of the Central Dinaric and Eastern Alps and the Western Balkans. Deposition of the Tertiary sediments has taken place around outliers of the older rocks and within reentrants of the mountain front. This accounts for the variable lithologic character of the formations and has produced a set of conditions which are not unfavorable to oil accumulation. Under these conditions of deposition, one could expect lenses, wedge-belts of porosity and a variety of stratigraphic traps, in addition to compressional folds and faults.

Structural folds are present along the mountain fronts. The lines of folding trend northwest-southeast in the southern part of the area, changing to north-south and then to northeast-southwest in the extreme western part of the area. These trends are governed by the encircling, buttressing rocks of the mountain chain. Considerable faulting accompanies the folding in most of the known structures which lie close to the mountains. The alluvium-covered plains to the north would seem to offer good prospects for other anticlinal folds buried beneath the masking formations. Such folds, if present, would be less broken and faulted and thus better oil traps.

Faulting and exposure of oil-bearing horizons by erosion has produced numerous oil and gas seepages. These surface shows occur in beds ranging in age from Recent to Eocene and are found both in the vicinity of the folded and faulted older rocks of the mountain uplifts and in the less disturbed plains.

Despite fifty years of sporadic exploration and drilling, no oil production of significance had been discovered in Yugoslavia prior to the war, most of the producing sands discovered up to that time having been of relatively poor porosity. However, it must be noted (1) that until about 1938 petroleum exploration in the country was in the hands of small local companies with inadequate technical backgrounds, capitalization and equipment, (2) that development largely had been carried out in the areas of seepages in the vicinity of the older rocks on which the Tertiaries rest unconformably, and, (3) that although some deep wildcat tests had been drilled to the crystalline rocks, the stratigraphic limits of the oil producing horizons had not yet been established.

Thus, while the oil prospects in Yugoslavia do not warrant wartime efforts to develop petroleum, judging the area on regional geologic evidence it appears that further geological work is warranted, particularly in the less disturbed part of the basin north and east of the mountains which is part of the promising Pannonian (lower Pliocene) basin of Hungary.

2.2 STRATEGIC CONSIDERATIONS

Value to enemy.- The current value to the enemy of the producing facilities of Yugoslavia is limited by the fact that the quantity of crude oil available, estimated at 1,000 barrels a day, is small. However, the location of the fields in a highly strategic area and the fact that local refineries are available make this small production important out of all proportion to the quantity produced.

Possible value to Allies.- Even if the enemy should fail to destroy the local refineries before retreating, which is considered unlikely, this small production would be of no great value to the Allied Forces.

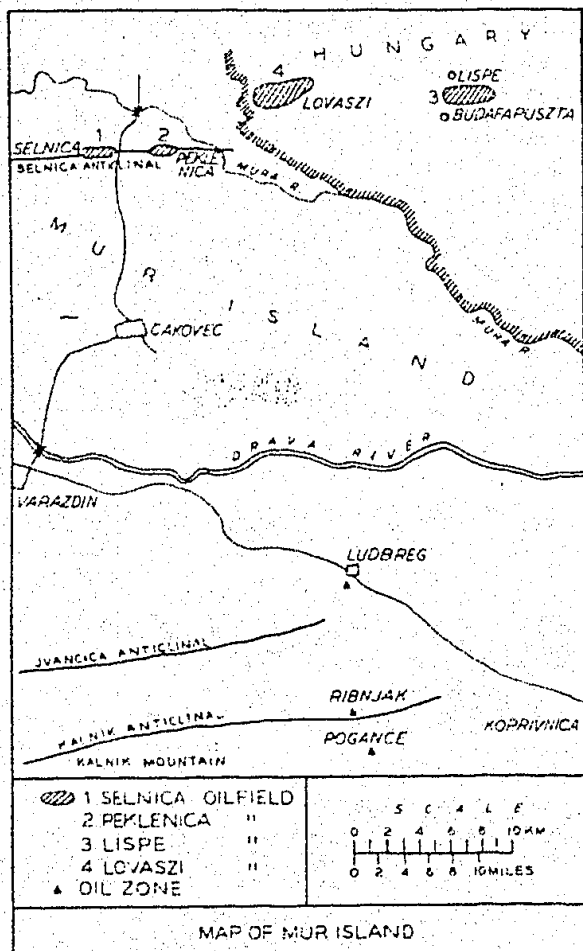
Importance in normal times.- There was no production of consequence in Yugoslavia before the outbreak of the present war. The future development of crude oil production in Yugoslavia may be a very important item in the economy of the country.

Wartime use.- There is no doubt that all of the indigenous production is being fully utilized with consequent saving in transport.

Effects of damage.- It is difficult to destroy producing fields by bombardment. Certainly in this case the effort would hardly be worth while. Sabotage operations, likewise, would hardly be worth the effort involved. As regards enemy denial operations the enemy may be expected to destroy the pumping equipment, gathering tanks, etc., but it is not likely that he will attempt to destroy other than the larger wells.

2.3 HISTORY OF OIL OPERATIONS

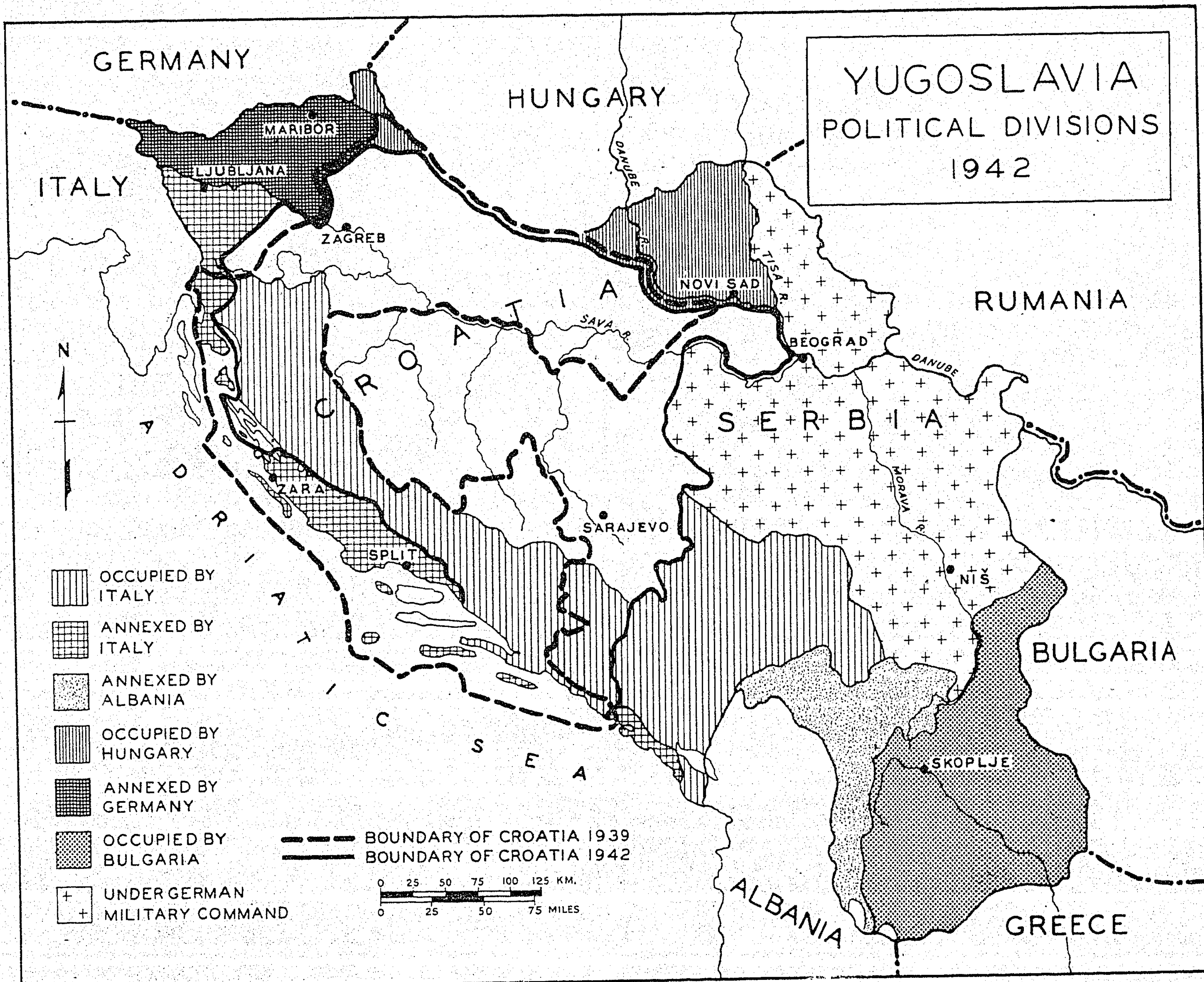
From 1884 to the middle of 1940 a total of 200 wells had been drilled for oil and gas in Yugoslavia. Of these, 134 were wells drilled in an effort to exploit the small oil fields of the Medjimurje (Mur Island), the area between the Mura and Drava Rivers in northeastern Slovenia; 12 were wells drilled in productive gas fields in Croatia, 20 were drilled in the "Flysch zone" of Bosnia, and the remainder were scattered over the country, usually in efforts to exploit local seepages. The great majority of these wells were drilled to depths of less than 500 meters (1,640 feet), and the deepest well drilled in the country to the middle of 1940 reached 2,000 meters (6,560 feet).



The Medjimurje (Mur Island) fields.- There are two small oil fields located close together on the peninsula at the confluence of the Mura and Drava Rivers, which are known as the Medjimurje (Mur Island) fields. Even though over 100 wells have been drilled in this region in the last 50 years, the yield of oil has been so slight as to be practically negligible. In various other parts of this area, on the basis of oil and gas seeps, tests have been drilled to the supposed oil beds with slight or no results; thus, nowhere in this area has a field with commercial production been found, and before the war, drilling activity had ceased.

The Germans are reported to have made a discovery early in 1941 in a well drilled at Goilo, Croatia, southeast of Zagreb, estimated to be good for about 350 barrels per day. The oil occurs in a Tertiary formation at about 4,000 feet. Based on this discovery it was estimated that production at Goilo would amount to 1,000 barrels per day (47,400 metric tons per year) in the last half of 1942, and 3,000 barrels per day in 1943 (a). This estimate was later considered high but it seems reasonable to assume that a production of 1,000 barrels per day might easily be developed on the known structures in Yugoslavia during 1943. Recent reports of large scale expenditures for drilling on the part of the Uljanik, Bitumen, and other Yugoslav companies tend also to substantiate this belief. A structure at Bujavica near Goilo, which produced gas, was tested for oil without results.

(a) After the above was written, Intelligence reported that 13 wells had been drilled on this structure and that they were producing at the rate of 73,000 metric tons a year or 1,520 barrels a day in 1944.



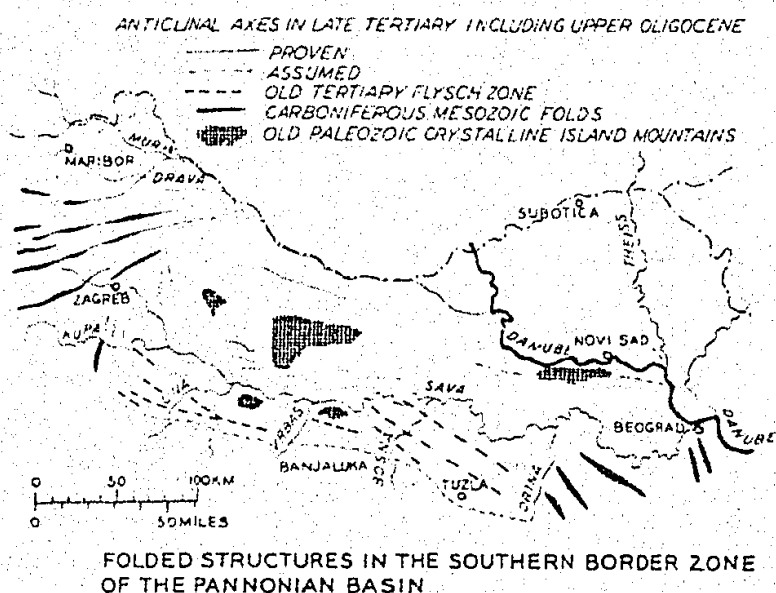
YUGOSLAVIA
POLITICAL DIVISIONS
1942

2.4. CIL POSSIBILITIES IN YUGOSLAVIA (a)

2.4.1 General Statement

Even with the most favorable interpretation, the oil possibilities of Yugoslavia offer little hope of fields comparable to those of Rumania or other areas in the foreland of the Carpathian arc. Although the Dinarske Mountains have likewise a foreland of oil-bearing Tertiary, which contains the Albanian oil fields, in Yugoslavia this foreland lies beneath the Adriatic Sea.

Geologic evidence suggests that the extension of the Upper Tertiary Pannonian Basin from Hungary into northeastern Yugoslavia is the area of greatest promise for the discovery of oil fields. This region, in Yugoslavia, contains strata which have already proved prolifically oil-bearing in Hungary, and the structural trends which contain the Hungarian oil fields are prolonged into this area of Yugoslavia. It is in this Tertiary area, also, that the small Yugoslavia oil fields at Selnica and Peklenica are located.



Less attractive than the Younger Tertiary formations, but still warranting exploration, is the Flysch zone of the Pannonian Basin, which may contain suitable source and reservoir beds. Tectonically, this region is controlled by the folding of the southern Alpine and Dinarske systems in the prevailing Alpine trend. The folds thus formed in the Flysch zone are commonly accompanied by faults and may have developed very suitable structures for oil and gas accumulation. Most of the oil and gas shows known in Yugoslavia are in this Flysch zone in the northern part of the country, as noted below.

The Paleozoic and Mesozoic ranges of the central Dinarske Alps and the Yugoslavian portion of the Eastern Alps are so intensively folded and metamorphosed as to be prohibitive of oil accumulation, and the area of the country which falls in the western Balkan ranges is similarly impossible for oil.

2.4.2 Oil in the Flysch of the Pannonian (Lower Pliocene) Basin

Some further detail may be noted in regard to the Flysch zone, which lies along the inner edge of the Dinarske Alps. Its southeastern limit is in the Majevica Range between the Tinja and Drina Rivers, where the Flysch is faulted down against the Paleozoic. The early Tertiary mountain core is surrounded by late Tertiary which overlies the folded pre-Miocene Flysch. To the south of the Majevica Range is the downfaulted late Tertiary basin of Spreca. In this basin lie the salt-bearing lenses worked at Tuzla. Most of the basin is occupied by folded Pannonian (lower Pliocene) sediments. Neither the lignite mines in the Pliocene nor the test holes and workings of the salt beds show any traces of oil. Oil shows are limited to the older Tertiary of the Majevica Range.

The hope of oil in the Majevica Mountain region began with the first discoveries in 1896. All oil occurrences lie at the southeastern end of the mountains in the area east of Tuzla, but are not contiguous. The best known localities are Rožanj, Tavid and Lopera. At Rožanj and Tavid shallow tests showed numerous shows of small quantities of light oil.

(a) Based on an article by L. Sommermeier, "Die Erdölhoffigen Gebiete in Jugoslawien", Oel und Kohle, No. 40, pp. 406-414, Oct. 22, 1940, translated by Dr. G. D. Johnson.

Oil shows on a structure in the Oligocene east of Tuzla directed exploration in recent years to that region. Several deep wells, the deepest 6,500 feet, were all without startling results. Initial daily production of 100 liters soon fell off and was followed by a strong flow of water. Nothing is known of the geological results of the more recent deep tests at Tuzla. It is certain that the wells did not repay the expense of drilling. So long as no other factors contribute, the Majevisa folds must be considered unfavorable structures for productive oil fields.

2.4.3 Indications in Other Areas

Asphalt and heavy oil in the headwaters of the Morava.- In the Morava Valley 100 km. south of Niš are Upper Cretaceous and Eocene bituminous shales and limestone lenses completely unfolded in the crystalline rocks. Where the rocks are most bituminous there are oil seeps; but the very nature of the occurrence precludes any thought of an oil field.

Oil near Verpazar at the west end of Lake Shkodres.- The oil occurs in what appears to be Triassic (Werfenian) beds. Several shallow tests yielded nothing. If the correlation is correct, this is a unique occurrence; but probably a confusion exists and the oil-bearing rocks are really Tertiary Flysch similar to occurrences at the east end of the lake in Albania. In both localities tectonic conditions indicate the improbability of any commercial oil-field.

Oil in the Oligocene coal measures near Kakanje.- Traces of oil are found here in coal mines in fresh-water Oligocene. Two test holes went into the underlying Cretaceous without results. It is not known whether the tests threw any light on the source of the oil.

Asphalt deposits of the Dalmatian coast.- Asphalt beds in the coastal region of Dalmatia result from impregnation of Upper Cretaceous limestones, dolomites and shales. The occurrence leads to the assumption that asphaltic oil is locally introduced into this series of rocks. It is of geologic interest to investigate whether there is a relation between the asphaltic limestones and oil deposits, and whether one could count on finding oil-producing horizons. The prospects do not appear to be good since the anticlines are made up of Cretaceous and Eocene limestones and the synclines of Flysch. Nevertheless, since we are dealing with regular undisturbed folds and oil sands might be found in deeper parts of the folded complex, the chances of oil in this zone are still undetermined.

2.5 OIL OCCURRENCES OF THE MEDJIMURJE (MUR ISLAND), YUGOSLAVIA

2.5.1 Historical Sketch (a)

Oil seepages at Peklenica, in northern Yugoslavia, were known at least as early as the end of the 18th century. Industrial exploration was begun about 1880 and several cycles of development took place. Between 1899 and 1905, W. Singer, with the help of the Hungarian Government, drilled 31 wells. The data on these wells as presented in the first edition of the Engler-Hoefer appears in the table on page 18.

Early in 1939 a German company, Gewerkschaft Elwerath, acquired control of the Medjimurje area, and after some preliminary work, including a soil analysis survey,

(a) From a translation by Mr. F. von Estorff, of the Socony-Vacuum Oil Co., Inc., of "Das Erdölvorkommen der Murinsel (Jugoslawien)", by Dr. rer. nat. K. Egon Böhm, Geologist of Jugo-Petrol, Zagreb.

Drilling and Producing Results of Singer Wells

Well No.	Location	Depth in meters	Year	Oil Yield to 1905 M ³	Oldest Rocks Penetrated
1	Selnica Valley	491.0	1899		Pannonian (lower Pliocene) and Mediterranean II (Miocene)
2	Eastern Selnica	509.0	1900	13.8	Pannonian (lower Pliocene) and Mediterranean II (Miocene)
3	Timber Yard N/side	210.0	1900	45.0	lower Pliocene
4	Timber Yard S/side	112.0	1900	232.5	lower Pliocene
5	Selnica Valley	778.7	1900	24.0	Pannonian (lower Pliocene) and Mediterranean II (Miocene)
6	Timber Yard S/side	177.0	1900	63.9	lower Pliocene
7	Singer shaft	174.6	1901	924.6	lower Pliocene
8	Street and Mursko	549.7	1901	1.0	Pannonian (lower Pliocene) and Mediterranean II (Miocene)
9	Singer shaft	206.2	1901	504.1	lower Pliocene
10	Eastern Singer shaft	610.0	1901		Pannonian (lower Pliocene) and Mediterranean II (Miocene)
11	Singer shaft	178.6	1901	246.3	lower Pliocene
12	Singer shaft	163.4	1901	700.7	lower Pliocene
13	Singer shaft	219.0	1901	87.1	lower Pliocene
14	Singer shaft	136.9	1901	162.4	lower Pliocene
15	Singer shaft	163.4	1901	123.3	lower Pliocene
16	Singer shaft	262.4	1902	61.6	lower Pliocene
17	Singer shaft	238.2	1902	74.9	lower Pliocene
18	Singer shaft	171.0	1902	404.6	lower Pliocene
19	Singer shaft	174.6	1902	316.5	lower Pliocene
20	Singer shaft	401.5	1902	4.5	lower Pliocene
21	Singer shaft	200.2	1902		lower Pliocene
22	Singer shaft	203.2	1902	1.3	lower Pliocene
23	Singer shaft	191.0	1902	2.0	lower Pliocene
24	Singer shaft	166.9	1902	175.4	lower Pliocene
25	Singer shaft	203.0	1902	13.1	lower Pliocene
26	Singer shaft	179.0	1902	301.0	lower Pliocene
27	Singer shaft	180.4	1902	7.7	lower Pliocene
28	Singer shaft	343.0	1902		lower Pliocene
29	Opposite Timber Yard	397.3	1904	2.1	lower Pliocene
30	Singer shaft yard	733.0	1904		Pannonian (lower Pliocene) and Mediterranean II (Miocene)
31	Selnica Valley	802.0	1904		Pannonian (lower Pliocene) and Mediterranean II (Miocene)

RESULTS OF THE DRILLING OF THE RAKY WELLS

No.	Location	Depth in Meters	Stratigraphy	Oil Horizon	Initial Production
1	Raky hill, N/side	141	9 m. Pleistocene 141 m. Sandstone Valenciennesia (lower Pliocene)	132 to 135.3 m. Base 98.7 m. Above sea level	360 liters of oil.
2	Singer shaft 65 m SE from Singer No. 9	501.2	21 m. Pleistocene 193 m. sandstone Valenciennesia (lower Pliocene) 400 m. Valenciennesia (lower Pliocene) 501.2 m. Mediterranean II (Miocene)	1. Horizon: 130 to 156.3 m. 2. Horizon: 184.4 to 189.7 m.	1. Horizon: Water and oil shows. 2. Horizon: Water and 10 liters of oil daily.
3	Selnica valley S/flank	702.0	6 m. Pleistocene 87 m. sandstone Valenciennesia 268 m. Valenciennesia 702 m. Mediterranean II (Miocene)	Oil shows at 6 m., gas shows at 87 m.	
4	Raky hill, E/slope	128	20.2 m. Pleistocene 128 m. sandstone Valenciennesia (lower Pliocene)	Upper horizon 88 to 90 m., lower horizon 120 to 125 m., Base 87m	Upper horizon: 40 liters of oil daily, lower horizon: 30 liters of oil daily with a great deal of water.
5	Raky hill, E/slope	134.4	22 m. Pleistocene 134.4 m. sandstone Valenciennesia (lower Pliocene)	Upper horizon 84 to 90 m., lower horizon 126 to 133.4 m.	Upper horizon: oil shows; lower horizon: 30 liters of oil daily, with a great deal of salt water.
6	Raky hill, E/slope	140.0	17.5 m. Pleistocene 140.0 m. sandstone Valenciennesia (lower Pliocene)	Upper horizon 83.6 to 88.5 m., lower horizon 129 to 133.7 m., Base 93 m.	Lower horizon: 1200 liters water daily with oil shows.
7	Raky hill, N/side	156.8	12.5 m. Pleistocene 121.0 m. sandstone Valenciennesia (lower Pliocene) 156.8 m. Valenciennesia (lower Pliocene)	103.3 to 112 m., Base 114.6 m.	400 liters water daily
8	Raky hill, Crest	132.9	14 m. Pleistocene 132.9 m. sandstone Valenciennesia (lower Pliocene)	128.5 to 132.9 m., Base 103 m.	600 liters oil daily
9	Raky hill, E/side	138.9	19 m. Pleistocene 138.9 m. sandstone Valenciennesia (lower Pliocene)	Upper horizon 98 to 101 m., lower horizon 131.3 to 138.9 m.	Upper horizon: water and oil shows; lower horizon: 20 liters oil daily
10	Raky hill, Crest	Approx. 136.7	136.7 m. sandstone Valenciennesia (lower Pliocene)	Approx. 131 to 136.7 m., Base 101 m.	1929 to 1930 production: 1112 kilograms yearly
11	Raky hill, N/side	Approx. 131	131 m. sandstone Valenciennesia (lower Pliocene)	Approx. 128 to 131 m., Base 108.3 m.	Only oil shows
12	Raky hill, N/side	133.6	16.7 m. Pleistocene 133.6 m. sandstone Valenciennesia (lower Pliocene)	130.0 to 133.6 m., Base 102.4 m.	700 kilograms oil daily
13	Raky hill, E-/side	124.4	11.5 m. Pleistocene 124.4 m. sandstone Valenciennesia (lower Pliocene)	121.1 to 124.4 m., Base 106.2 m.	Only strong oil shows
14	Raky hill, N/side	Approx. 135	135 m. sandstone Valenciennesia (lower Pliocene)	Approximately 132 m.	No production
15	Raky hill, Crest	Approx. 135	135 m. sandstone Valenciennesia (lower Pliocene)	Approximately 133 m.	1290 kilograms yearly, 1929 to 1930
16	Selnica Valley, S/flank near Raky No. 3	386 ?	8 m. Pleistocene 80 m. sandstone Valenciennesia (lower Pliocene) 270 m. Valenciennesia (lower Pliocene) 386 m. ? Mediterranean II (Miocene)	2 c.m. of oil sand at 318 m. 321.5 to 382.1 oil sand	Bailing brought no oil
17	Selnica Valley, near the axis	690	8 m. Pleistocene 40 m. sandstone Valenciennesia (lower Pliocene) 280 m. Valenciennesia (lower Pliocene) 690 m. Mediterranean II (Miocene)	Oil shows at 40 meters	Bailing attempt at 40 m. brought 160 kilograms of oil.
18	Selnica Valley, near Raky No. 17	Approx. 45	Approximately 45 m. sandstone Valenciennesia (lower Pliocene)	39 to 40 m.	905 kilograms yearly, 1929 to 1930
19	Raky hill, Crest	1083	14 m. Pleistocene 133 m. sandstone Valenciennesia (lower Pliocene) 388 m. Valenciennesia (lower Pliocene) 1083 m. Mediterranean II (Miocene)	Main horizon: 127.5 to 133 m. 553.4 to 564.8 m. oil sand, at 574 m. oil shows; 656 to 657 m. oil impregnation, 760 to 761.2 m. oil streaks.	Bailing at 133 m. brought 70 liters of oil; at 368 m., water.

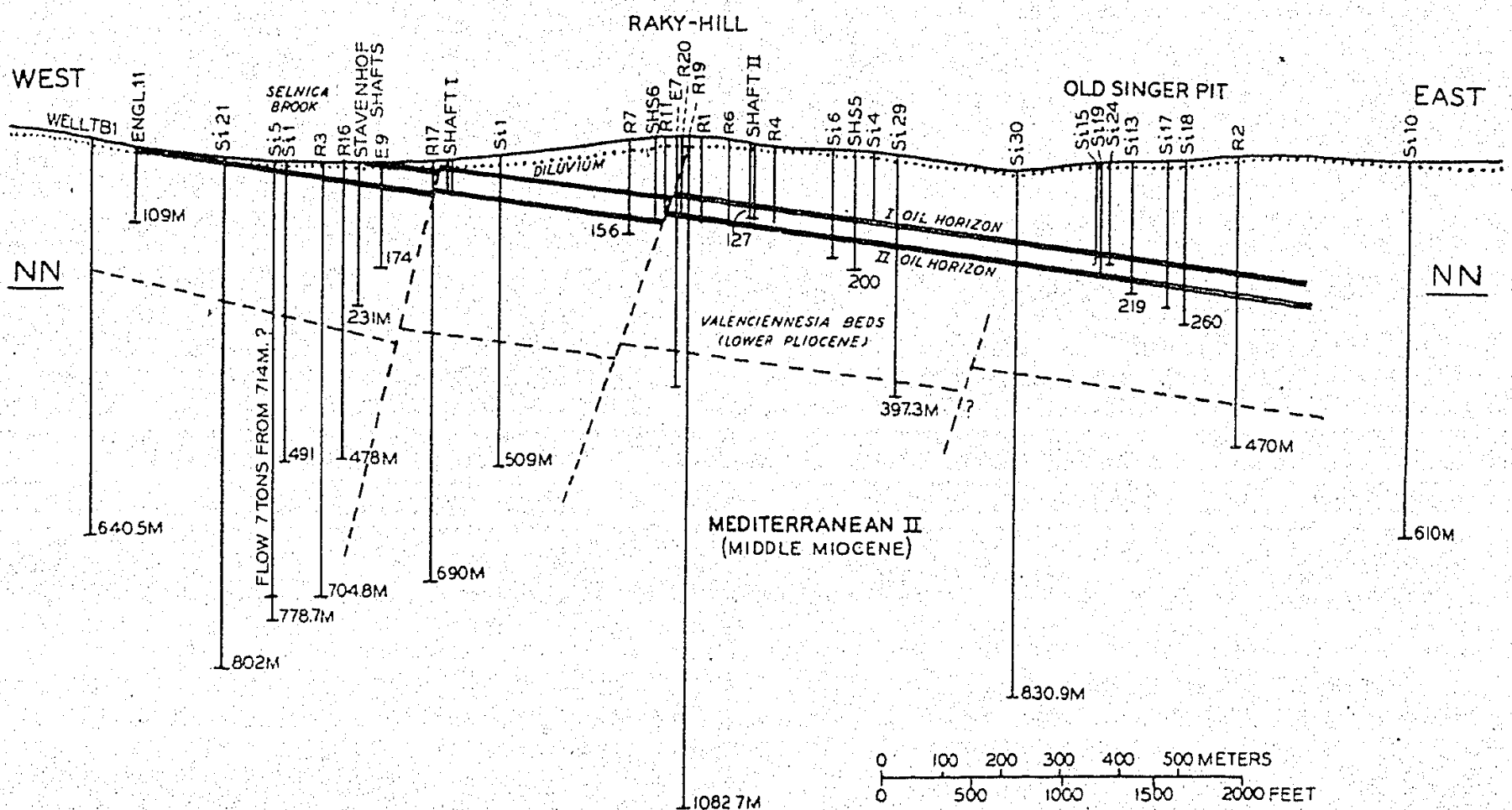
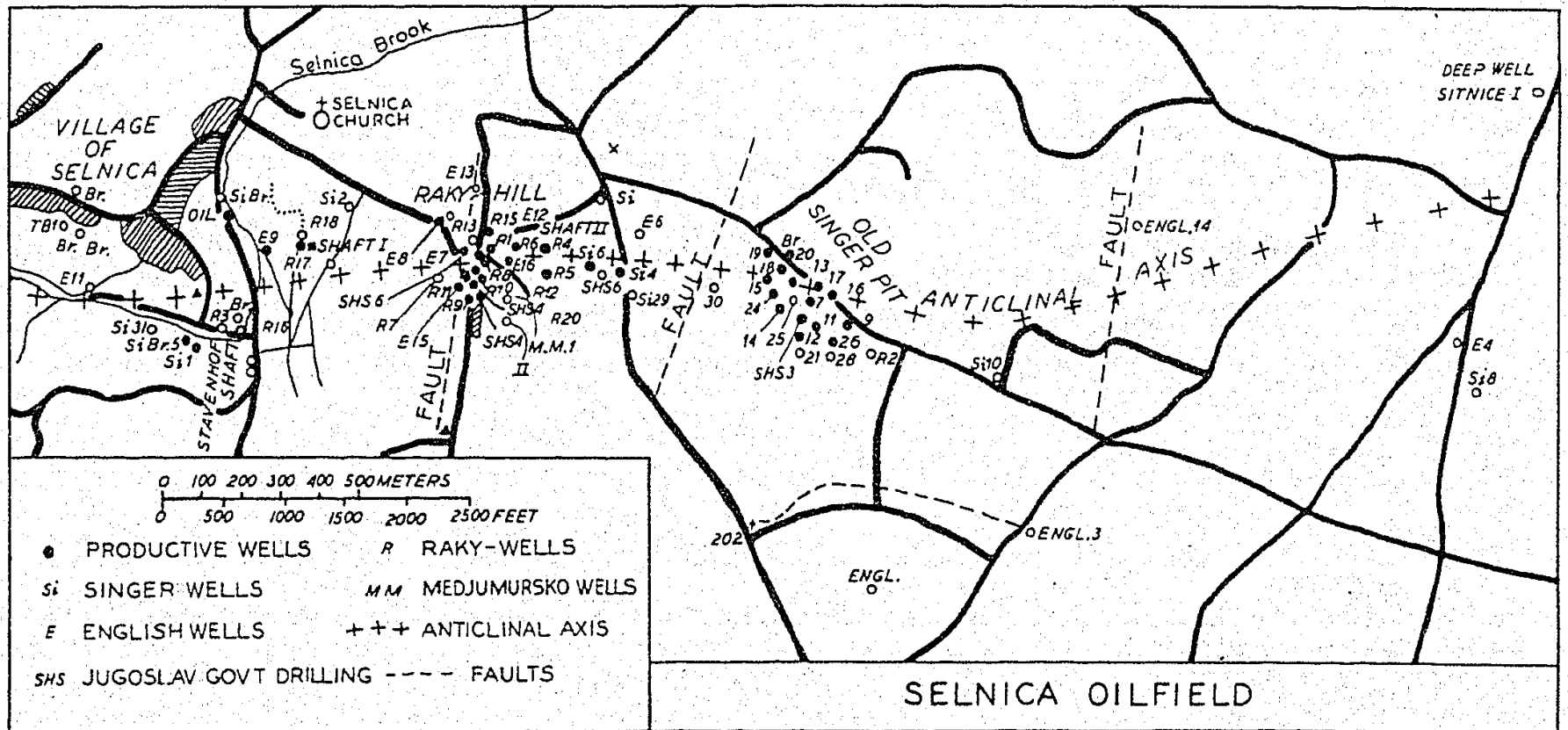
m. = meters
c.m. = cubic meters

20 - PRODUCING
Geological summary

drilled a deep test during the same year. This well, like its predecessors, was unsuccessful but obtained traces of light oil. Gewerkschaft Elwerath, operating under the name "Jugo-Petrol", is reported to have subsequently drilled several smaller wells in the Medjimurje area. Production from one of these was reported early in 1941 as being 30 barrels a day, or about 1,500 metric tons a year.

2.5.2 Geological Summary

The geological formations of this oil district are of Tertiary age and are reported to consist approximately of the sequence shown in the table on page 21.



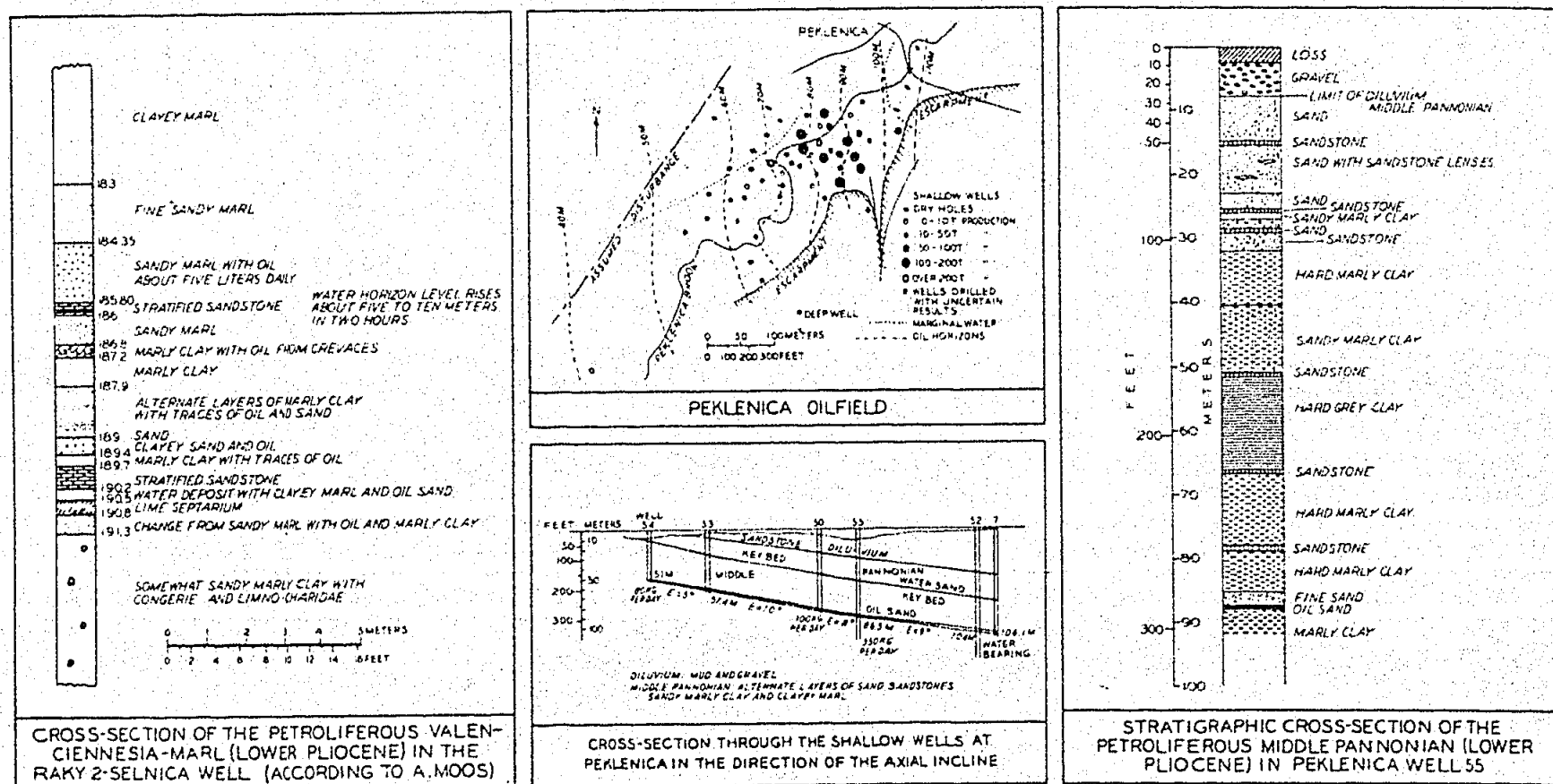
SELNICA OIL REGION, EAST-WEST CROSS-SECTION (AXIAL DIRECTION)

Stratigraphic Section in Northern Yugoslavia

Age	Description	Thickness Meters
Upper Pliocene	Sand and gravel	Unimportant
-----Disconformity-----		
Middle Pliocene:	Fine sands and clays with lignites	300
(Upper Pannonian)	Gray marly clay with sand lenses	
(Middle Pannonian)	(oil zone of Peklenica field)	200
Lower Pliocene:	Interbedded clay marl (a) and fine micaceous sands and massive clay marls	250
-----Angular Unconformity-----		
Middle Miocene	Marly shales with intercalated sands and limestones	450 plus.

The oil horizon at Peklenica occurs in the lower Pliocene (middle Pannonian). At Selnica the oil is found in an older formation, the middle Valenciennes stage of the lower Pliocene (lower Pannonian). Some exploratory wells penetrated portions of the underlying middle Miocene beds (Tortonian or so-called Mediterranean II beds) but without succeeding in discovering commercial production.

Both of these oil fields are on an anticlinal structure which is closely related to the structural system controlling oil accumulation in the Lispe and Budafapuszta fields of Hungary (Figure, page 14). The structure of Selnica field is interpreted as being anticlinal, but complicated by cross faults (Figure, page 20) which have produced small, separated reservoirs. Structurally the Peklenica oil field is represented as being monoclinial (Figure, page 21) from which it may be inferred that the accumulation is in part controlled by pinching-out of oil sands.



2.5.3 Crude Oil Production

The total oil production of the Selnica field, from 1900 to the end of 1938, amounts to about 10,000 metric tons of which about 6,000 metric tons have come from the "Singer mine" area and 4,000 metric tons from the Raky hill district. The crude oil of the Selnica main oil horizon is of a dark green color in direct

(a) Contains the oil zone of the Selnica field and gas zones of the Croatian field.

22 - PRODUCING Gas production

light, and in transmitted light is of a reddish brown color. The average specific gravity is 0.830 at 15° C. (39.00° A.P.I.). The straight-run gasoline content is about 25%.

The crude oil of the Peklenica field is black and its specific gravity ranges from 0.927 (21.15° A.P.I.) to 0.948 (17.75° A.P.I.). The initial boiling point is about 270° F. The current production in the field is about 2.4 metric tons or 18 barrels per day.

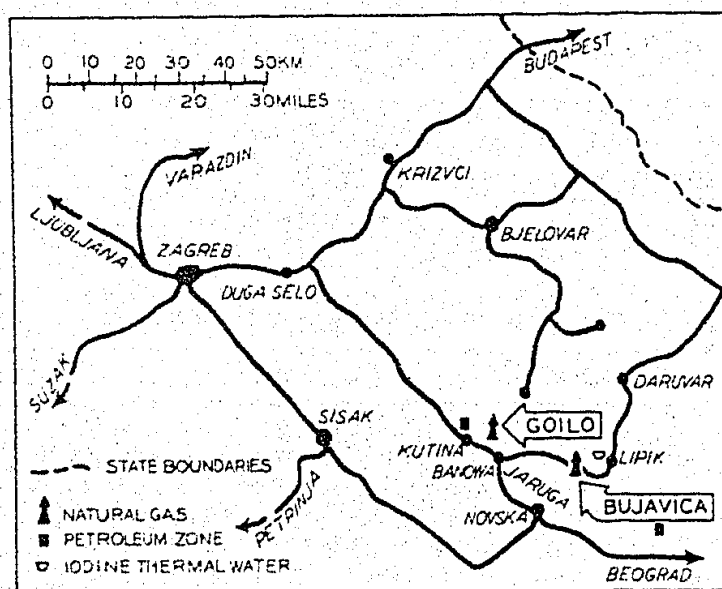
In the years 1911 to 1913, seventeen wells were drilled by an English concern. No record of the results of this drilling is available. The Yugoslav Government drilled six wells in the Selnica field in 1921 and 1922. During 1927 to 1930, inclusive, nineteen wells were drilled under the management of an individual named Raky. The record of the Raky wells is shown on page 19. Subsequent to 1932 the Medjumursko Petrolejsko dioncarsko društvo has drilled about 55 wells to depths between 60 and 100 meters, chiefly in the district of Peklenica.

Production of oil from the Medjimurje fields to the end of 1939 is shown by the following table.

Section	Metric Tons	Barrels	Barrels Per Day
1900- 1934	11,700	86,580	-
1935	260	1,924	5
1936	137	1,013	2
1937	463	3,426	9
1938	1,091	8,073	22
1939	1,114	8,243	22
TOTAL	14,765	109,259	297

2.6 GAS PRODUCTION AND EXPLOITATION IN YUGOSLAVIA, (a)

The gas fields of central Yugoslavia have been known for many years, but only during recent years have they been considered important. The principal gas fields are Bujavica and Goilo, shown in the accompanying figure, where gas is found at a depth of about 350 meters (1,100 to 1,400 feet) in lower Pannonian sediments.



NATURAL GAS FIELDS IN CENTRAL YUGOSLAVIA

Gas in non-commercial quantities was also found at Sisak. Gas exploitation in this district is controlled by a company known as Ulanik A.C., of Zagreb, under terms of a contract with the Yugoslav government.

Gas production from the Bujavica field amounted to 2,628,105 cubic meters in 1939. No production figures are available from Goilo. Typical analyses of gas from the Bujavica field follow:

(a) "Erdgasgewinnung und -Verarbeitung in Kroatien (Yugoslawien)", by Ing. Chem. Petrunic Aleksandar, Institut für Brennstoffe, Erz und Metallurgie, Zagreb, in "Oel und Kohle", No. 40, October 22, 1940

	Sample No. 1	No. 2	No. 3	No. 4
CH ₄	94.5%	98.1%	95.32%	93.2%
C _n H _m	0.3	--	0.5	0.3
CO	0.2	0.1	0.76	0.6
CO ₂	1.3	0.3	0.3	0.33
N ₂	3.7	1.5	2.7	4.9
	100.0%	100.0%	99.58%	99.33%

A carbon black plant was built in 1938 at Kutina, near the fields, which operates on gas from the Goilo field. The reported daily production is between 800 and 900 kilograms of carbon black. Gas compressed in bottles is also utilized to a limited extent in industry. In about 1935, its use as a motor fuel was begun. Practical experience is said to indicate that one cubic meter of this gas is equivalent to about 1.15 liters of gasoline. It is reported that the use of bottled gas approximates 3,000,000 cubic meters per year.

Since the outbreak of the war the German Elwerath Company has taken an interest in the exploitation of the Bujavica and Goilo structures. It is reliably reported (statement of Professor Benz to an American oil company official in late 1941) that one of several wells drilled by this company at Goilo was yielding an initial production of 350 barrels per day (18,250 tons per year). Recent Intelligence reports that 13 wells have been drilled at Goilo and that they are producing at the rate of 73,000 metric tons a year.

24 - REFINING
Refinery data

STATISTICAL SUMMARY OF DATA ON YUGOSLAV REFINERIES
FOR THE YEAR 1943

x = Data Unknown

1. Common name of Refinery	Brod	Caprag (Sisak)	Osijek
2. Location of Refinery			
(a) Place	Bosanski-Brod	Caprag	Osijek
(b) Index	Lat. (a)	45° 29' N (b)	45° 34' N
Map			
Coordinates	Long.	16° 22' E (b)	18° 42' E
3. Refinery Capacity:	MT/yr.	100,000	20,000
	Bbls/day	2,200	500
4. Normal throughput:	MT/yr.	27,000	Shut down
	Bbls/day	600	Shut down
5. Crude for which designed	Rumanian artificial	Rumanian artificial	Rumanian artificial
6. Crude used currently	Yugoslavian	Yugoslavian	Shut down
7. Products made, running for maximum	Diesel and fuel oil	Diesel and fuel oil	Shut down
	% of Total	Metric Tons A Year	% of Total
Gasoline	20	6,000	21
Kerosine, Gas Oil & Diesel Oil	30	9,000	29
Lubes	7	2,000	3
Fuel Oil	30	10,000	34
Asphalt	-	-	-
Refinery Fuel & loss, and Misc.	13	3,000	13
Totals	100	30,000	100
			24,000
8. Refining Units			
(a) Crude distillation facilities	Atmospheric pipe still, 300-360 metric tons/day.	4 shell stills for 300 metric tons/day total.	Three shell stills.
(b) Cracking facilities	None	None	None
(c) White products finishing facilities	Three agitators for kerosine.	One still for special B. P. gasoline and kerosine agitators	One small agitator
(d) Lube facilities	5 agitators for acid treating and 4 vacuum shell stills of 15-20 metric tons/day each.	Two Brünn Königsfeld high vacuum shell stills of 50 metric ton/day total.	None
(e) Hydrogenation, Alkylation, etc.	None	None	None
(f) Asphalt facilities	Asphalt blowing	Yes	None
(g) Gas plant	None	None	None
(h) Specialties	Grease (axel and cup)	See item "C" above.	None
(i) Boiler Plant	One Babcock Wilcox boiler and one Brünn Königsfeld boiler.	Babcock and Wilcox boiler.	Yes
(j) Power Plant	Steam electric with auxiliary diesel electric	One steam electric (AC) and one diesel electric	None
9. Tankage Capacity:			
Black: M ³	33,165	31,000	
Bbls.	208,609	194,990	x
White: M ³	19,889	12,000	
Bbls.	125,100	75,480	x
Total: M ³	53,054	43,000	2,960
Bbls.	333,709	270,470	18,750
10. Construction:			
(a) When built	Shell stills 1896-1897 Pipe still 1930; vacuum phase 1940	1926-1927	x
(b) Built by what concern	Brünn Königsfeld	Shell	x
(c) Flow plans and working drawings in possession of whom	Brünn Königsfeld and Standard-Vacuum of Croatia Inc.	Jugoslovensko Shell D.D.	x
11. Name of Company	Standard-Vacuum of Croatia Inc.	Jugoslovensko Shell D.D.	Ivanovic and Co. (Ipoll) (Astra D.D.)
12. Address of Company	Kumičićeva Ul. 5 Zagreb	Zagreb	Osijek
13. Affiliations of Company			
(a) Name(s) of owner firms	Socony-Vacuum Oil Co. Inc.	Royal Dutch Shell Group	Phoenix Oil & Transport Co., Ltd.
(b) Address(es) of owner firms	26 Broadway, New York, N.Y.	London, England	London, England

REMARKS: (a) Latitudes and longitudes taken from Index-Gazetteer to "The Times" Sunday Atlas of the World, London, 1922; edited by John Bartholomew, The Edinburgh Geographical Institute. (b) Coordinates are for Sisak which is in the immediate vicinity of Caprag.

3.0 REFINING3.1 INTRODUCTION

General.- Yugoslavia, following the example of France, Italy and other European countries, imposed prohibitive import duties on petroleum products, thus forcing the building in the country of refineries designed to rerun mixtures of imported products called "artificial crude" (a). In peacetime the artificial crude was imported from Rumania, being barged up the Danube and its tributaries.

On January 1, 1937 there were four refineries operating, listed in order of relative importance as follows:

Status of Refineries Operating in Yugoslavia on January 1, 1937

Name of Refinery	Daily Throughput Barrels a Day	Company	Owner Company
Brod	2,240	Standard-Vacuum of Croatia, Inc.	Socony-Vacuum
Caprag	1,725	Jugoslovensko Shell dioničarsko društvo	Royal Dutch Shell
Osijek	385	Ipoil dioničarsko društvo	Ivanovic and Co, Astra dioničarsko društvo
Dravograd	100	Dravograd Rafinerija Mineralnog Ulja-Goll	Independent
Total	4,450		

It is understood that the above throughput rates were maintained as late as January 1, 1939.

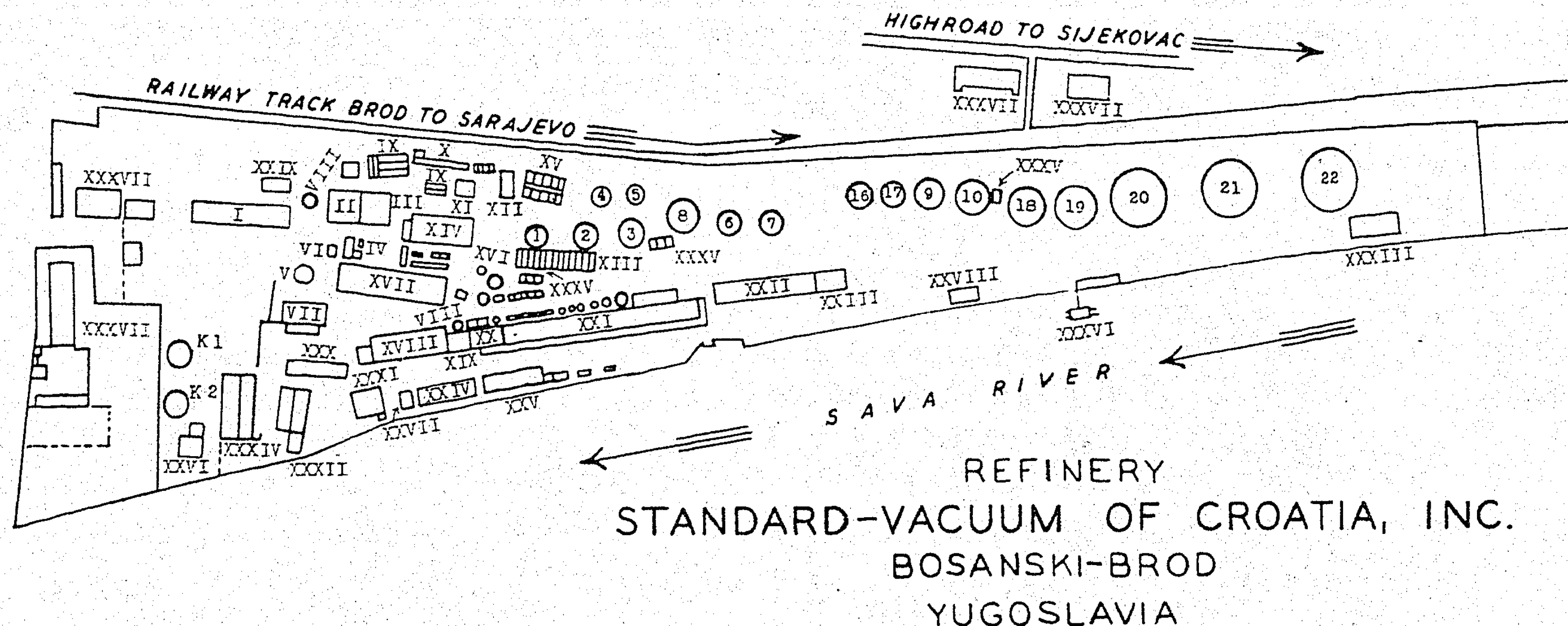
Present situation.- It is believed that artificial crude no longer is imported from Rumania and that the operations of Yugoslav refineries are restricted to running the indigenous crude, a post war development presently estimated as totalling some 1,000 barrels a day. It is considered likely that the entire quantity is being processed at Brod or Caprag, or both, and that the other refineries are shut down. Present refinery output by volume is estimated as: gasoline-24 per cent, kerosine, gas oil and diesel oil-45 per cent, lube oils-4 per cent, fuel oil-18 per cent, refinery fuel and losses-9 per cent.

New refineries.- Aerial reconnaissance shows that a new refinery has been constructed, probably by the Sumadiska Kreditna Banka, at Smederevo, approximately 20 miles southeast of Beograd. So far as can be determined from aerial photographs this plant has a capacity of around 50,000 metric tons a year.

3.2 STRATEGIC CONSIDERATIONS

Importance in normal times.- The construction of refineries within the country was not justified economically as products refined abroad in large low cost

(a) Either crude oils enriched with kerosine and gasoline, or mixtures of finished products, i.e., gasoline, kerosine, gas oil and fuel oil. These mixtures satisfied customs requirements for classification as crude oil.



LEGEND

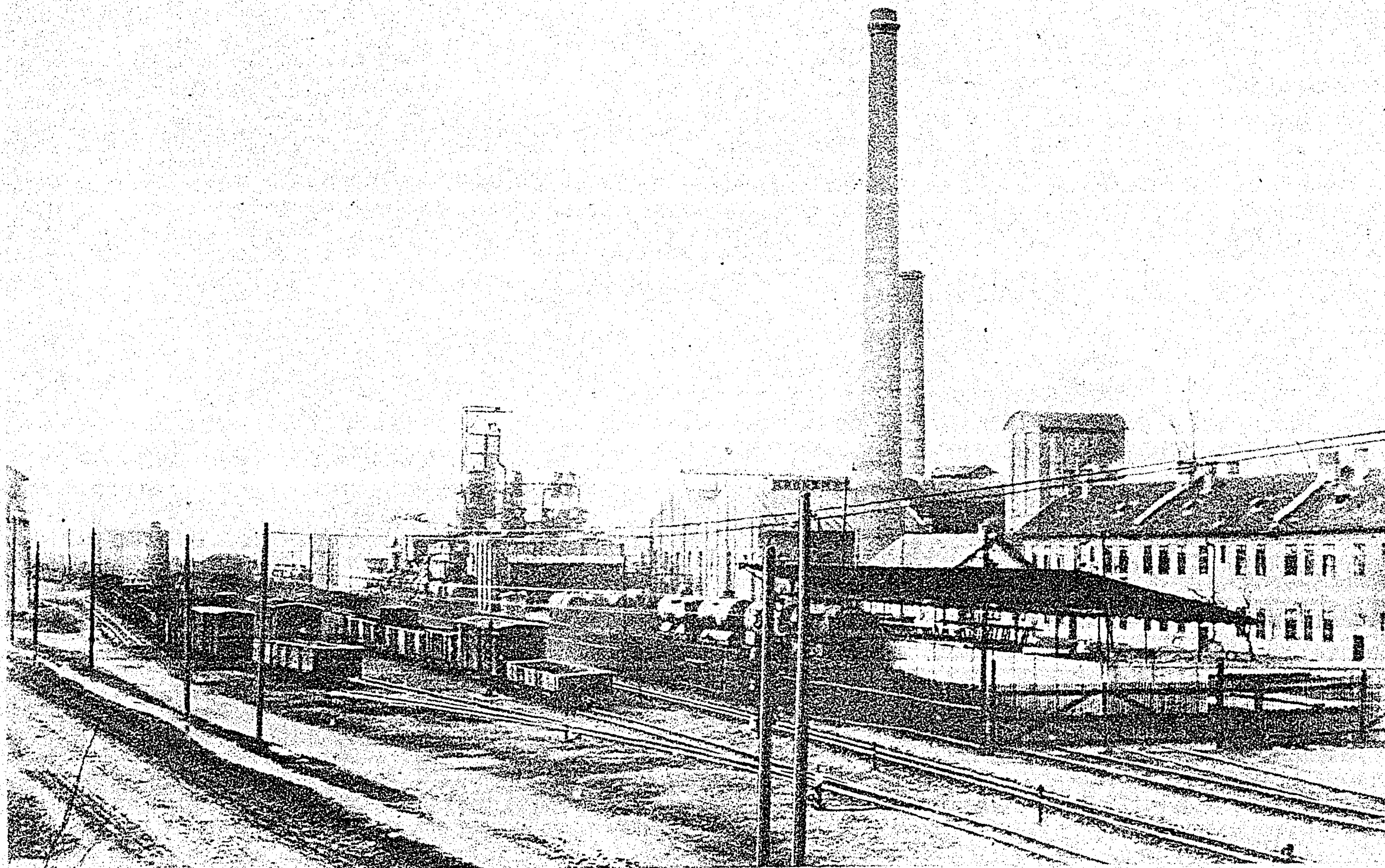
- | | |
|--|--|
| I Office Building | XVIII Drum Factory |
| II Power Plant | XIX Grease and Flit Factory |
| III Boiler House | XX Tin Factory |
| IV Laboratory | XXI Barrel Filling |
| V C.F.R. Motor Building | XXII Cased Kerosine stores |
| VI Gasoline Rectifier | XXIII Axle Grease Factory |
| VII Gasoline Tanks | XXIV Drum Store |
| VIII Stacks | XXV Cased Kerosine stores |
| IX Vacuum Stills | XXVI Water Pump House |
| X Vacuum Receiving House | XXVII Fire Pump House |
| XI Tube Still | XXVIII Foam House |
| XII Tube Still Receiving House | XXIX Foam Chemicals' store |
| XIII Run Down Tanks to
Crude Distillation | XXX Repair Shop |
| XIV Old Crude Stills | XXXI Boilermaker Shop |
| XV Run down Tanks to
Vacuum Distillation | XXXII Carpenters' Shop |
| XVI Refined Oil Treating Plant | XXXIII Tank Car Repair Shed |
| XVII Lubricating Oil Treating
Plant | XXXIV Storehouse |
| | XXXV Pump Houses |
| | XXXVI Dock |
| | XXXVII Dwelling Houses, Canteen
Garage, Stables, etc. |

MAIN STORAGE TANKS

Exclusive of a large number of small rundown and working tanks

Tank No.	Diameter m.	Height m.	Capacity M ³	Barrels
1	14	8.25	1,268	7,988
2	14	8.25	1,268	7,988
3	18	10.	2,543	16,020
4	10	7.75	615	3,874
5	10	7.75	615	3,874
6	14	8.25	1,268	7,988
7	14	8.25	1,268	7,988
9	14	8.25	1,268	7,988
10	14	8.25	1,268	7,988
16	10	9.	706	4,448
17	9	11.	706	4,448
18	18	9.40	2,387	15,038
19	20	11.40	3,579	22,548
20	28	11.	6,769	42,644
21	28	11.	6,769	42,644
22	30	14.	9,891	62,313
K 1	14	8.25	1,268	7,988
K 2	14	8.25	1,268	7,988

Total 44,724 281,761



BOSANSKI-BROD REFINERY, YUGOSLAVIA

refineries could have been delivered to the Yugoslav market at a lower cost. Thus, the importance of these plants in normal times was political rather than economic.

Now that there is a little local crude production, it is expected that some refining will be continued in Yugoslavia.

Wartime use.- The reported development of indigenous production since the outbreak of the war to some 1,000 barrels a day has slightly increased the importance of refineries in Yugoslavia. If additional products were required in the country, these plants might be used to handle some of the Hungarian crude presently being produced in quantity in excess of Hungarian refining capacity. However, no reports that this is being done have been received. Rumanian crude, of course, also could be handled.

3.3 BROD REFINERY

Location.- At the town of Bosanski-Brod, on the Sava River about 113 miles ESE of Zagreb.

Description.- This refinery, owned by the Standard-Vacuum of Croatia, Inc., a subsidiary of Socony-Vacuum Oil Co. Inc., was purchased from the Danica Petroleum Company, a local Yugoslav organization, in 1928. At the time of purchase the equipment consisted of obsolete batch type shell stills. In 1930 Standard-Vacuum built a Brünn Königsfeld pipe still and four vacuum shell stills. Two of the old shell stills that were used to store hot oil were dismantled in 1939 and three of them (coal fired) are used for standby and rerun. The Brünn Königsfeld atmospheric pipe still has a rated capacity of 300 to 360 metric tons or 2,250 to 2,700 barrels per day. The four vacuum shell stills are designed for continuous operation and have a capacity of 15 to 20 metric tons per day each. The pipe still and vacuum shell stills run together and are oil fired. There are no wax pressing or dewaxing facilities. The plant had a tetra-ethyl lead mixing unit, products of which were sold exclusively to the air lines and Yugoslav Government.

3.4 CAPRAG (SISAK) REFINERY

Location.- The Caprag (Sisak) refinery is located at Caprag, one and a half miles southeast and across the railroad bridge from Sisak.

Description.- This refinery is the most modern of the Yugoslav plants despite the fact that it was built in 1928. It is owned by the Jugoslovensko Shell d.d., a subsidiary of the Royal Dutch Shell group. Distillation unit consists of a battery of shell stills capable of handling 300 metric tons (2,250 barrels) per day. There is no pipe still. The vacuum shell stills have a total capacity of 50 metric tons (375 barrels) a day. There is also a still for special boiling point gasoline and treating equipment for kerosine and lube oils.

3.5 OSIJEK REFINERY

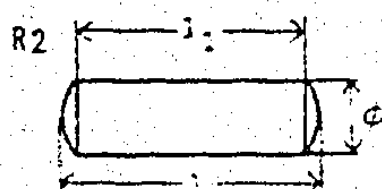
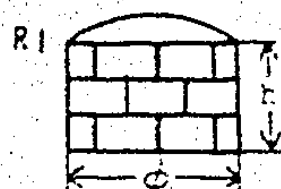
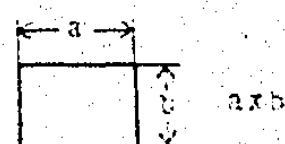
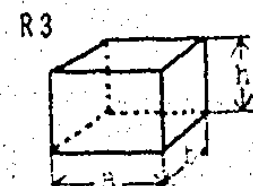
Location.- This refinery is located in the town of Osijek on the Drava River, 105 miles northwest of Beograd.

Description.- Of the three operable refineries in Yugoslavia, this is the smallest. It is believed at present to be shut down. The refinery was built of second-hand equipment. It was last reported operating in 1938 when its throughput was 402 barrels a day (55 metric tons per day) and products by volume were produced as follows: 35 per cent gasoline, 15 per cent kerosine, 17 per cent lube oils and 33 per cent gas oil, fuel oil and diesel oil.

SHEET 1 OF 4

SHELL REFINERY CAPRAG (YUGOSLAVIA) (1934)

RESERVOIRE - TANKS

Above Ground
Oberirdisch
Under Ground
Unterirdisch

Produkt	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) m	Abmessung (L x B x H) 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* Graded Product

SHELL REFINERY CAPRAG (YUGOSLAVIA) (1934)

SHEET 2 OF 4

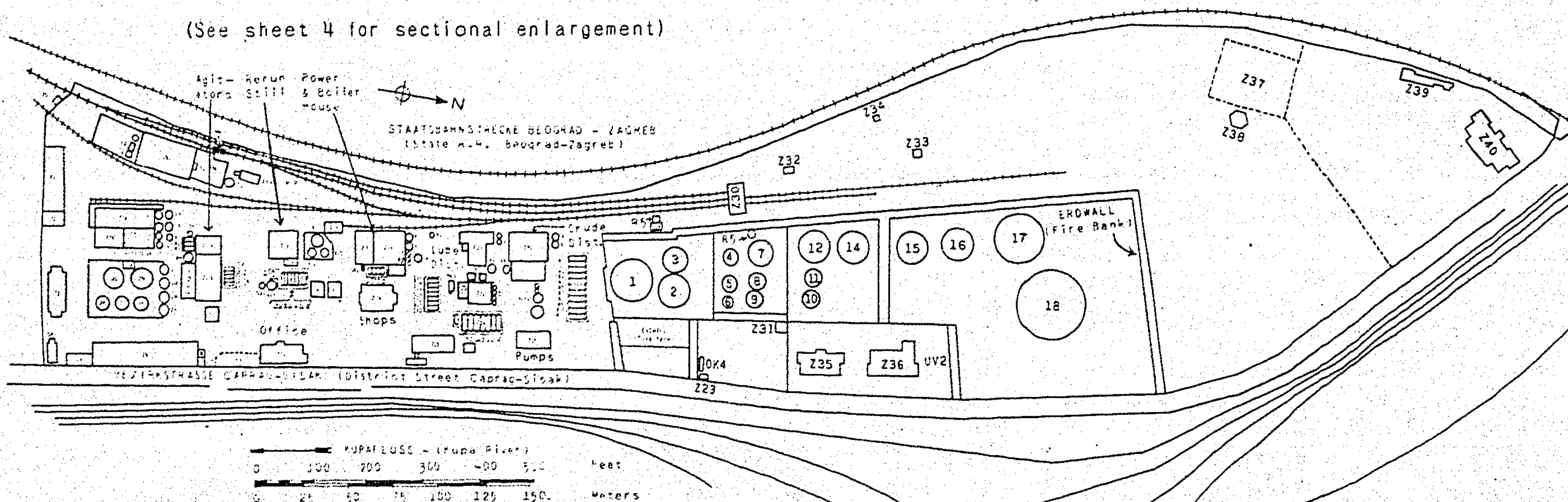
SHELL REFINERY CAPRAG (YUGOSLAVIA) (1934)

Refinery	Dist.	Q. x L	H. ft	Vol. cu ft	Surf. sq ft	Vol. cu ft	Surf. sq ft	Product	Dist. ft	Type	Q. x L	H. ft	Vol. cu ft	Surf. sq ft	Vol. cu ft	Product	
1	R1	2.00	4.00	10.00	20	20	20	Extrak. Benzin	53	R2-0	0.50'	32.15'	33.79'	732'	201	Naptha	
2	R1	2.00	4.00	10.00	20	20	20	Steamstock	54	R2-0	0.50'	32.15'	33.79'	732'	201	Steam Stock	
3	R1	2.00	4.00	10.00	20	20	20	Lackbenzin	55	R2-0	0.50'	32.15'	33.79'	732'	201	Painters Naptha	
4	R1	2.00	4.00	10.00	20	20	20	Leichtbenzin	56	R2-0	0.50'	32.15'	33.79'	732'	201	Light Naptha	
5	R1	2.00	4.00	10.00	20	20	20	Extrak. Benzin	57	R2-0	0.50'	32.15'	33.79'	732'	201	Naptha	
6	R1	2.00	4.00	10.00	20	20	20	Extrak. Benzin	58	R2-0	0.50'	32.15'	33.79'	732'	201	Naptha	
7	R1	4.00	4.00	10.00	20	20	20	Benzin	59	R1	13.78'	15.42'	785'	416	371	Gasoline	
8	R1	8.00	4.00	10.00	20	20	20	Benzalko	60	R1	26.25'	22.97'	1431'	818	736	Benzalko +	
9	R1	1.895	4.00	5.65	37	15	15	Bruckluft	61	R2-0	0.20'	17.06'	18.54'	398'	94	84	Compressed Air
10	R1	1.895	4.00	5.65	37	15	15	Warmwasser	62	R2-0	0.20'	17.06'	18.54'	398'	94	88	Hot Water
11	R1	1.895	4.00	5.65	37	15	15	Warmwasser enthaertet	63	R2-0	0.20'	17.06'	18.54'	398'	94	88	Hot Water, softened
12	R1	1.895	4.00	5.65	37	15	15	Warmwasser enthaertet	64	R2-0	0.20'	17.06'	18.54'	398'	94	88	Hot Water, softened
13	R1	2.00	2.00	2.00	21	7	7	Fuel	65	R1	0.55'	7.55'	228'	44	38	Fuel	
14	R1	2.00	2.00	2.00	21	7	7	Fuel	66	R1	0.55'	7.55'	228'	44	38	Fuel	
15	R1	1.895	4.00	5.65	37	15	15	Fuel	67	R2-0	0.20'	17.06'	18.54'	398'	94	88	Fuel
16	R1	2.00	4.00	10.00	20	20	20	Cyl. oil konzent.	68	R2-0	0.50'	32.15'	33.79'	732'	201	182	Cyl. Oil Concentrate
17	R1	2.00	4.00	10.00	20	20	20	S. Cyl. oil dest.	69	R2-0	0.50'	32.15'	33.79'	732'	201	182	Heavy Cyl. Oil Distillate
18	R1	2.00	4.00	10.00	20	20	20	L. Cyl. oil dest.	70	R2-0	0.50'	32.15'	33.79'	732'	201	182	Light Cyl. Oil Distillate
19	R1	2.00	4.00	10.00	20	20	20	S. Masch. oil dest.	71	R2-0	0.50'	32.15'	33.79'	732'	201	182	Heavy Machine Oil Dist.
20	R1	2.00	4.00	10.00	20	20	20	L. Masch. oil dest.	72	R2-0	0.50'	32.15'	33.79'	732'	201	182	Light Machine Oil Dist.
21	R1	2.00	4.00	10.00	20	20	20	Spindel oil dest.	73	R2-0	0.50'	32.15'	33.79'	732'	201	182	Spindle Oil Distillate
22	R1	2.00	4.00	10.00	20	20	20	Spindel oil dest.	74	R2-0	0.50'	32.15'	33.79'	732'	201	182	Spindle Oil Distillate
23	R1	1.80	4.00	5.50	36	14	14	Slop	75	R2-0	0.50'	32.15'	33.79'	732'	201	182	Slop
24	R1	1.80	4.00	5.50	36	14	14	Spindel oil dest.	76	R2-0	0.50'	32.15'	33.79'	732'	201	182	Spindle Oil Distillate
25	R1	1.80	4.00	5.50	36	14	14	Harz	77	R2-0	4.92'	12.30'	13.12'	237'	44	38	Resin
26	R1	2.00	4.00	10.00	20	20	20	S. Masch. oil dest.	78	R2-0	0.50'	32.15'	33.79'	732'	201	182	Heavy Mach. Oil Distillate
27	R1	2.00	4.00	10.00	20	20	20	S. Cyl. oil dest.	79	R2-0	0.50'	32.15'	33.79'	732'	201	182	Heavy Mach. Oil Distillate
28	R1	2.00	4.00	10.00	20	20	20	L. Cyl. oil dest.	80	R2-0	0.50'	32.15'	33.79'	732'	201	182	Light Cyl. Oil Distillate
29	R1	2.00	4.00	10.00	20	20	20	L. Masch. oil dest.	81	R2-0	0.50'	32.15'	33.79'	732'	201	182	Light Machine Oil Dist.
30	R1	2.00	4.00	10.00	20	20	20	Spindel oil dest.	82	R2-0	0.50'	32.15'	33.79'	732'	201	182	Spindle Oil Distillate
31	R1	2.00	4.00	10.00	20	20	20	Gas oil	83	R2-0	0.50'	32.15'	33.79'	732'	201	182	Gas Oil
32	R1	2.00	4.00	10.00	20	20	20	Asphalt	84	R2-0	0.50'	32.15'	33.79'	732'	201	182	Asphalt
33	R1	1.70	1.80	1.80	14	4	4	Fuel	85	R1	0.55'	5.91'	151'	25	25	Fuel	
34	R1	1.70	1.80	1.80	14	4	4	Fuel	86	R1	0.55'	5.91'	151'	25	25	Fuel	
35	R1	2.00	4.00	10.00	20	20	20	Fuel	87	R2-0	0.20'	32.81'	32.81'	958'	227	295	Fuel
36	R1	2.00	4.00	10.00	20	20	20	Resid.	88	R1	0.20'	13.12'	13.12'	441'	126	113	Crude Oil
37	R1	2.00	4.00	10.00	20	20	20	Resid.	89	R1	16.05'	34.45'	2208'	1573	1415	Crude Oil	
38	R1	1.70	1.80	1.80	14	4	4	Fuel	90	R1	0.55'	5.91'	151'	25	25	Fuel	
39	R1	1.70	1.80	1.80	14	4	4	Fuel	91	R1	0.55'	5.91'	151'	25	25	Fuel	
40	R1	2.00	4.00	10.00	20	20	20	Octan-Benzine	92	R1	16.41'	19.69'	1345'	785	711	Octane Gasoline	
41	R1	2.00	4.00	10.00	20	20	20	Whitespirit	93	R1	16.41'	19.69'	1345'	785	711	Heavy Naptha	
42	R1	2.00	4.00	10.00	20	20	20	Resid.	94	R2-0	0.50'	32.81'	34.45'	958'	340	315	Residue
43	R1	2.00	4.00	10.00	20	20	20	Resid.	95	R2-0	0.50'	32.81'	34.45'	958'	340	315	Residue
44	R1	2.00	4.00	10.00	20	20	20	Gas oil	96	R2-0	0.50'	32.81'	34.45'	958'	340	315	Gas Oil
45	R1	2.00	4.00	10.00	20	20	20	Gas oil	97	R2-0	0.50'	32.81'	34.45'	958'	340	315	Gas Oil
46	R1	2.00	4.00	10.00	20	20	20	Petr. dest.	98	R2-0	0.50'	32.81'	34.45'	958'	340	315	Kerosine Distillate
47	R1	2.00	4.00	10.00	20	20	20	Petr. dest.	99	R2-0	0.50'	32.81'	34.45'	958'	340	315	Kerosine Distillate
48	R1	2.00	4.00	10.00	20	20	20	Lackbenzin	100	R2-0	0.50'	32.81'	34.45'	958'	340	315	Painters Naptha
49	R1	2.00	4.00	10.00	20	20	20	Lackbenzin	101	R2-0	0.50'	32.81'	34.45'	958'	340	315	Painters Naptha
50	R1	2.00	4.00	10.00	20	20	20	Benzin	102	R2-0	0.50'	32.81'	34.45'	958'	340	315	Gasoline
51	R1	2.00	4.00	10.00	20	20	20	Benzin	103	R2-0	0.50'	32.81'	34.45'	958'	340	315	Gasoline
52	R1	2.00	4.00	10.00	20	20	20	Slop	104	R2-0	0.50'	32.81'	34.45'	958'	340	315	Slop
53	R1	2.00	4.00	10.00	20	20	20	Gas oil	105	R1	72.18'	39.37'	13084'	26305	25475	Gas Oil	
54	R1	2.00	4.00	10.00	20	20	20	Vulkan	106	R1	33.37'	29.53'	4307'	6290	5681	Vulkan *	
55	R1	2.00	4.00	10.00	20	20	20	Resid.	107	R1	49.22'	37.40'	7729'	12580	11322	Residue	
56	R1	2.00	4.00	10.00	20	20	20	Resid.	108	R1	49.22'	37.40'	7729'	12580	11322	Residue	
57	R1	2.00	4.00	10.00	20	20	20	Crude Oil	109	R3-U	7.55'x12.36'	6.58'	367'	138	126	Crude Oil	
58	R1	2.00	4.00	10.00	20	20	20	Aviation Naptha	110	R1	26.53'	28.25'	3120'	3145	2831	Aviation Naptha	
59	R1	2.00	4.00	10.00	20	20	20	Fuel	111	R1	26.53'	28.25'	3120'	3145	2831	Fuel	
60	R1	2.00	4.00	10.00	20	20	20	Harvest oil	112	R1	24.35'	21.98'	2023'	1573	1415	Harvest Oil *	
61	R1	2.00	4.00	10.00	20	20	20	Aviation Naptha	113	R1	39.37'	29.53'	4907'	6290	5681	Aviation Naptha	
62	R1	2.00	4.00	10.00	20	20	20	Gasoline	114	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
63	R1	2.00	4.00	10.00	20	20	20	Diesel Fuel	115	R1	26.53'	28.25'	3120'	3145	2831	Diesel Fuel	
64	R1	2.00	4.00	10.00	20	20	20	Gasoline	116	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
65	R1	2.00	4.00	10.00	20	20	20	Gasoline	117	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
66	R1	2.00	4.00	10.00	20	20	20	Gasoline	118	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
67	R1	2.00	4.00	10.00	20	20	20	Gasoline	119	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
68	R1	2.00	4.00	10.00	20	20	20	Gasoline	120	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
69	R1	2.00	4.00	10.00	20	20	20	Gasoline	121	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
70	R1	2.00	4.00	10.00	20	20	20	Gasoline	122	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
71	R1	2.00	4.00	10.00	20	20	20	Gasoline	123	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
72	R1	2.00	4.00	10.00	20	20	20	Gasoline	124	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
73	R1	2.00	4.00	10.00	20	20	20	Gasoline	125	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
74	R1	2.00	4.00	10.00	20	20	20	Gasoline	126	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
75	R1	2.00	4.00	10.00	20	20	20	Gasoline	127	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
76	R1	2.00	4.00	10.00	20	20	20	Gasoline	128	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
77	R1	2.00	4.00	10.00	20	20	20	Gasoline	129	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
78	R1	2.00	4.00	10.00	20	20	20	Gasoline	130	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
79	R1	2.00	4.00	10.00	20	20	20	Gasoline	131	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
80	R1	2.00	4.00	10.00	20	20	20	Gasoline	132	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
81	R1	2.00	4.00	10.00	20	20	20	Gasoline	133	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
82	R1	2.00	4.00	10.00	20	20	20	Gasoline	134	R1	26.53'	28.25'	3120'	3145	2831	Gasoline	
83	R1	2.00	4.00	10.00	20	20	20	Gasoline	135	R1	26.53'	28.25'	3120'	3			

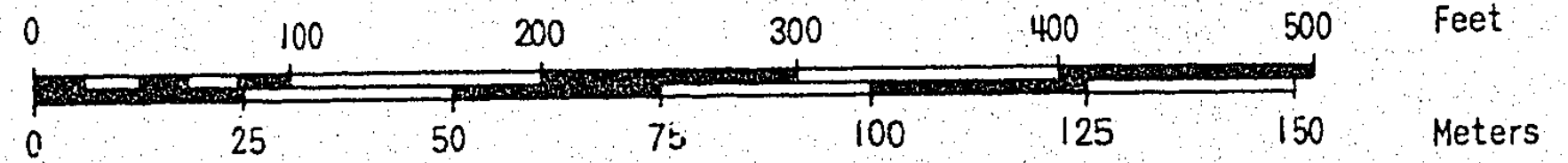
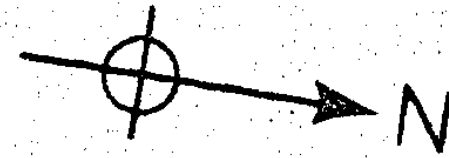
* Branded Product

SHELL REFINERY CAPRAG (YUGOSLAVIA) (1934)

(See sheet 4 for sectional enlargement)



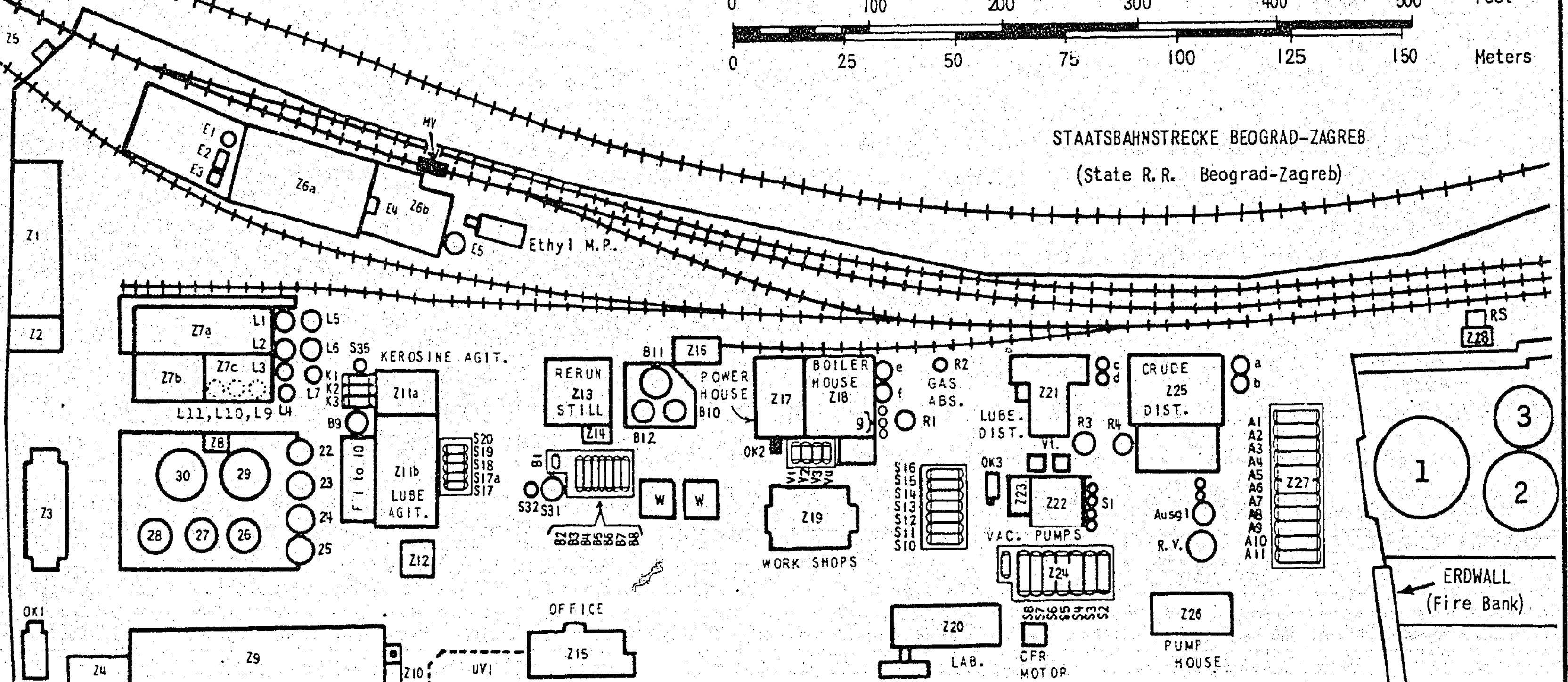
(Sectional enlargement of sheet 3)



STAATSBAHNSTRECKE BEOGRAD-ZAGREB

(State R.R. Beograd-Zagreb)

Ethyl M.P.



BEZIRKSTRASSE CAPRAG-SISAK (District Street Caprag-Sisak)

KUPAFLUSS - (Kupa River)

34 - REFINING
Dravograd

The refinery is operated by the Ipoil d.d. This company was formed by the Ivanovic interests (a Yugoslav family) who eventually sold an approximate 45 per cent interest to Astra d.d. which in turn is owned by the Phoenix Oil and Transport Company, Ltd., of London, England.

The whole plant is very small, consisting only of three shell stills with a rated capacity of 100-150 metric tons per day and possibly a small agitator for white products.

3.5 DRAVOGRAD REFINERY

Location. - Located in the town of Dravograd which is on the Austrian border.

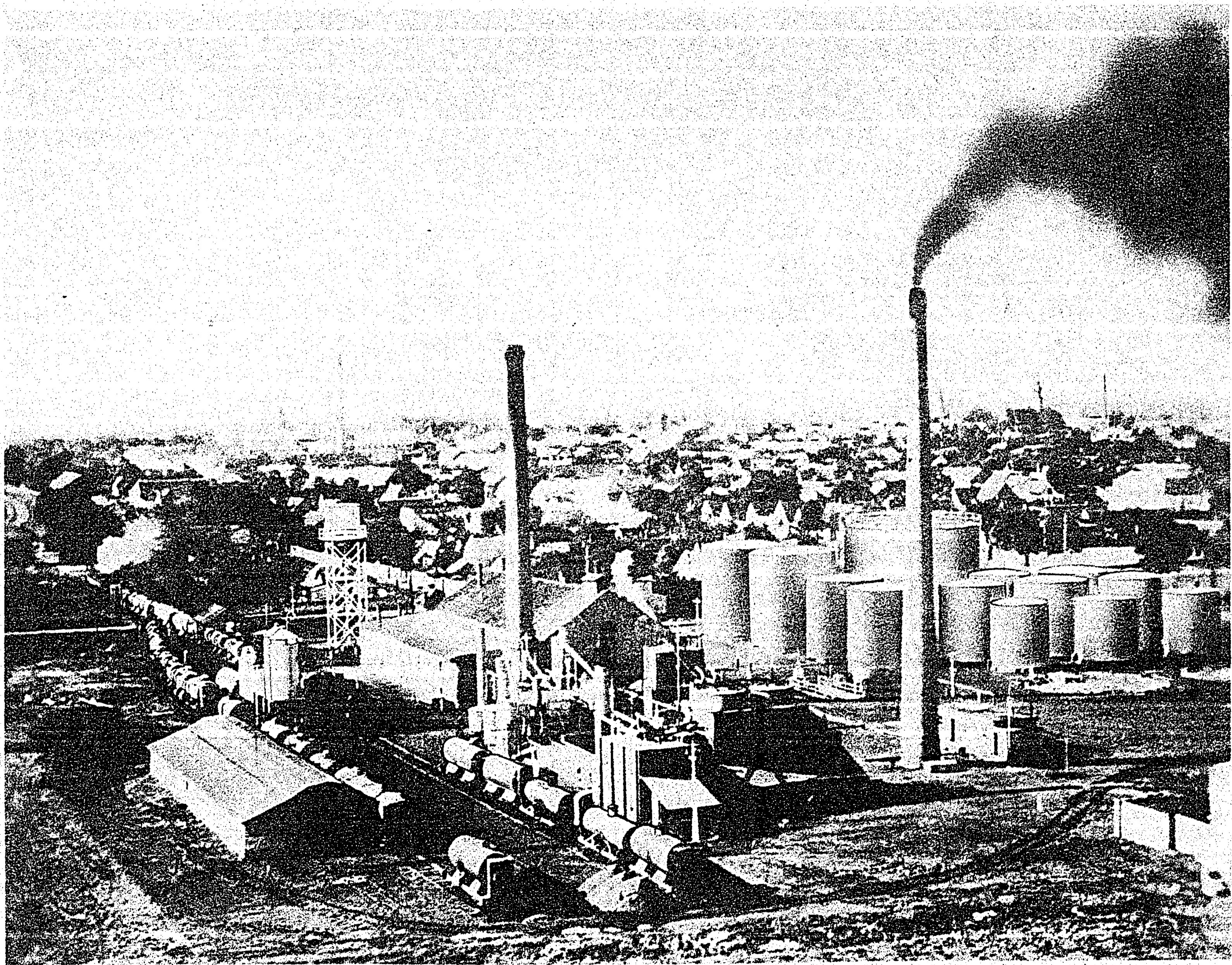
Description. - This refinery is reported to have been operating in 1938 at an increased rate of 220 barrels a day (30 metric tons per day) as compared with 100 barrels a day in 1937. It, too, operated on Rumanian artificial crude.

It is owned by the Dravograd Rafinerija Mineralnog Ulja-Coll, but before the war it was leased by the Shell Company who reduced its operation to the minimum necessary to keep the refinery permit alive. The one or two shell stills that constituted the complete distillation unit, were sold to "Ipoil" in recent years. The remaining equipment was reported in 1943 as being shut down.

In the last normal year (1938) output by volume by percentages was 45 per cent gasoline, 22 per cent diesel oil, fuel oil and gas oil and 33 per cent other products.



SHELL COMPANY REFINERY AT CAPRAG



IPOIL COMPANY REFINERY AT OSIJEK, YUGOSLAVIA

4.0 D I S T R I B U T I N G

4.1 GENERAL

This section of the report deals with the methods of and facilities for the distribution of petroleum products in Yugoslavia. All available data on bulk storage facilities at refineries, ocean terminals, and inland bulk plants are included. A summary of this data is given on the table on pages 62 and 63 and a map showing the locations of all known refinery and storage facilities in Yugoslavia appears on page 6. Plant layout plans, location sketches, and photographs, where available, are presented along with a description of the installations. Port data on the ocean terminals are summarized on the forms appearing on pages 45 and 59. Layout plans and detailed descriptions of the refineries will be found in the Refining section of this report.

Information on facilities is based on data submitted by the two principal companies operating in Yugoslavia, i.e., the Socony-Vacuum Oil Company, Inc., and the Shell Oil Company. Many minor discrepancies between the data received from the various sources obviously resulted from different mathematical methods employed in calculating capacities and in making conversions from one unit of measurement to another.

In the case of major discrepancies all available information was given careful consideration and discussed with persons having a personal knowledge of the area (a) before a final judgment was reached. Plans and statistics are, of necessity, based on pre-war conditions as there are few data available on possible subsequent additions, modifications, or damage.

4.2 C O N S U M P T I O N

Because Yugoslavia has never reached a high degree of economic and industrial development, its normal consumption of petroleum products is small. Pre-war consumption of all products amounted to only some 160,000 metric tons (approximately 1,200,000 barrels) per annum. Most of the requirements were supplied by the Yugoslavian refineries from artificial crude coming from Rumania. Most high grade lubricants were imported, however. A table showing imports of crude and finished products for the year 1938 appears on page 9.

Kerosine was an important product in Yugoslavia, being extensively used for lighting purposes. A considerable volume of gas oil and diesel oil was also consumed, the principal users being electric power plants. Small quantities of both kerosine and gas oil were consumed in tractors and small boats.

A table showing the marketing positions of the various companies and the total consumption figures, by products, for a representative year (1938) is given on the following page.

(a) A principal informant was Mr. F. M. Smith, formerly General Manager of the Standard-Vacuum of Croatia, Incorporated, affiliated with Socony-Vacuum Oil Company, Inc. Mr. Smith did not leave Yugoslavia until June 1941.

Marketing Position of Various Marketing Companies in Yugoslavia
Year 1938

In Metric Tons

Product	Total Consumption	Standard Vacuum	Shell	Astra	Ipoil	Gov't. Receipts	Others
Motor Fuel	57,996	24,418	15,733	1,658	322	12,010	3,802
Kerosine	37,440	21,637	10,710	1,232	404	-	3,357
Gas/Diesel Oil	37,982	13,472	10,353	1,777	20	6,571	5,739
Fuel Oil	4,497	1,066	2,174	249	-	-	1,008
Lube Oils	18,006	6,652	4,923	1,324	-	-	2,102
Greases	706	452	153	96	-	-	-
Paraffins	-	-	-	-	-	-	-
Asphalt	10,296	1,422	6,593	91	-	-	2,190
Other Products	52	52	-	-	-	-	-
Total	163,945	69,221	50,704	6,475	746	18,581	18,248
% of Total	100.0	42.0	31.0	4.0	-	12.0	11.0
Ships Bunkers	308						

In Barrels

Motor Fuel	434,745	183,135	118,410	12,420	2,415	90,075	28,515
Kerosine	280,800	162,652	80,325	9,615	3,030	-	25,173
Gas/Diesel Oil	284,865	101,040	77,643	13,328	150	49,232	43,413
Fuel Oil	33,728	7,995	16,305	1,368	-	-	7,560
Lube Oils	112,545	49,890	36,960	9,930	-	-	15,765
Greases	-	-	-	-	-	-	-
Paraffins	-	-	-	-	-	-	-
Asphalt	77,220	10,665	49,443	682	-	-	16,425
Other Products	390	390	-	-	-	-	-
Total	1,229,588	519,157	320,231	43,563	5,595	139,357	136,861

* Astra = Astra dioničarsko društvo ** Ipoil = Ipoil dioničarsko društvo

4.2.1 Industrial and Civilian Consumption of Liquid Petroleum Products
in Serbia and Croatia during 1943

Overall consumption.- The kingdom of Yugoslavia has been broken up into (a) the puppet states of Serbia, under German military occupation, and Croatia, under Italian rule until September 1943. Certain other parts of the country were incorporated into or administered by Germany, Italy, Hungary, Bulgaria and Albania. Petroleum consumption of the two puppet states in 1943 has been estimated at a total of 35,000 metric tons or at only 25 per cent of peace time requirements. An estimated 8,000 metric tons were light motor fuel, 6,000 tons kerosine, 6,000 metric tons lubricants, 8,000 metric tons gas oil and 7,000 metric tons fuel oil. Except for a small domestic production of crude oil in Croatia and a small alcohol production in both States, requirements were covered by imports from Rumania.

Road transportation.- Statistics on the number of motor vehicles in use early in 1941 shortly before the country was invaded are available and are presented herewith:

(a) See map on page 15.

Number of Motor Vehicles in Use in Yugoslavia, 1941

Motorcycles	11,643
Private cars	15,886
Busses	968
Trucks	5,331
Total	33,828

Estimated Industrial and Civilian Consumption of Liquid Fuels and Lubricants in Serbia and Croatia, 1943

(Metric Tons)

Category	Light Motor Fuel	Kerosine	Lubricants	Gas Oil	Fuel Oil	Total
Road transport	7,000	-	1,000	5,000	-	13,000
Inland shipping and fishing	-	-	-	1,000	1,000	2,000
Agriculture	1,000	1,000	5,000	-	-	2,000
Industry	-	-	-	2,000	6,000	13,000
Household	-	5,000	-	-	-	5,000
Total	8,000	6,000	6,000	8,000	7,000	35,000

Estimated Industrial and Civilian Consumption of Liquid Fuels and Lubricants In Yugoslavia, 1938

(Metric Tons)

Category	Light(a) Motor Fuel	Kerosine	Lubricants	Gas Oil	Fuel Oil	Total
Motorcycles	1,000	-	-	-	-	1,000
Private cars	12,000	-	1,000	-	-	26,000
Busses	9,000	-	-	4,000	-	-
Trucks	7,000	-	1,000	12,000	-	20,000
Total Road transport	29,000	-	2,000	16,000	-	47,000
Railways	-	-	4,000	1,000	-	5,000
Inland Shipping	2,000	2,000	1,000	2,000	5,000	12,000
Commercial Aviation	1,000	-	-	-	-	1,000
Agriculture	2,000	3,000	1,000	-	-	6,000
Industry	8,000	2,000	12,000	3,000	38,000	63,000
Household	-	25,000	-	-	-	25,000
Total	42,000	32,000	20,000	22,000	43,000	159,000

(a) Includes alcohol.

4.3 SUBSTITUTE FUELS

4.3.1 The Use of Substitute Fuels in Yugoslavia during 1943 (a)

Serbia (a), road transportation.- In October 1942 a Central Office for Generators was established in the Office of the German Commissary for Economics (b). This office organized and supervised the installation of gas generators in trucks, buses, tractors, rail cars, stationary engines, etc., and was also in charge of supply of generator fuel (c). German firms were asked to supply the necessary equipment for the conversion and for the production of charcoal from wood (d). Equipment could be imported duty-free.

With the huge conversion program under way in Germany, obviously only small quantities of generators and other equipment could be spared for Serbia. Conversions required a special permit from the local Traffic Commissioners. Sales of generator fuels were rationed. For the year 1943 it is tentatively estimated that 15 per cent of the pre-war motor fuel requirements of the country have been replaced by substitute fuels.

Croatia (a), road transportation and industry.- A special Office for Domestic Fuels was created in Croatia in September 1942 (e). In view of the natural gas production of the country some stress was laid on the replacement of liquid fuels by gaseous fuel. The utilization of the country's natural gas resources was, however, limited by distribution difficulties, lack of steel bottles, etc. The use of the available timber resources was handicapped by transportation difficulties and labor shortages. By July 1943 probably only a relatively small number of vehicles had been converted to substitute fuels.

Some small savings of liquid fuel were probably achieved in industry. Early in 1942 it was decreed that stationary motors using more than .2 tons of liquid fuel a month must be converted to gas or alcohol within 6 months.

4.3.2 Alcohol

Since 1932, in compliance with legislation favoring the local production of alcohol, all gasoline sold for automotive use in Yugoslavia was blended with alcohol. The intent of this provision, which was similar to that in effect in other European countries with limited indigenous petroleum resources, was to favor local agriculture and industry at the expense of foreign oil importers.

200 proof dehydrated alcohol was produced in local distilleries from corn and sugar beets and sold at a price fixed by government regulations to the oil companies.

The law required that 20 kilograms of dehydrated alcohol be mixed with every 100 kilograms of automotive gasoline. The result was a motor fuel containing approximately 16 2/3 per cent alcohol on a basis of weight.

The method commonly used in Yugoslavia was the Melle Process, of French origin. Extensive documentation exists on the use of alcohol mixtures as motor fuels. Some of the more obvious features are a certain loss of power as compared to the same volume of pure gasoline, the solvent action of the alcohol in feed systems and on some types of pump diaphragms and carburetor floats and the

(a) Refers to puppet states created by the Germans. See map on page 15.
(b) From "Oel und Kohle", November 1, 1942.
(c) "Nachrichten für den Aussenhandel", November 3, 1942
(d) "Berliner Börsen Zeitung", February 12, 1943
(e) From "Oel und Kohle", September 22, 1942.

affinity of alcohol for moisture, the presence of which has a pronounced destabilizing effect on the mixture.

The total pre-war alcohol production of Yugoslavia distilleries was between 50,000 and 60,000 metric tons, (about five times the amount required by the oil companies). The principal distilleries, in the order of their importance, are listed below:

Place

Brod	Cooperative distillery. Capacity approximately 3,000 metric tons per annum. Located opposite the Standard-Vacuum refinery.
Kreka	In Bosnia
Sisak	Distillery located about six miles from Shell's Caprag refinery.
Zagreb	Arko Company
Marof	
Ljubljana	Union Brewery
Beograd	Sugar refinery - Government owned.
Cervenka	Sugar refinery

4.4 TRANSPORTATION

Movement of crude oil to the refineries by river barges has been described in the refinery section of this report. Finished products left the refineries in river barges, railway tank cars, and by tank trucks.

The Rečna Plovidba, a company controlled by the Government of Yugoslavia, owned and operated all of the petroleum barges. This company owned approximately 30 barges with an average capacity of 700 metric tons (5,250 barrels) each, i.e., a total of 21,000 metric tons (157,500 barrels). While these barges were largely employed in the transporting of crude oil supplies to the refineries from Rumania, some were also used to transport finished products from the refineries to bulk storage plants at important centers of distribution.

Railway tank cars provided the principal transportation from the major distribution centers and also supplemented the barges, particularly in the winter when frozen rivers halted that traffic. The main railway system of Yugoslavia is of standard European meter gauge. However, the line from Dubrovnik and Zelenika (opposite Kotor) through Sarajevo to Brod is narrow (76 centimeter) gauge.

The standard railway tank cars were 15 metric tons (112.5 barrels) in capacity, though some of them were of only 12 1/2 metric tons capacity. The tank cars on the narrow gauge railway line were of two sizes, seven metric tons and fifteen metric tons capacity. The Standard Vacuum Company owned 285 regular railway tank cars and the railway itself owned over 1,000. On the narrow gauge railway, there were approximately 50 tank cars, 15 of which were owned by the Standard-Vacuum of Croatia, Inc.

The Shell Company owned no tank cars but rented this type of equipment from a large Hungarian tank car company.

A transshipping point of importance was Vukovar, (Latitude 45° 20' N, Longitude 19° E) where pumping equipment, owned by the Standard-Vacuum of Croatia, was installed for transferring products from barges to tank cars. There was no storage tankage there, however.

4.5 STORAGE

Storage facilities, while quite adequate for the needs of the country, were small. The largest individual storage points were at the refineries. There were no large ocean terminals. As a consequence of the method of supply, i.e., by river to the refineries located in the northern part of the country, thence by river and rail to the points of local distribution, the ocean terminals on the Adriatic coast of Yugoslavia were few and small. They were not important receiving and distributing points but were used primarily as bulk plants for local distribution to other small ocean terminals lacking railway connections, fishing villages and nearby interior points.

The government of Yugoslavia made several unsuccessful attempts to induce the oil companies to build inland storage facilities in order to provide reserves of petroleum products in case of war. Failing in this, the government constructed a number of its own bulk storage plants, of varying capacities, throughout the country. These plants represented the most important and extensive inland storage facilities. They were reserved entirely for military and governmental use. Commercial bulk plants were very limited in both number and size.

4.6 RETAIL MARKETING

There were no modern gasoline service stations in the complete sense of the word. There were a few small drive-in type filling stations, but the needs of the country were largely served by curb pumps, having small underground tanks, located in front of shops and garages. They were supplied by tank truck or by drums. There were approximately 600 pumps in operation in the entire country before the war (a). Principal localities where such gasoline outlets are known to have existed prior to the war are listed below:

Adriatic Coastal Section	Danube or North-eastern Section	Upper Sava or North-western Section	The Central and Southern Area
Cetinje Dubrovnik Crikvenica Dugiraj Gospic Imotski Kotor Livno Mostar Podgorica Split Sušak	Beograd Novi Sad Osijek Pančevo Ruma Sombor V. Bečkerek V. Kikinda Vinkovci Vukovar Vršac Zemun	Banjaluka Celje Darugar Karlovac Križevci Ljubljana Maribor Našice Novomesto Ptuj Slovenjgradec Varaždin Zagreb	Bitolj Kragujevac Leškovac Niš Sarajevo Skoplje

Much of the trade for all products was served by cases and drums. Cans and cases were manufactured locally by both the Shell Company and the Standard-Vacuum of Croatia Inc. Prior to the war the companies operating in Yugoslavia owned and used in the distribution of products approximately 150,000 steel drums of an average capacity of 150 kilograms (approximately 200 liters or 40 gallons) each. The army probably had an additional 20,000 drums of the same capacity. Most of these drums were manufactured in Germany. Some, however, were manufactured in the country, as follows:

(a) The Standard-Vacuum of Croatia, Inc. owned 42 drive-in stations and approximately 320 pumps.

STATISTICAL SUMMARY OF DATA ON OCEAN AND RIVER TERMINALS YUGOSLAVIA

x = Data Unknown

- = Not applicable

IDENTIFICATION OF PLACE AND PLANT	Identification of Place	Place	Dubrovnik	Split	Vibinek	Dužak (Port Baroš)												
		Location: Lat... Long..	42° 39' N 16° 3' E	43° 31' N 16° 26' E	42° 44' N 15° 53' E	45° 20' N 14° 26' E												
	Identification of Plant	Name	Shell Dubrovnik (a)	Shell Split (c)	x	x												
		Location	On Umbla Inlet, north of Dubrovnik (Gruz)	North shore of Solin Bay	South side of harbor (i)	At base of mole												
		Owner	Jugoslavensko Shell D.D.	Jugoslavensko Shell D.D.	Government	x												
	Nature	Small ocean terminal and can and case factory (b)	Small ocean terminal, mainly black oils.	Naval gas oil station	Creosote tanks													
SITUATION OF TANKS	Underground	x	x	x	x													
	Above-ground ...	Above-ground	x	x	Above-ground													
TYPES OF TANKS		Normal steel cylindrical vertical.	Normal steel cylindrical vertical	x	x													
CAPACITY OF STORAGE TANKS	Black	Number ...	2	5	5	4												
		M ³	1,425 (c)	11,180	500	2,000												
		Barrels ..	8,977	70,434	3,150	12,600												
	White	Number ...	7	2	-	-												
		M ³	3,389	120	-	-												
		Barrels ..	21,352	756	-	-												
	Total Plant	Number ...	9	7	5	4 (k)												
		M ³	4,814	11,300	500 (j)	2,000												
		Barrels ..	30,329	71,190	3,150	12,600												
Total Place	Number ...	9	7	5	4													
	M ³	4,814	11,300	500	2,000													
	Barrels ..	30,329	71,190	3,150	12,600													
STORAGE FOR CASED GOODS		Small	Small	x	x													
FIRE PROTECTION		x	x	x	x													
CAMOUFLAGE		x	x	x	x													
DAMAGE		x	x	x	x													
DESCRIPTION OF PUMPING EQUIPMENT		Electric from city mains	Electric pumps, 2 for each product (f)	x	x													
LOADING RACKS		None	Yes	No rail connection	x													
CASE & CAN PLANT		Yes	No	No	No													
SUPPLY		By rail from inland refineries.	x	x	x													
DISTRIBUTION		By rail and road and by small vessels.	x	x	x													
GENERAL DATA	Common Name of Berth		Shell Dubrovnik (d)	Shell Split	x	Port Baroš												
	Used by		Royal Dutch Shell group	Royal Dutch Shell group	Naval vessels	All												
	Length of Berth		x	x	x	x												
	Width of Berth		x	x	x	x												
	Fresh water supply at dock?		x	x	x	x												
	Ships Accommodated:																	
	Maximum length of vessel in feet.		460	Unlimited (g)	x	x												
	Maximum beam of vessel in feet...		Unlimited	Unlimited	x	x												
Maximum draft of vessel in feet..		16 (orr Jetty is 23 feet)	27' 6"	x	x													
DWT accommodated		x	x	x	x													
DISCHARGE DATA	Products:		Kerosine	Gasoline	Lube Oil	Fuel Oil	Diesel	Kerosine	Gasoline	Lube Oil	Fuel Oil	Diesel	Kerosine	Gasoline	Lube Oil	Fuel Oil	Diesel	
	PIPE LINES	Number of pipe lines	1						1(h)									
		Length of pipe lines: meters'.....	x						220									
			feet	x						x								
		Diameter of pipe lines: inches	8	UNKNOWN					8	UNKNOWN								
		Pressure allowed in pounds	125atm						130									
	Discharge rate, long tons per hour .		x						150-									
	Side or stern discharge		x						x					x				
	Steam		Ship's						Ship's					x				
	PORT PARTICULARS																	
	Tugs required docking		x						x					x				
	Tugs required undocking		x						x					x				
	Bottom		x						x					x				
	REMARKS (a) Supplied by small ocean tankers. (b) Mainly for distribution of kerosine. (c) Gas oil (d) Vessel lies alongside the head of a short jetty 23 feet wide and is moored to shore bollards with one anchor down ahead and a stern rope to a mooring buoy. See plan on page 52. (e) Supplied by small ocean tanker and rail. (f) Electric power from city mains. (g) Vessels moor side on. They use their own ropes and one anchor down in mooring alongside the jetty dolphins. (h) An alternative pipe line was planned in 1939 but it is not certain whether it was actually laid. Plan of this projected line is shown on plan on page . (Plate 6) (i) Close to the Motor Torpedo Boat base on SW side of the Mandolina Isthmus. (j) In some bay there was formerly one 100 M ³ lighter and some oil barges, total capacity 2,500 M ³ . (k) Normally used for creosote, but presently might be used for fuel oil.																	

Zagreb: Hinko Meyer and Company
Annual production: 20,000 one-tripper drums.
Brod: Standard-Vacuum Oil Company of Yugoslavia
Annual production: 30,000 one-tripper drums.
Ljubljana: The "Saturnis" factory, production unknown.

4.7 STRATEGIC CONSIDERATIONS

Petroleum storage facilities are of course essential to the enemy's military and civil operations. Refineries cannot operate satisfactorily without adequate storage for crude oil, intermediate and finished products. Bulk storage at major transshipping and distributing centers is also important, and if destroyed the supplying of vital areas is greatly hampered.

Oil storage has not proven an exceptionally good target for aerial bombardment since it is seldom that any one plant is destroyed in its entirety and much of the damage is of a type that can be repaired or replaced comparatively easily. Storage in Yugoslavia furthermore, presents a highly dispersed target since most of the units are small and no great concentration exists in any one area.

Owing to the inflammable nature of the contents, oil storage is susceptible to sabotage, though not to the extent that is commonly supposed. It is usually necessary to let the contents of a tank run to waste in the open before they can be fired. Larger tanks usually have a water seal which has to be drawn off first, thus increasing the difficulties. With the possible exception of operating refinery units extensive results from sabotage can hardly be expected. Acids or abrasives, properly introduced, are effective to a limited extent.

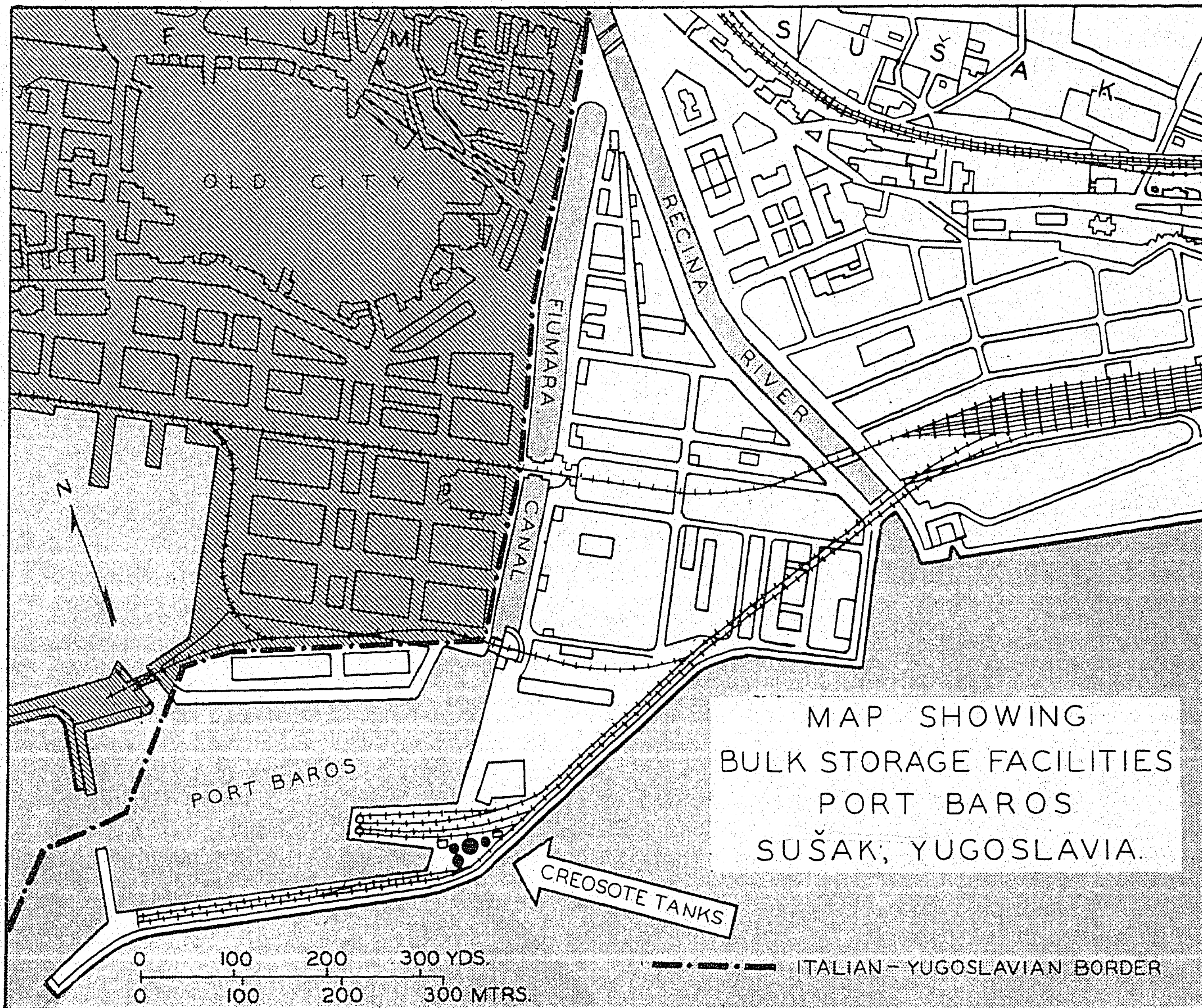
Transport, particularly in Yugoslavia which depends upon supplies from outside the country, and where the railroads and other transportation routes are somewhat limited, is the weakest link in the oil economy of the country. Transport, however, is both a difficult and highly dispersed target and successful operations do not generally result in permanent stoppage. Even temporary results, if recurring frequently enough, can have a serious effect on the enemy's operations.

As the enemy is forced to quit any area, it is to be expected that he will seriously damage or destroy all important petroleum facilities and remove all railroad rolling stock, automotive equipment, and marine or river transport units.

4.8 OCEAN TERMINALS

The seaboard petroleum facilities of Yugoslavia, located at several points on the Adriatic coast, are of comparatively limited size and importance. As a consequence of the method by which the Yugoslav market was supplied, i.e., from the refineries located inland and receiving their crude oil by river barge, the ocean terminals were not important bulk importing points.

They functioned primarily as bulk plants, receiving their supplies from the inland refineries and served as distributing points to local consumers, other smaller bulk plants and bunkering small coastal and fishing vessels. Terminal facilities on the Adriatic coast are located at the following points, reading downward from the Italian border in the northwest to the Albanian border in the southeast.



<u>Place</u>	<u>Total Storage</u>	
	<u>M³</u>	<u>Barrels</u>
Sušak	2,000	12,600
Sibinik	500	3,150
Split	12,325	77,648
Dubrovnik	5,070	31,938
Kotor Area	11,820	74,466
Total	31,715	199,802

Layout plans for the individual plants are given, when available, with tankage capacities for black and white products listed separately. Allocations of tankage to products is on the basis of pre-war operating information. Since such allocations are not necessarily permanent classification, and reallocation can usually be effected without great difficulty, it is quite possible that the tanks have since been used to store other products.

4.8.1 Sušak (Port Baroš)

This is the Yugoslavian port adjacent to the Italian port of Fiume and actually a part of the same harbor. A location sketch is given on page 47.

The only bulk tankage here are the four tanks on the base of the Port Baroš mole. These tanks, having a total capacity of approximately 2,000 cubic meters or 12,600 barrels were originally designed to store creosote for use as timber coating, but they might be used for fuel oil.

However, on the Italian side of the line in Fiume there are terminal facilities and extensive tankage at the "Romsa" refinery. This refinery has some 60 tanks with a total capacity of 66,077 M³ or 409,985 barrels and is described in more detail in the report on "The Petroleum Facilities in Italy". A map of Fiume showing the location of the Romsa refinery is shown on page 49.

4.8.2 Šibenik

The only known storage plant at Šibenik is the naval gas oil station belonging to the government, with a total capacity of 500 M³ (3,150 barrels). This plant consists of five tanks located on the south side of the harbor close to the Motor Torpedo Boat base on the southwest side of the Mandelina Isthmus. Apparently this plant has no rail connection, but no layout plan or other details are available.

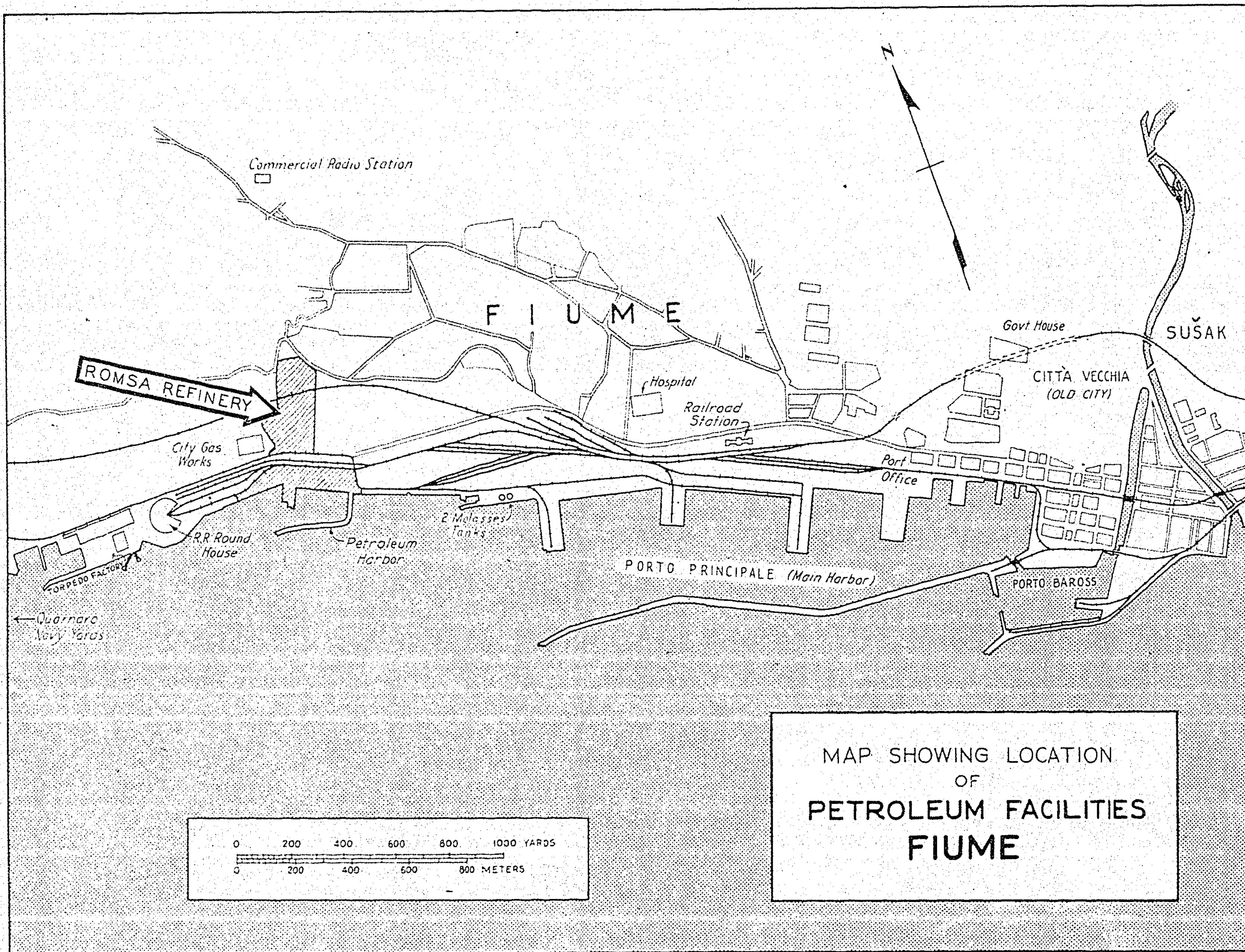
Formerly a number of oil barges were employed in this harbor for the transport and storage of petroleum products. Their total capacity was estimated at 2,500 M³ (15,750 barrels).

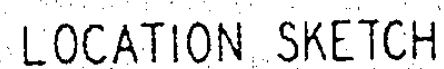
While one source reported 9,154 tons (approximately 68,655 barrels) total storage capacity at Šibenik there is no confirmation of these figures and it is believed to be in error.

4.8.3 Split

The only terminal in Split is that of the Shell Company located on the northern shore of Solin Bay. A plant layout plan and location sketch is given on page 50. It is the most important of the Yugoslav ocean terminals and can accommodate vessels with drafts up to 27 feet, 6 inches.

This terminal was designed to receive crude oil tankers as an alternative





NO.	PRODUKT	Ø m	H m	KAPAZITÄT m³	NO.	PRODUCT	Ø FT.	H FT.	CAPACITY BBLs.
I	MILIT HEIZÖL	24.00	12.80	5500	I	MILITARY FUEL OIL	78.72	41.98	34,650
II	ROHÖL	24.00	12.80	5500	II	CRUDE OIL	78.72	41.98	34,650
III	GASÖL - STEUER BEZAHLT	3.80	5.70	60	III	GAS OIL - DUTY PAID	12.46	18.69	378
IV	GASÖL - STEUER BEZAHLT	3.80	5.70	60	IV	GAS OIL - DUTY PAID	12.46	18.69	378
V	PETROLEUM - STEUER BEZAHLT	3.80	5.70	60	V	KEROSINE - DUTY PAID	12.46	18.69	378
VI	BENZALKO - STEUERFREI	3.80	5.70	60	VI	BENZALKO - DUTY FREE	12.46	18.69	378
VII	GASÖL - STEUER BEZAHLT	3.80	5.70	60	VII	GAS OIL - DUTY PAID	12.46	18.69	378
VIII	PETROLEUM, BENZIN, GASÖL	3 x 1.20	1.20	4	VIII	KEROSINE, GASOLINE, GAS OIL	9.84 x 3.94	3.94	25.2
IX	FISCHERPETROL	0.85	1.30	0.70	IX	FISCHERPETROL	2.78	4.26	4.4
							TOTAL		

TOTAL 71,219.6

1 DWELLINGS
2 WAREHOUSE & FILLING ROOM
3 MACHINE HOUSE & GARAGE
4 OFFICE BUILDING
5 WAREHOUSE FOR OILS
FREE OF CONSUMERS
AND EXCISE TAXES

method of supplying the Shell refinery at Caprag when transportation on the Danube and Sava river route was shut down by freezing or low water.

It was seldom used for this purpose, however, since during the winter season when the rivers are frozen the railway line is usually blocked by snow in the mountains.

The major activity of the terminal was the serving of the local coastal trade and it normally was supplied by railway tank car. There is a railway siding with facilities for handling about 12 tank cars. The railway connects with the Beograd-Zagreb mainline at Sisak.

Tankage.- The detail of tankage is as follows:

Tank Number	Diameter (Meters)	Height (Meters)	Capacity M3	Capacity (Barrels)	Product
1	24	12.8	6,000	37,800	Fuel or crude oil
2	24	12.8	6,000	37,800	Gas oil
3	3.8	5.7	65	409	Gas oil
4	3.8	5.7	65	409	Gas oil
5	3.8	5.7	65	409	Kerosine
6	3.8	5.7	65	409	Gasoline
7	3.8	5.7	65	409	Gas oil
	Total		12,325	77,645	

All these tanks are of the normal steel cylindrical vertical type.

Pipe lines.- One 8" black oil line to dock. Length 220 meters, an alternate line, as indicated on the plant layout plan was planned in 1939 but it is not certain if it was actually laid.

Pumps.- 6 pumps, two for each product. Power supplied from electric mains.

It is reported that this terminal was bombed in December, 1943, but details of damage are not available.

4.8.4 Dubrovnik

The only bulk storage was that of the Shell Company located on the Umbla inlet to the north of the town of Dubrovnik. A location sketch is given with the plant layout plan on page 52.

This plant is a small ocean terminal with a case and can factory and was mainly used for the distribution of kerosine. There is a jetty where small tankers with maximum draft of 18 feet could tie up. However, sixteen feet off the head of the jetty the depth of the water is 26 feet.

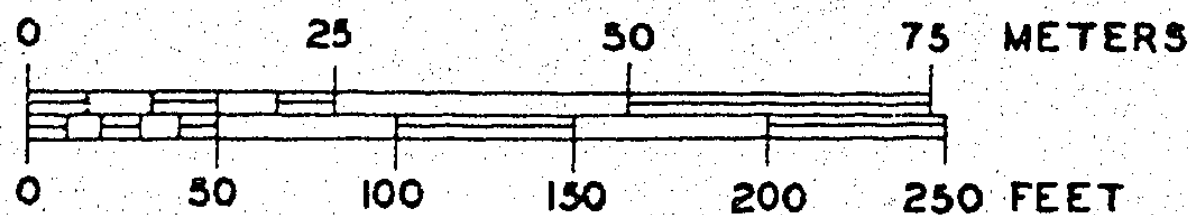
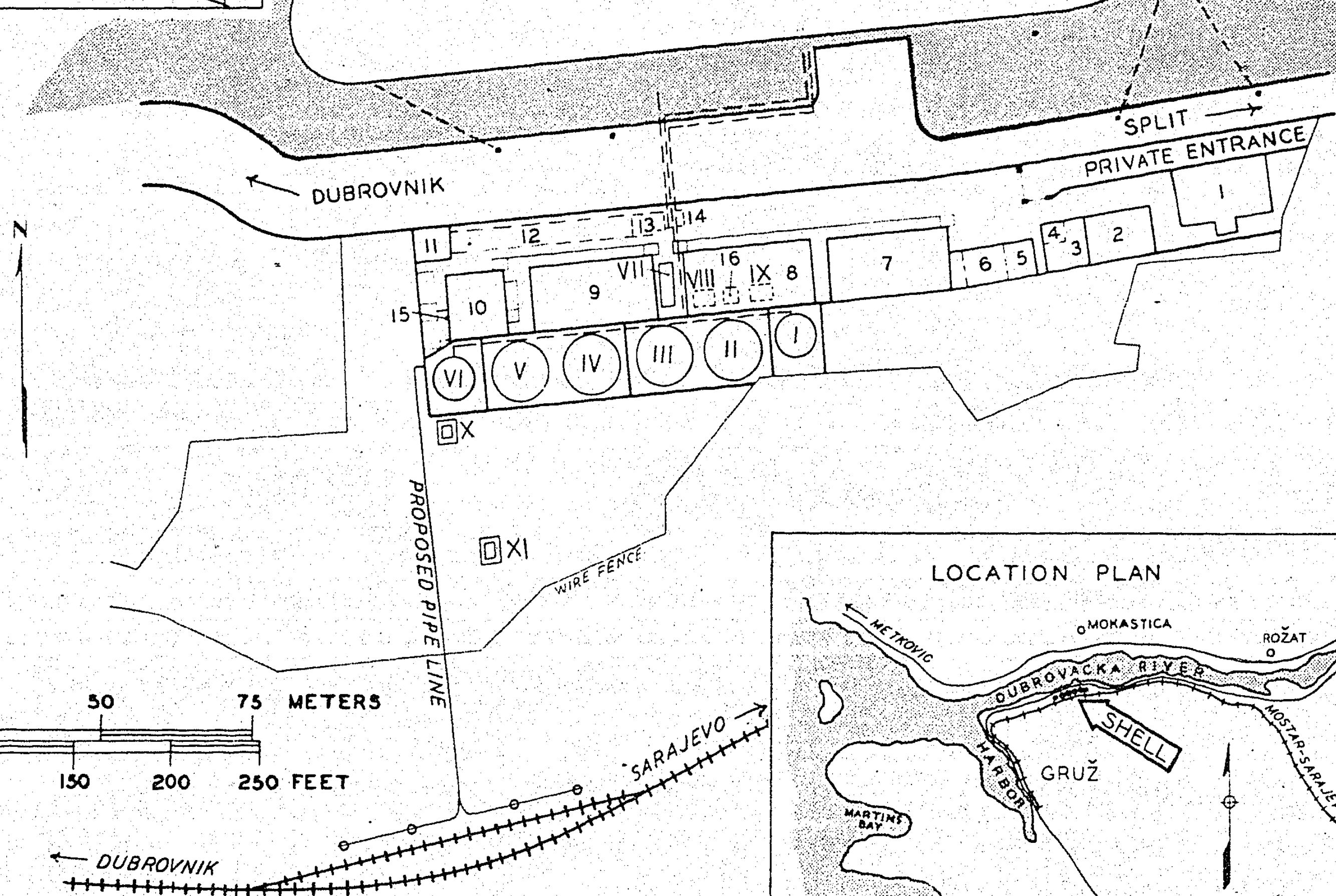
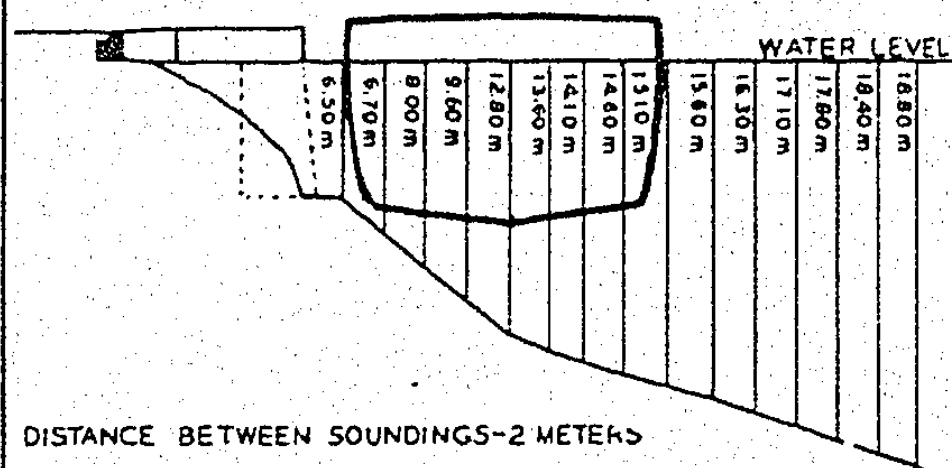
This plant normally was supplied by rail, but since it has no rail siding products had to be trucked from the railroad yards to the plant.

Products normally are distributed by road to the Dubrovnik area and to the nearby towns of Trebinje and Mostar. However, the narrow gauge railway, Brod to Dubrovnik (with a branch line to Zelenika located opposite Kotor), passes along the mountainside about 100 yards above the plant and a loading rack possibly could be installed by laying a short pipe line, with a pumping unit. A sketch showing such a line is shown on the plan on page 52. The primary difficulty is the lack of space on the mountainside to lay a railway siding.

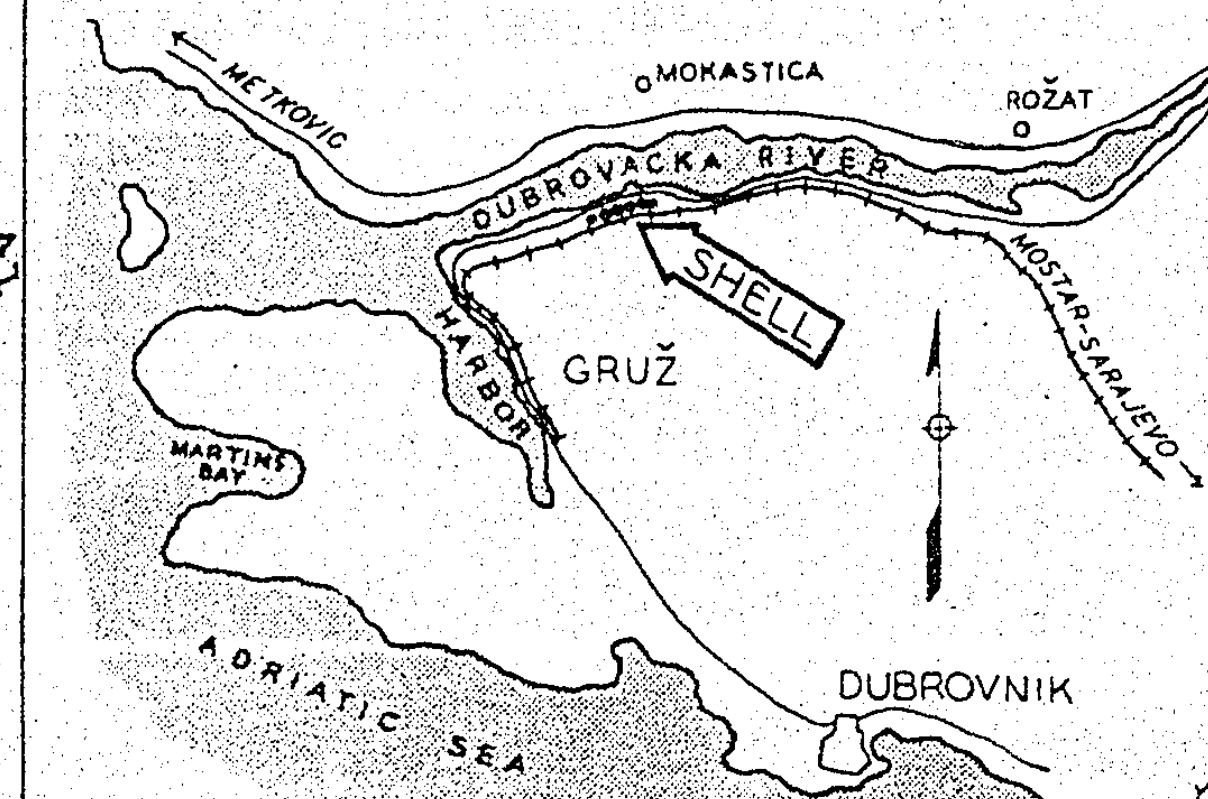
OCEAN TERMINAL JUGOSLOVENSKO SHELL D.D. DUBROVNIK (GRUŽ), YUGOSLAVIA

1934

DEPTH OF WATER AT JETTY



LOCATION PLAN



RESERVOIRE (RESERVOIR)

R ₁		R ₂		OBERIRDISCH R ₂ O (ABOVE-GROUND) UNTERIRDISCH R ₂ U (UNDER-GROUND)	R ₃			A × B
----------------	--	----------------	--	---	----------------	--	--	-------

BEZEICHN.	TYPE	Φ: a x b m	h: L ₁ m	L _m	OBERFLÄCHE m ²	KAPAZITÄT m ³	PRODUKT	DESIGNATION	TYPE	Φ: a x b m	h: L ₁ m	L _m	SURFACE (sq.m.)	GALS.	CAPACITY (cubic m.)	PRODUCT
I	R ₁	7.5	11.40		316	390	FISCH. PETROL.	I	R ₁	7.5	11.40		316	2992	475	?
II	R ₁	10.0	12.80		482	780	PETROLEUM	II	R ₁	10.0	12.80		482	5985	950	KEROSINE
III	R ₁	10.0	12.80		482	835	GASOL- ZOLLFREI	III	R ₁	10.0	12.80		482	5985	950	GAS OIL - DUTY FREE
IV	R ₁	10.0	12.80		482	780	PETROLEUM- ZOLLFREI	IV	R ₁	10.0	12.80		482	5985	950	KEROSINE DUTY FREE
V	R ₁	10.0	12.80		482	780	PETROLEUM- ZOLLFREI	V	R ₁	10.0	12.80		482	5985	950	KEROSINE - DUTY FREE
VI	R ₁	7.5	11.40		316	418	GASOL-STEUER BEZAHLT	VI	R ₁	7.5	11.40		316	2992	475	GAS OIL - DUTY PAID
VII	R ₂ O	2.5	10.00	10.730		33.5	BENZALKO- STEUERFREI	VII	R ₂ O	2.5	10.00	10.730		283	45	BENZALKO - DUTY FREE
VIII	R ₃	2.75 x 2	1.75			7	PETROLEUM	VIII	R ₁	2.75	1.75			53	8.5	KEROSINE
IX	R ₃	3 x 2	2.00			9	PETROLEUM	IX	R ₁	3 x 2	2.00			69	11	KEROSINE
X	R ₃	BETONRESERVOAR				19.5	MEERWASSER	X	R ₁	CONCRETE RESERVOIR				123	19.5	SEA WATER
XI	R ₃	BETONRESERVOAR				13	MEERWASSER	XI	R ₁	CONCRETE RESERVOIR				82	13	SEA WATER

TOTALS: 4032.5 4847

TOTALS: 30534 4847

LEGENDE

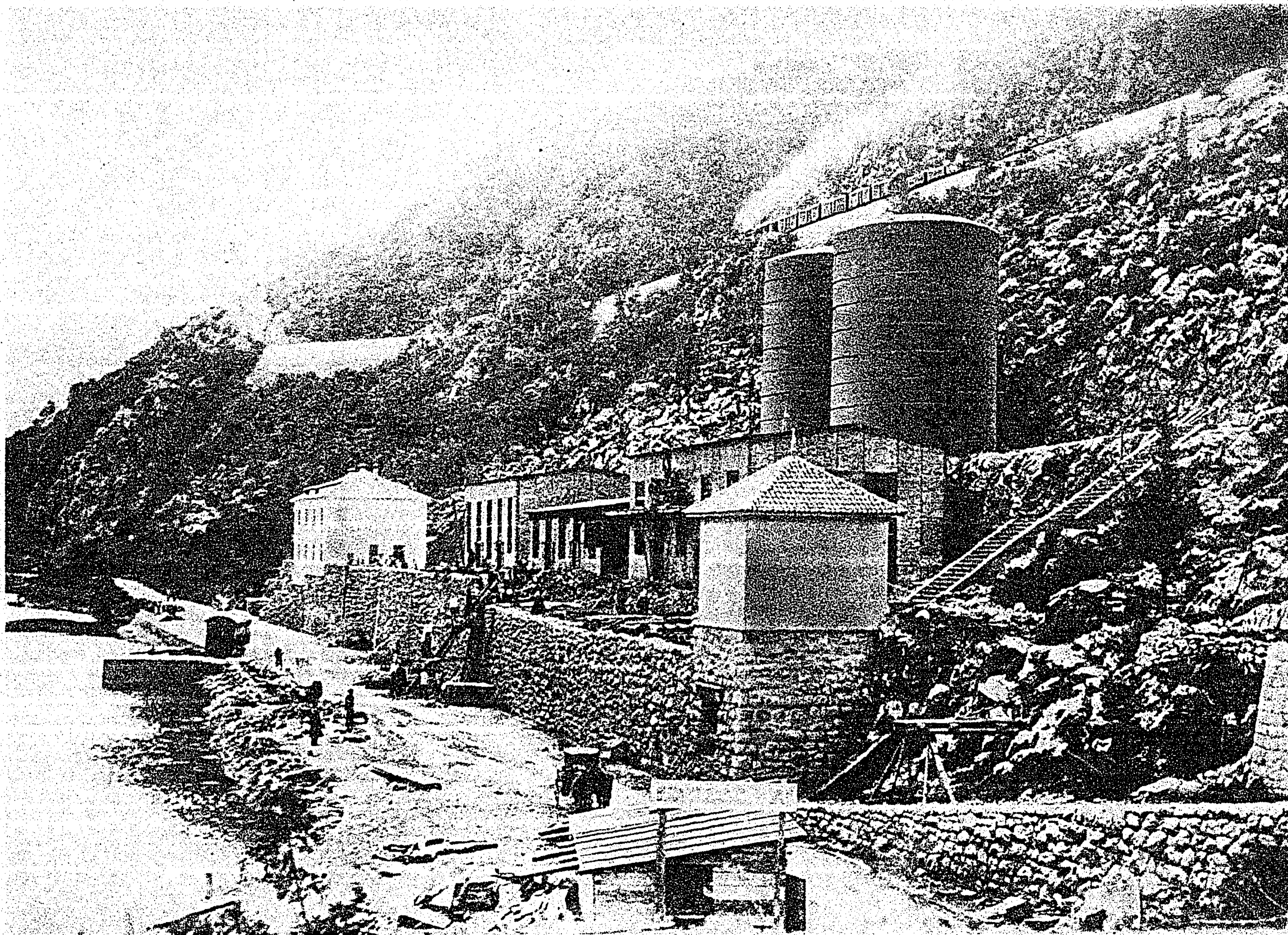
- 1 KANZLEI UND WOHNGEBÄUDE
- 2 MATERIALRAUM
- 3 ARBEITERSPEISERAUM
- 4 PORTIERAUM
- 5 MASCHINENRAUM
- 6 GARAGE F. 2 AUTOS
- 7 KANNENFABRIK
- 8 ABFÜLLHALLE
- 9 LAGERRAUM F. VOLLE BENZINFÄSSER
- 10 MAGAZIN FÜR STEUERFREI O.ELE
- 11 GEBÄUDE F. d. ELEKTR. AUFZUG
- 12 LAGER F. SCHMIEROELE
- 13 BETONRESERVOIR
- 14 PUMPENRAUM (f. M.W.P.)
- 15 ARBEITER CLO
- 16 PETROL, KANNEN-ABFÜLLAPPARAT

LEGEND

- 1 OFFICES & DWELLINGS
- 2 MATERIAL HOUSE
- 3 WORKMEN'S DINING ROOM
- 4 PORTER'S HOUSE
- 5 MACHINE SHOP
- 6 TWO-CAR GARAGE
- 7 CAN FACTORY
- 8 FILLING ROOM
- 9 CAN FACTORY
- 10 WAREHOUSE FOR DUTY-FREE OILS
- 11 TRANSFORMER HOUSE
- 12 STORAGE PLACE FOR LUBRICATING OILS
- 13 CONCRETE RESERVOIR
- 14 PUMP ROOM
- 15 WORKMEN'S LAVATORY
- 16 OIL CAN FILLING EQUIPMENT

DUBROVNIK (GRUŽ) YUGOSLAVIA
SHEET 2 OF 2

Y15



SHELL COMPANY OCEAN TERMINAL AT DUBROVNIK (GRUŽ)

Tankage. - The detail of tankage is as follows:

Tank Number	Diameter (Meters)	Height (Meters)	Capacity M ³	Capacity (Barrels)	Product
1	7.5	11.4	500	3,150	Kerosine
2	10	12.8	1,000	6,300	Kerosine
3	10	12.8	1,000	6,300	Gas oil
4	10	12.8	1,000	6,300	Kerosine
5	10	12.8	1,000	6,300	Kerosine
6	7.5	11.4	500	3,150	Gas oil
7	2.5	10	50	315	Motor spirit
8			8.5	54	Kerosine
9			11	69	Kerosine
Total			6,069.5	31,938	
10			19.5	123	Sea water
11			13	82	Sea water
Total			32.5	205	

Tanks 1 to 6 are of the normal, vertical, cylindrical, steel, type.

Pipe lines. - One 8 inch white products line to dock. One 8 inch black products line to dock.

Pumps. - Power is supplied from electric mains.

4.8.5 Kotor Area

There was no bulk storage in the town of Kotor itself, but the Yugoslav Government maintained small installation on four points in the harbors adjoining Kotor, as follows:

	Capacity M ³	Capacity (Barrels)
Lipci	9,400	59,220
Tivat	220	1,386
Kumbor Channel	2,000	12,600
" " (Djenovici)	200	1,260
Total	11,820	74,466

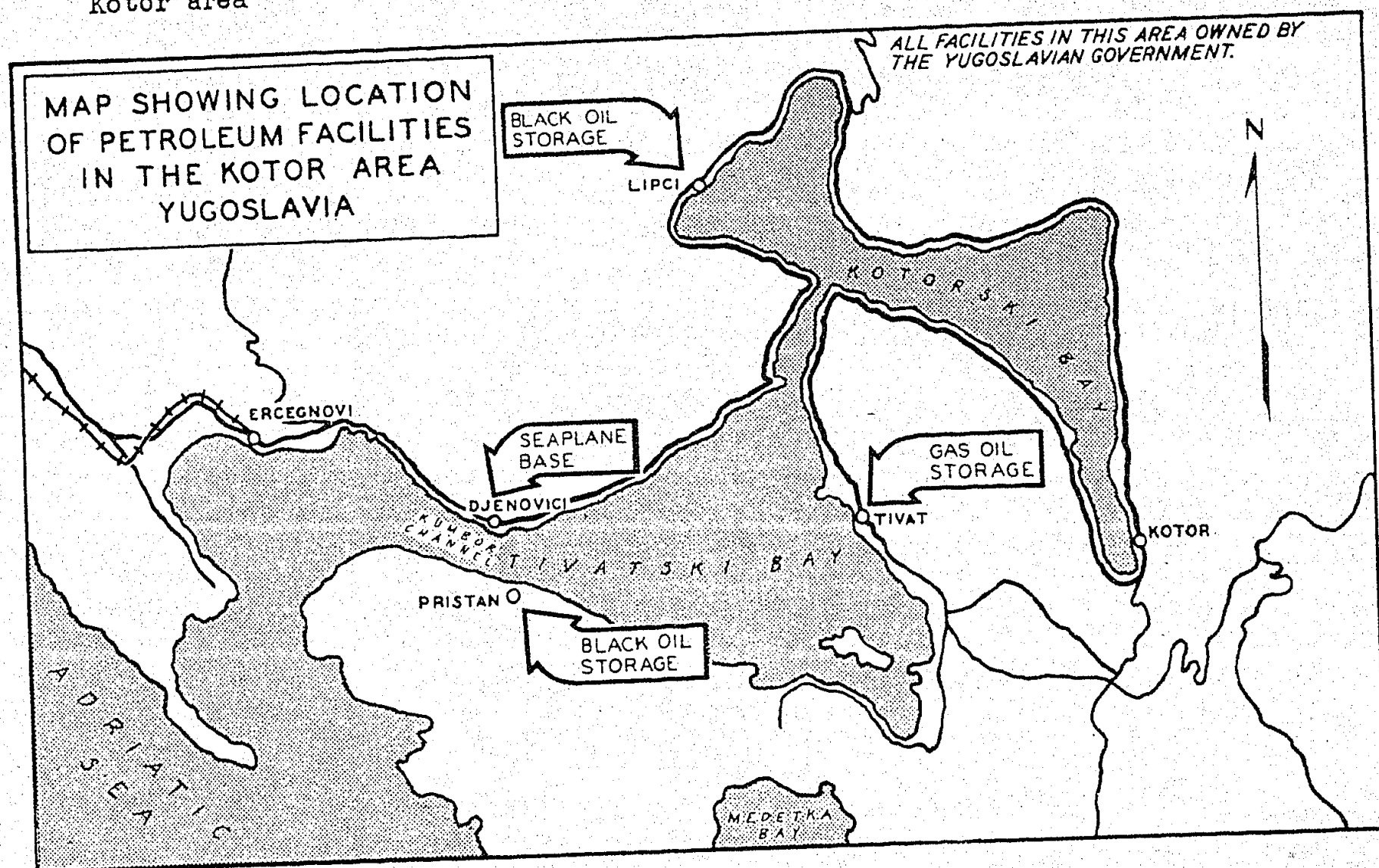
Locations of these storage plants are shown on the sketch of the area appearing on page 58. Known details concerning these plants are as follows:

Lipci. - Government black oil bunkering station.

Details of Tankage

	M ³	Barrels
4 tanks of 600 M ³ each, fuel oil -	2,400	15,120
5 tanks of 1,400 M ³ each, gas oil -	7,000	44,100
Total	9,400	59,220

Tanks are reported situated on concrete emplacements sunk 4 feet into the ground on the foreshore. The tanks are no longer clearly visible in air cover;



it is possible that they have been destroyed or that underground storage has been built.

Distribution was by barge or road, there being no rail connection. Two tanker barges were used for bunkering large vessels.

Tivat.- Government gas oil depot. There are four tanks of 55 M³ each for gas oil, totalling 220 M³ (1,386 barrels).

In former times one lighter, capacity 100 M³ (630 barrels), and two barges with a capacity of 600 M³ (3,780 barrels) each were based at Tivat.

Kumbor Channel.- Government owned.

There are reported to be four cylindrical tanks, capacity 500 M³ each, totalling 2,000 M³ (12,600 barrels), for fuel oil on the south side of the Channel between Spilica and Priština. The tanks are 200 yards apart, close to the water's edge. These tanks are not clearly visible in air cover and it is possible they have been destroyed.

The Djenovici seaplane base in Kumbor Channel, on the north side of this Channel, has at least two gasoline tanks, capacity about 100 M³ (630 barrels) each.

The tanker "Perun", 3,500 metric tons, formerly was based on the Kotor harbor and there were normally one tug and seven or eight oil lighters, capacity 250-300 metric tons each. Products for the Kotor area were transported by R.R. tank car to Zelenika, opposite Kotor. From there the transfer to storage points was effected in drums or by bulk barges.

4.8.6 Other Possible Storage

In addition to the Adriatic terminals described in this section of the report, the possible existence of other small tankage of undetermined localities along

x = Data Unknown

- = Not applicable

IDENTIFICATION OF PLACE AND PLANT	Identification of Place	Place	Kotor (Lipci)	Kotor (Tivat)	Kotor (Kumber Channel)	Kotor (Kumber Channel)												
		Location: Lat... Long...	42° 25' N 18° 47' E	42° 29' N 18° 42' E	42° 25' N 18° 37' E	42° 25' N 18° 37' E												
	Identification of Plant	Name	Lipci Bunkering Terminal (a)	Tivat (Gov't) Gas oil plant	Fristin Bunkering Terminal	Djenovici Seaplane Base												
		Location	Western shore of Morinski Bay	Eastern Shore of Tivat Bay	South side of Channel between Spilica and Fristina	North side of Channel												
		Owner	Government	Government	Government	Government												
	Nature	Ocean bunkering Terminal	Gas oil station	Ocean bunkering station	Seaplane base													
SITUATION OF TANKS	Underground	SITUATION OF TANKS		Underground	Situated on concrete emplacements. Bunk 4 feet into ground on foreshore	--	--	--										
		Above-ground ...	Above-ground		Above-ground	Above-ground	Above-ground	Above-ground										
	TYPES OF TANKS		(b)	Normal steel, cylindrical vertical	Normal steel cylindrical vertical	Normal steel cylindrical vertical	Normal steel cylindrical vertical											
	CAPACITY OF STORAGE TANKS	Black	Number ...	9	4 (f)	4 x 500 M ³ (fuel oil) (h)	-											
			M ³	9,400 (c)	320	2,000	-											
		Barrels ..	59,220	1,326	12,600	-												
			White	Number ...	-	-	-	2 (i)										
		M ³		-	-	-	200											
		Barrels ..	-	-	-	1,260												
			Total Plant	Number ...	9	4	4	2										
		M ³		9,400	320	2,000	200											
		Barrels ..	59,220	1,326	12,600	1,260												
			Total Place	Number ...	-	-	-	19										
		M ³		-	-	-	11,820											
		Barrels ..	-	-	-	74,460												
STORAGE FOR CASED GOODS		None	x	x	x													
FIRE PROTECTION		x	x	x	x													
CAMOUFLAGE		x	x	x	x													
DAMAGE		x	x	x	x													
DESCRIPTION OF PUMPING EQUIPMENT			x	x	x													
LOADING RACKS		No rail connection	x	x	x													
CASE & CAN PLANT		No	No	No	No													
SUPPLY		No rail connection	x	x	x													
DISTRIBUTION		By barges.																
COMMON NAME OF BERTH	Common Name of Berth		Lipci One-a Jetty built of stone (a)	Tivat (g)	Fristin	Djenovici												
	Used by		Government	Government	Government	Government												
	Length of Berth		x	x	x	x												
	Width of Berth		x	x	x	x												
	Fresh water supply at dock?		x	x	x	x												
	Ships Accommodated:																	
	Maximum length of vessel in feet.		x	x	x	x												
	Maximum beam of vessel in feet...		x	x	x	x												
Maximum draft of vessel in feet..		16	x	x	x													
DWT accommodated			x	x	x													
DISCHARGE DATA	DISCHARGE DATA		Kerosine	Gasoline	Lube Oil	Fuel Oil	Diesel	Kerosine	Gasoline	Lube Oil	Fuel Oil	Diesel	Kerosine	Gasoline	Lube Oil	Fuel Oil	Diesel	
	Products:																	
	PIPE LINES	Number of pipe lines																
		Length of pipe lines: meters																
			feet															
		Diameter of pipe lines: inches																
		Pressure allowed in pounds																
	Discharge rate, long tons per hour ..																	
	Side or stern discharge		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
	Steam		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
	PORT PARTICULARS																	
	Tugs required docking		(e)	(e)	(e)	(e)												
Tugs required undocking		x	x	x	x													
Bottom		x	x	x	x													
REMARKS	(a) Supplied small tankers. (b) Tanks no longer visible from air cover. Possibly removed or underground storage built. (c) Gas oil= 5 tanks x 1400 M ³ . Fuel oil= 4 x 600 M ³ . (d) Lipci: barges were used to bunker large vessels. (e) The tanker, Perun, 3,600 metric tons, formerly was used on Kotor harbor with one tug and 7 or 8 lighter barges, capacity 250-300 metric tons each, for general service in the Kotor area. (f) Four of 33 M ³ each, used for gas oil. (g) Tivat: There were 1 lighter, capacity 100 M ³ , and 2 barges, capacity 600 M ³ each. (h) Tanks are 200 yards apart close to water's edge. Presently not clearly visible in air cover and may have been destroyed. (i) Of 100 M ³ capacity each. Used for aviation gasoline.																	

the coast is reported. However, the aggregate would approximate only 1,200 (7,560 barrels) and confirmation is lacking.

Mention should be made of the small Italian island of Zara on the coast of Yugoslavia, latitude 44°07'N, longitude 15°14'E, where gasoline and oil is believed to be stored at the head, or southeast end, of the port and gas and oil pumps are reported at the seaplane base at the entrance to Valle di Pola.

4.9 INLAND STORAGE FACILITIES

Storage tankage at the refineries has been described in the refining section of this report. Except for their river bulk plants at Beograd and Zagreb the petroleum companies had very little inland storage. The local market was so small that extensive facilities were not justified. Distributors and consumers were, in most cases, supplied by shipments direct from the refineries or by the few river or coastal bulk installations. Shipments in bulk were made by auto truck, barge, and railroad tank car. Also, a considerable portion of the trade was supplied by products shipped in drums.

The largest inland bulk storage capacity was represented by the government tankage for military purposes located at numerous points throughout the country. While no layout plans or other details are available, a fairly accurate list of locations and capacities for these plants is contained in the statistical summary of storage facilities on page 62.

4.9.1 Beograd - Ćukarica - Shell Company Bulk Plant

The most important commercial inland plant was that of the Shell Company located on the Sava River at Ćukarica, a suburb of Beograd. This plant was equipped to receive and ship products both by river and railways. It contained a small tin and case factory. A layout plan appears on page 64.

Details of Tankage

Tank Number	Diameter (Meters)	Height (Meters)	M ³	Barrels	Product
A	7	6.7	240	1,512	Gas Oil
B	9	8	485	3,055	Gas Oil
C	9	8	485	3,055	Gas Oil
D	9	8	485	3,055	Gasoline
E	15	11.4	1,910	12,033	Kerosine
F	12	9	970	6,111	Gasoline
G	9	8	485	3,055	Gasoline
H	18	11	2,660	16,752	Gasoline
I-R	15 small tanks		317	2,044	Miscellaneous
Total			8,037	50,673	

The main tanks are of the normal steel cylindrical type and surrounded by low fire walls. There is also a small water tank, capacity 6 M³ (39 barrels).

Pipe lines. - 2 lines (1 for white oil, 1 for black products) to jetty.

Pumps. - Electric, powered by steam driven dynamo.

4.9.2 Dravograd Shell Company Bulk Plant

This plant, formerly a very small independent refinery, was bought out or leased by the Shell Company, who curtailed the refinery operations but continued

to use the storage facilities. Total storage capacity was only 767 M³ (4,832 barrels). A layout plan is given on page 66.

4.9.3 Zagreb

Besides the bulk plants of the major oil companies, small bulk tankage was owned by Hinko Meyer and the Arko Alcohol Company. The former operated a local oil jobbing business while the latter manufactured and stored commercial alcohol of the type that was mixed with gasoline to comply with government regulations. Layout plans of the "Astra" Shell and Standard-Vacuum plants are shown on pages 67, 68 and 71.

STATISTICAL SUMMARY OF DATA: STORAGE FACILITIES, YUGOSLAVIA

x = Data Unknown

- = Not available

* = Capacities estimated

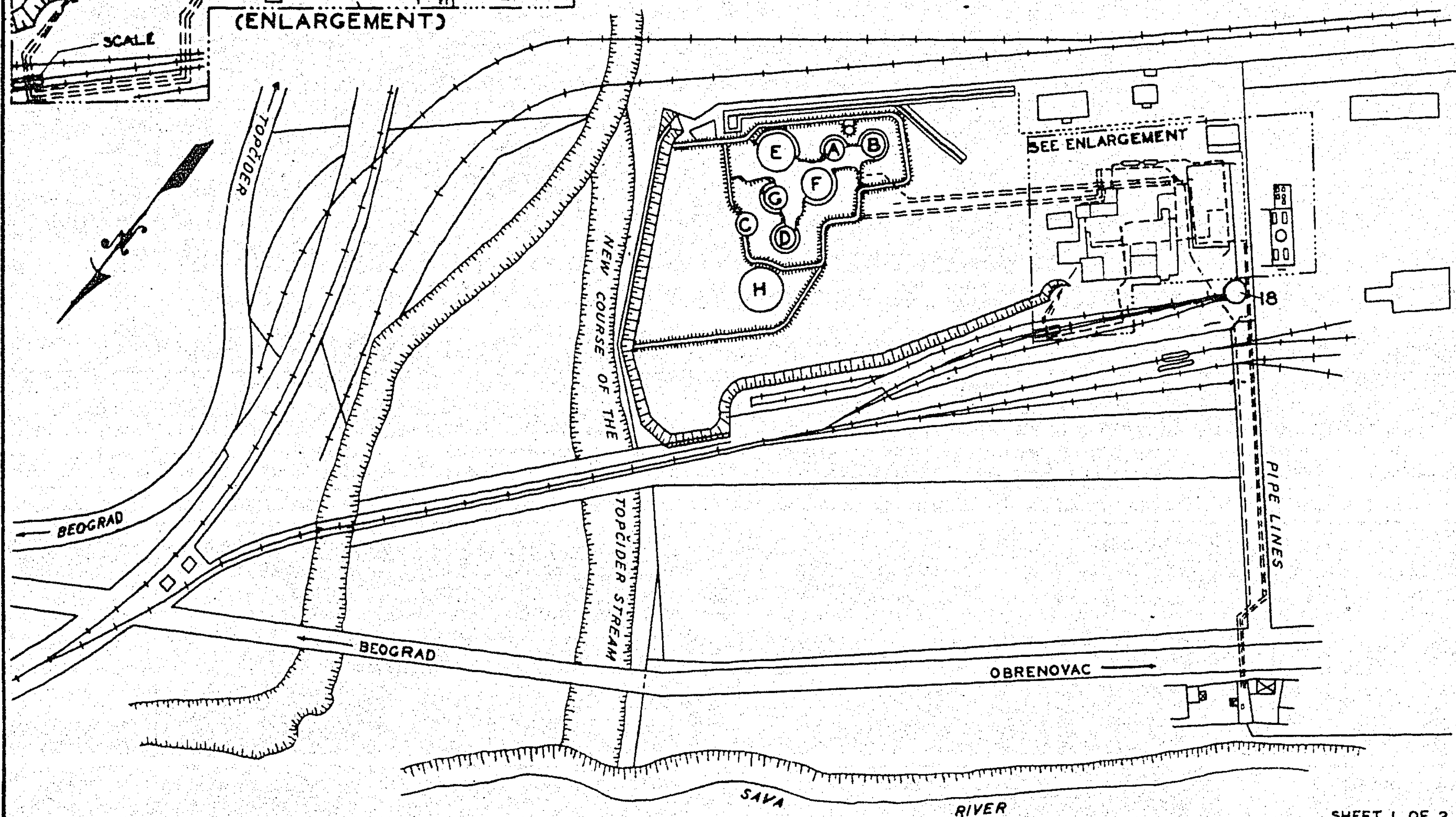
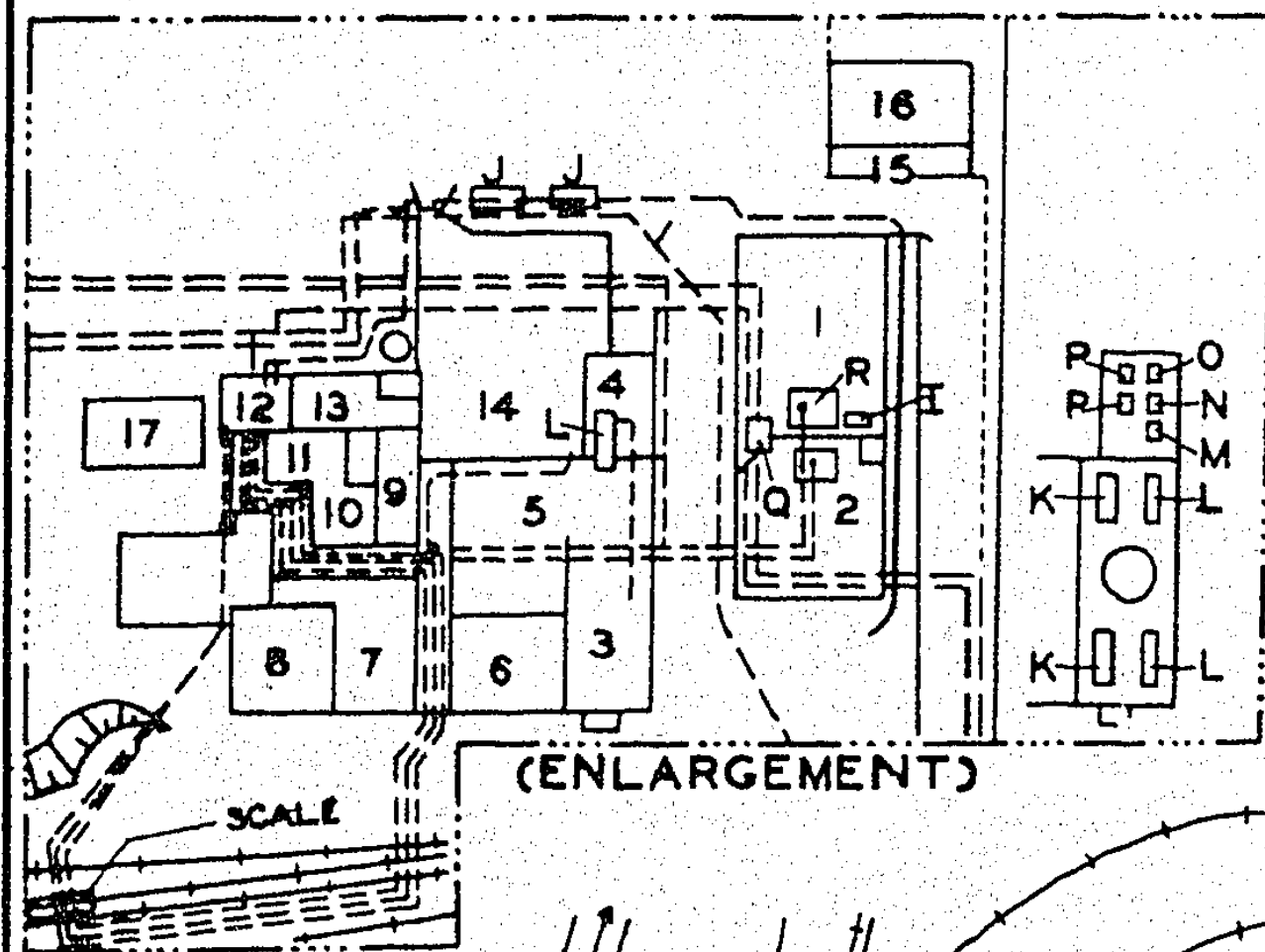
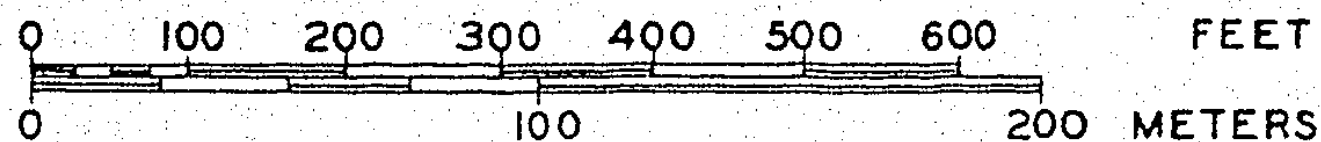
IDENTIFICATION OF PLACES			IDENTIFICATION OF PLANTS		SITUATION OF STORAGE TANKS		CAPACITY OF STORAGE TANKS								REMARKS
Places	Locations on Index Map		Owners of Plants	Location of Plants	Above-ground	Under-ground	Black		White		Total Plant		Total Place		
	Lat. N	Long. E					M ³	Barrels	M ³	Barrels	M ³	Barrels	M ³	Barrels	
REFINERIES (a)															
Brod	45 9	18 1	Standard Vacuum	Western end of town of Bosanski-Brod on Sava River, approx. 156 miles above Beograd.	18		27,732	174,712	17,000	107,100	44,732	281,812	44,732	281,812	Refinery working, tanks not included. Allocation of tankage to products is approximate.
Caprag	45 29	16 22	Jugoslovensko Shell	On north side of Kupa River across railway bridge from Sisak just above junction of Kupa and Sava Rivers	21		30,700	193,410	-	-	-	-	-	-	
					13		-	-	13,780	86,814	44,480	280,224	44,480	280,224	
Dravograd	46 36	15 2	Dravograd Rafinerija Mineralnog Ulja-Goli		4	1	637	4,013	-	-	-	-	-	-	Leased or bought by the Shell Co., who limited refining activity and used it primarily as a bulk plant.
					3	2	-	-	130	819	767	4,832	767	4,832	
Osijek	45 34	16 42	Ipoli d.d.	Southern section of city of Osijek	13		x	x	x	x	10,000*	63,000*	10,000*	63,000*	Possibly more than 13 tanks, no details available.
Smederevo	44 39	20 57	Sumadiska Kreditna Banka	South side of Danube River below Beograd			x	x	x	x	x	x	x	x	Refinery reported under construction, but no details available. Reported damaged and as of June 1943 not yet working.
OCEAN TERMINALS															
Dubrovnik (Grat)	42 39	18 9	Jugoslovensko Shell	On Umbla inlet on north side of Grad (Dubrovnik)	2		1,425	8,977	-	-	-	-	-	-	Also 2 cement water tanks with total capacity of 205 barrels.
					7		-	-	3,339	21,352	4,614	30,323	4,614	30,323	
Kotor	42 25	18 37	Yugoslav Government	Djenovici seaplane base, north side of Kumbor Channel	2		-	-	200*	1,260*	200*	1,260*	-	-	No storage located at Kotor proper.
Kumbor Channel	42 25	18 37	"	Between Spilica and Pristan on south side of Kumbor Channel	4		2,000	12,600	-	-	2,000	12,600	-	-	May have been destroyed
Lipci	42 25	16 47	"	West side of Morinski Bay	9		9,400	59,220	-	-	9,400	59,220	-	-	Black oil bunkering station
Tivat	42 29	18 42	"	East side of Tivat Bay	4		220	1,386	-	-	220	1,386	11,820	74,466	Gas oil depot
Sibenik	43 44	15 53	Yugoslav Government	South side of harbor close to Naval Torpedo Boat Base S.W. side of Mandolina Isthmus	5		500*	3,150*	-	-	500*	3,150*	500*	3,150*	Naval gas oil station. Unconfirmed sources report 9,154 M ³ total storage here, but no details are available.
Split (Solina)	43 31	16 26	Jugoslovensko Shell	On Bay, north of Split	5		11,180	70,434	120	756	11,300	71,190	11,300	71,190	Also small mixing or dispensing tanks, 30 barrels capacity. Reported bombed in Dec. 1943, but details of damage not available.
Sušak	45 20	14 26	Unknown	At base of mole, Fort Baroš	4		2,000*	12,600*	-	-	2,000*	12,600*	2,000*	12,600*	Normally used to store creosote but could be used for fuel oil.
INLAND BULK TANKS															
Bela Crkva	44 54	21 24	Yugoslav Government			3 (a)	-	-	110	693	110	693	110	693	
Čukarica	44 49	20 29	Jugoslovensko Shell	Čukarica, suburb of Beograd, on Sava River just above Trgovačka Bridge.	3		1,210	7,623	-	-	-	-	-	-	Can receive supplies both by rail and by river barge. 16 small miscellaneous tanks with 322 M ³ total capacity not included.
					5		-	-	6,510	41,013	7,720	48,626	-	-	
Čemun	44 51	20 26	Jugoslovensko Shell	Čemun, suburb of Beograd, north of Sava River.		2	-	-	60	304	60	304	-	-	Aviation gasoline storage at air port.
			Yugoslav Government	Ibid.	10		-	-	500	3,150	500	3,150	8,300	52,290	Aviation gasoline storage plant with both river and rail connections. May now have additional underground storage.
Brđani	43 59	20 26	Yugoslav Government		5		-	-	7,000	44,100	7,000	44,100	7,000	44,100	Also has a tetra-ethyl-lead blending plant for aviation gasoline.
Kragujevac	44 1	20 56	Yugoslav Government				-	-	500*	3,150*	500*	3,150*	500*	3,150	
Kraljevo	43 43	20 42	Yugoslav Government		3 (b)		-	-	150	945	150	945	150	945	
Kruševac	43 34	21 20	Yugoslav Government			3 (b)	-	-	45	284	45	284	45	284	

Ljubljana	46 3	14 32	Standard-Vacuum	Near H.M. freight station	2	-	-	98	620	98	620	-	-	
			Yugoslav Government		1(b)	-	-	13	53	10	53	105	553	
			Jugoslavensko Shell	Airport		x	x	x	x	x	x	x	x	Small aviation gasoline tankage underground. Details not available.
Lopatnica	43 33	20 22	Yugoslav Government		5(b)	-	-	7,000	44,100	7,000	44,100	7,000	44,100	Also has an Ethyl blending plant for aviation gasoline.
Mostar	43 20	17 49	Yugoslav Government		6(b)	-	-	300	1,890	300	1,890	300	1,890	Aviation gasoline storage.
Nis	43 19	21 54	Yugoslav Government		1(b)	-	-	5	32	5	32	5	32	
Novi Sad	45 16	19 50	Standard-Vacuum	Piroski drum 104 and 105	4	-	-	160	1,008	160	1,008	-	-	
			Yugoslav Government		3(b)	-	-	450	2,835	450	2,835	610	3,543	
Petok	44 18	16 53	Yugoslav Government			-	-	1,200	7,560	1,200	7,560	1,200	7,560	Location somewhat uncertain. Some sources refer to it as Lima-Petok.
Sarajevo	43 52	18 26	Standard-Vacuum		2	-	-	60	378	60	378	-	-	
			Jugoslavensko Shell	2 1/2 miles from town on road to Mostar	3	-	-	20	126	20	126	-	-	
			Yugoslav Government		14(b)	-	-	525	3,325	525	3,325	602	3,820	
Skoplje	42 0	21 25	Yugoslav Government		11	-	-	620	3,906	620	3,906	620	3,906	Shell has small underground tanks at airport. Details not available.
Strazarevo	44 39	20 57	Yugoslav Government		1	2,500	15,750	2,500	15,750	2,500	15,750	2,500	15,750	
Trebigne	42 43	12 22	Yugoslav Government		1(b)	-	-	3	19	3	19	3	19	
Velje	45 20	15 5	Yugoslav Government		5	-	-	7,000	44,100	7,000	44,100	7,000	44,100	
Veliki Beckerek	45 24	23 25	Astra d. d.	On Tamiš River		x	x	x	x	500*	3,150*	500*	3,150*	
Vitanovac	43 44	20 45	Yugoslav Government		5	-	-	7,000	44,100	7,000	44,100	7,000	44,100	Also has Ethyl blending plant for aviation gasoline.
Vrdnik	45 7	19 49	Yugoslav Government		3(b)	-	-	450	2,835	450	2,835	450	2,835	Aviation gasoline storage (4500 tons under construction in 1939)
Zabrenje	44 34	25 8	Yugoslav Government	13 miles SE of Beograd where railway crosses Sava River	1	-	-	2,500	15,750	2,500	15,750	2,500	15,750	
Zagreb	45 48	16 58	Arko Alcohol Co.			-	-	557*	3,598*	557*	3,598*	-	-	Bulk storage for commercial alcohol.
			Hinko Meyer			-	-	238*	1,500*	238*	1,500*	-	-	Independent jobbers.
			Jugoslavensko Shell	Radnicka 47	2	1	-	102	641	102	641	-	-	Shell also had small underground tankage at airport for aviation gasoline.
			Standard-Vacuum	1 mile east of main RS station south of Zagreb-Beograd RS line tracks	1	3	-	571	4,325	571	4,325	-	-	
			Yugoslav Government		11(b)	-	-	620	3,906	620	3,906	-	-	
(Vrapče)	45 39	15 58	Astra d. d.	Vrapče, a suburb on the west of Zagreb	11	-	-	370	2,331	370	2,331	2,500	16,291	Some of this tankage may have been used for black oils.

(a) Latitudes and longitudes taken from Index-Gazetteer to "The Times" Survey Atlas of the World, London, 1928; edited by John Bartholomew, The Edinburgh Geographical Institute, except those marked * which are approximated. (b) Probable location of tanks.

RIVER BULK TERMINAL JUGOSLOVENSKO SHELL D. D. ČUKARIKA, YUGOSLAVIA.

1934



RESERVOIRE (RESERVOIR)

R ₁		R ₂		OBERIRDISCH LABOVE-GROUND UNTERIRDISCH (UNDER-GROUND)		R ₃		A × B									
BEZEICHN.	TYPE	Ø: a x b m	H: L ₁ m	L _m	OBERFLÄCHE m ²	KAPAZITÄT IN TONNEN	KAPAZITÄT m ³	PRODUKT	DESIGNATION	TYPE	Ø: a x b m	H: L ₁ m	L _m	SURFACE (sq. m.)	CAPACITY (cubic m.)	CAPACITY (bbls.)	PRODUCT
A	R ₁	7	6.70		187	210	240	DIESOLINE MIT BEZAHLTER STEUER	A	R ₁	7	6.70		187	240	1512	DIESOLINE DUTY PAID
B	R ₁	9	8.00		292	430	485	GASOIL MIT BEZAHLTER STEUER	B	R ₁	9	8.00		292	485	3055	GAS OIL DUTY PAID
C	R ₁	9	8.00		292	356	485	DIESOLINE MIT BEZAHLTER STEUER	C	R ₁	9	8.00		292	485	3055	DIESOLINE DUTY PAID
D	R ₁	9	8.00		292	361	485	BENZALKO MIT BEZAHLTER STEUER	D	R ₁	9	8.00		292	485	3055	BENZALKO DUTY PAID
E	R ₁	15	11.40		717	1565	1910	PETROLEUM MIT BEZAHLTER STEUER	E	R ₁	15	11.40		717	1910	12033	KEROSENE DUTY PAID
F	R ₁	12	9.00		464	723	970	BENZALKO STEUERFREI	F	R ₁	12	9.00		464	970	6111	BENZALKO DUTY FREE
G	R ₁	9	8.00		292	356	485	LEER	G	R ₁	9	8.00		292	485	3055	EMPTY
H	R ₁	18	11.00		875	1955	2660	BENZIN STEUERFREI	H	R ₁	18	11.00		875	2660	16758	GASOLINE DUTY FREE
I	R ₂	1.41	5.00	5.35		6	7	GASOIL	I	R ₂	1.41	5.00	5.35		7	44	GASOIL
J	R ₂	2.5	9.94	10.30		41	45	T.D. 2	J	R ₂	2.5	9.94	10.30		45	283	T.D. 2
K	R ₂	2	10.00	10.48		27	29	B. 1	K	R ₂	2	10.00	10.48		29	183	B. 1
L	R ₂	2	10.00	10.48		27	29	B.D. 2	L	R ₂	2	10.00	10.48		29	183	B.D. 2
M	R ₃	3.27 x 2.29	2.00			12	13.50	T.D. 2	M	R ₃	3.27 x 2.29	2.00			13.50	85	T.D. 2
N	R ₃	3.27 x 2.29	2.00			12.75	13.50	B.E. 2	N	R ₃	3.27 x 2.29	2.00			13.50	85	B.E. 2
O	R ₃	3.27 x 2.29	2.00			12.75	13.50	B.D. 2	O	R ₃	3.27 x 2.29	2.00			13.50	85	B.D. 2
P	R ₃	3.27 x 2.29	2.00			12.70	13.50	B. 1	P	R ₃	3.27 x 2.29	2.00			13.50	85	B. 1
Q	R ₃	2.15	1.50			2.98	4	BENZALKO	Q	R ₃	2.15	1.50			4	25	BENZALKO
R	R ₃	4.2	1.50			9.70	11	GASOIL	R	R ₃	4.2	1.50			11	69	GASOIL

LEGENDE

- 1 PETROL. ABFÜLLHALLE
- 2 BENZIN ABFÜLLHALLE
- 3 OELMANIP. RAUM
- 4 FÜR OELRESERVOIREN
- 5 OELXPEDITION RAUM
- 6 KANNENFABRIK
- 7 LAGER F. KISTEN GARNIT.
- 8 0. ETAGE - MÜHLE F. PYRETHRUM
U. TISCHLEREI
- 1 & 2. ETAGE - SPEZIALÖLE U.
EMBALLAGE
- 9 KESSELHAUS
- 10 WERKSTÄTTE
- 11 WERKSTÄTTE U. DREHEREI
- 12 PUMPENHAUS
- 13 MASCHINENHAUS
- 14 FASSWÄSCHEREI
- 15 GARAGE F. 2 AUTO
- 16 BUTANGAS LAGER
- 17 WASSER RESERVOIRE-KAP. 6M³

LEGEND

- 1 KEROSENE FILLING ROOM
- 2 GASOLINE FILLING ROOM
- 3 OIL CONTROL ROOM
- 4 FOR OIL TANKS
- 5 OIL DISPATCH ROOM
- 6 CAN FACTORY
- 7 STORAGE PLACE FOR CASE FITTINGS
- 8 1ST FL.-PYRETHRUM MILL AND
CARPENTER SHOP
- 2ND & 3RD FL.- SPECIAL OILS AND
PACKAGING
- 9 BOILER ROOM
- 10 WORKSHOP
- 11 WORKSHOP AND MACHINE SHOP (LATHE)
- 12 PUMP ROOM
- 13 MACHINE ROOM
- 14 BARREL WASHING ROOM
- 15 2 CAR GARAGE
- 16 BUTANE STORAGE
- 17 WATER RESERVOIR - CAP. 6M³

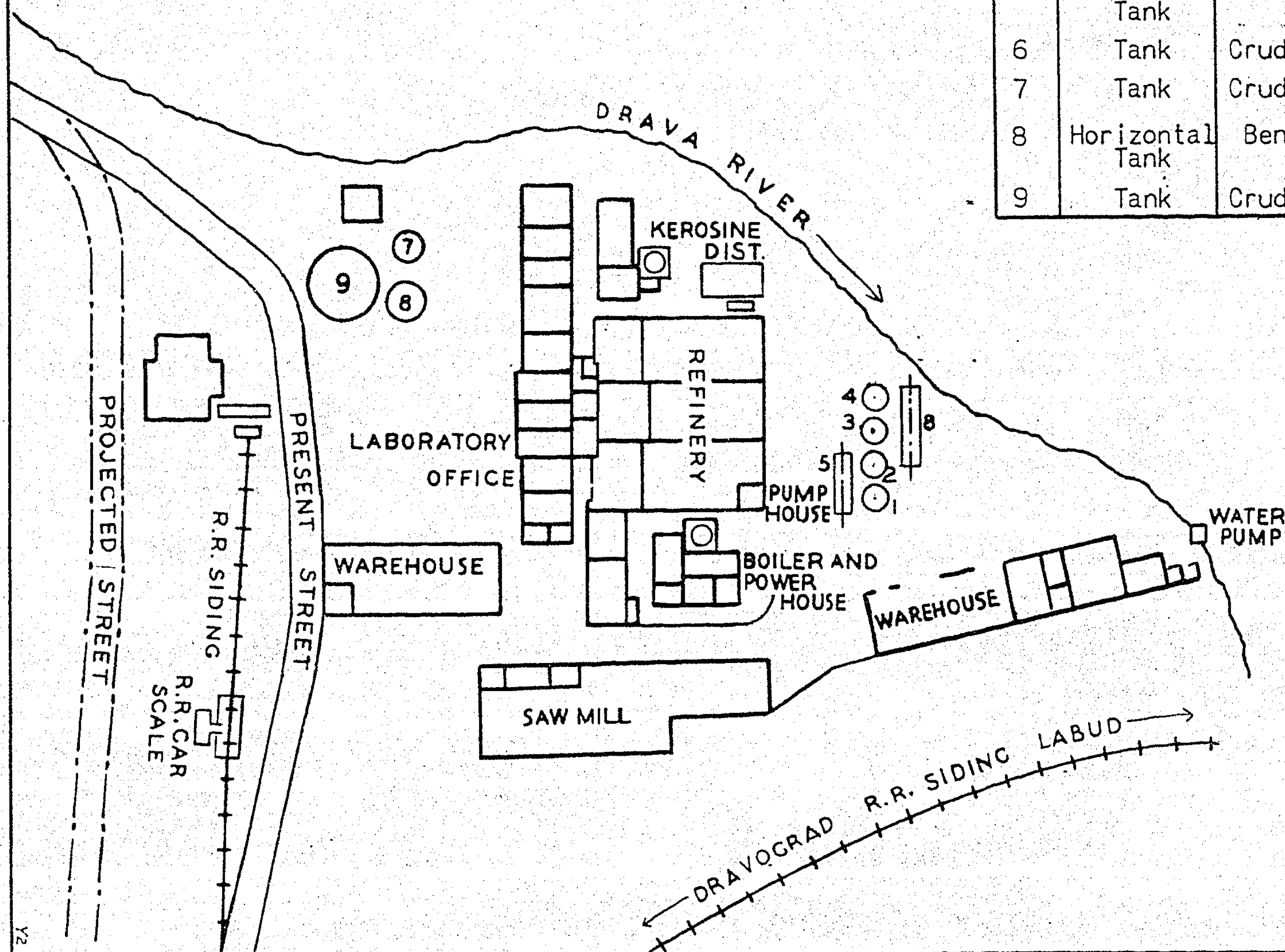
ČUKARICA - YUGOSLAVIA

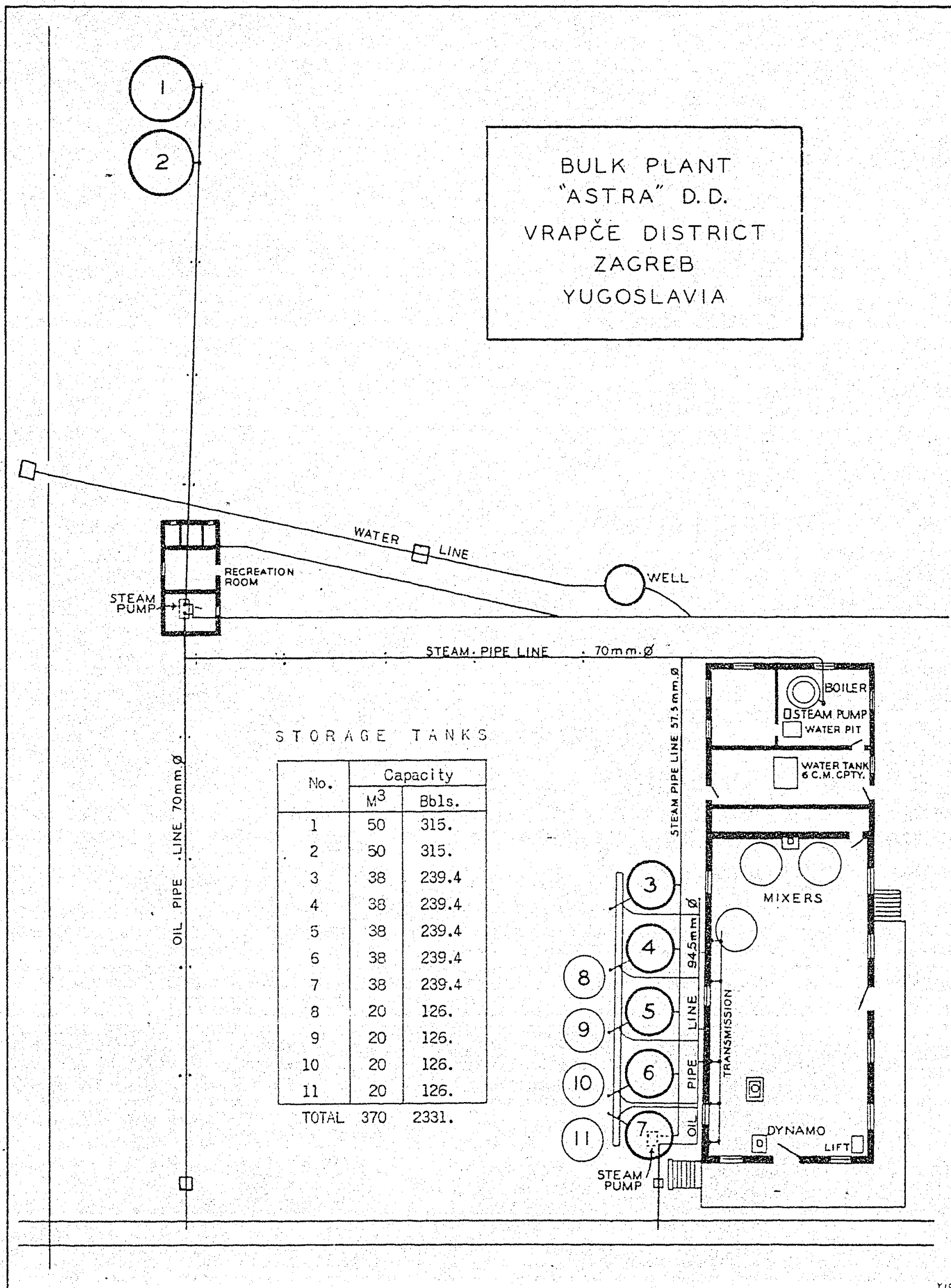
SHEET 2 OF 2

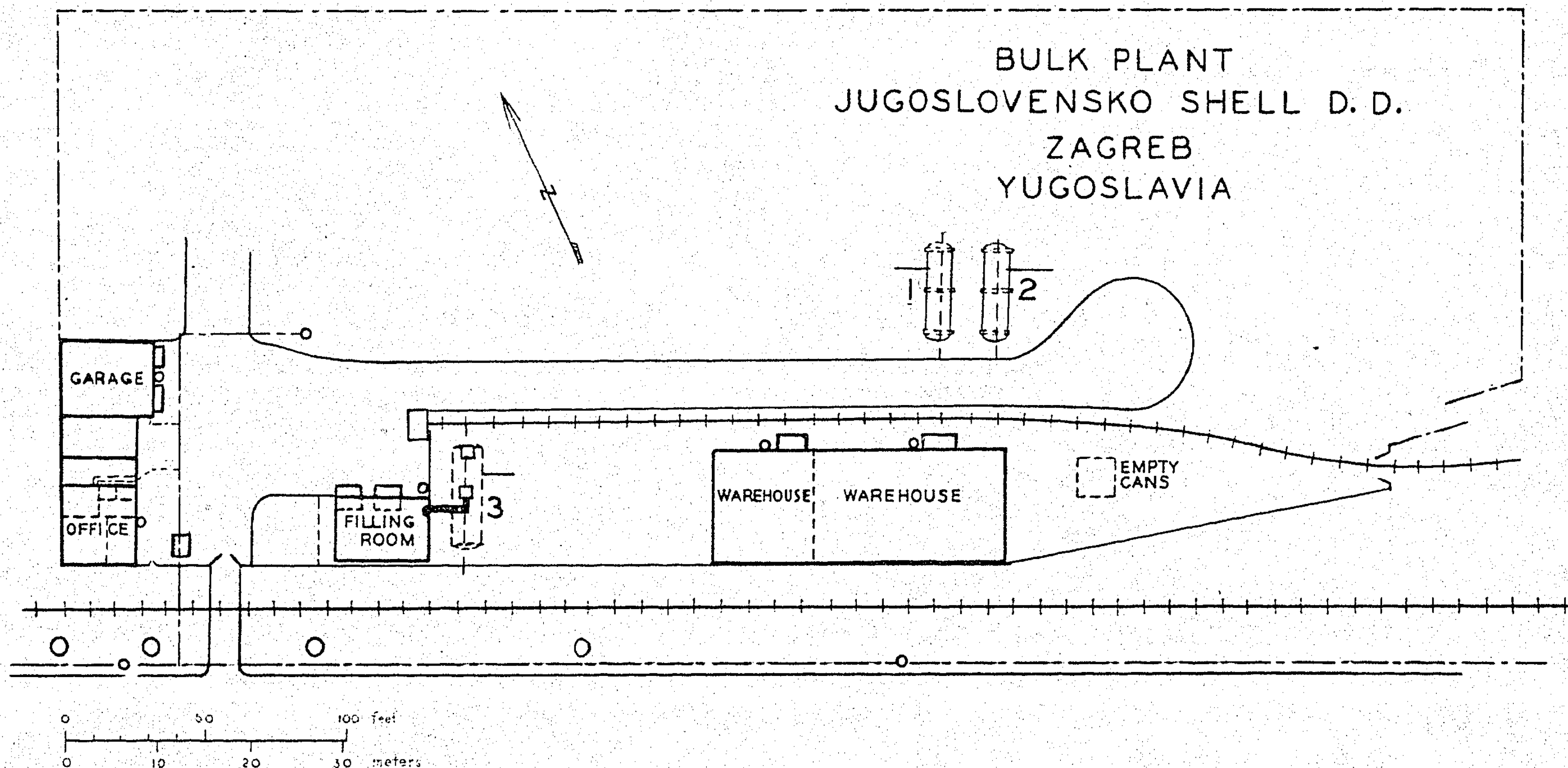
BULK PLANT, (AND REFINERY) JUGOSLOVENSKO SHELL D.D DRAVOGRAD YUGOSLAVIA

STORAGE TANKS

No.	Unit	Product	Capacity	
			M ³	Bbls.
1	Tank	Gas Oil	18	113.4
2	Tank	B.A.Mixture	25	157.5
3	Tank	B.A.Mixture	25	157.5
4	Tank	Benzine	25	157.5
5	Horizontal Tank	Gas Oil	14	88.2
6	Tank	Crude Oil	70	441.
7	Tank	Crude Oil	35	220.5
8	Horizontal Tank	Benzine	28	176.4
9	Tank	Crude Oil	500	3150.
TOTAL			740	4662.



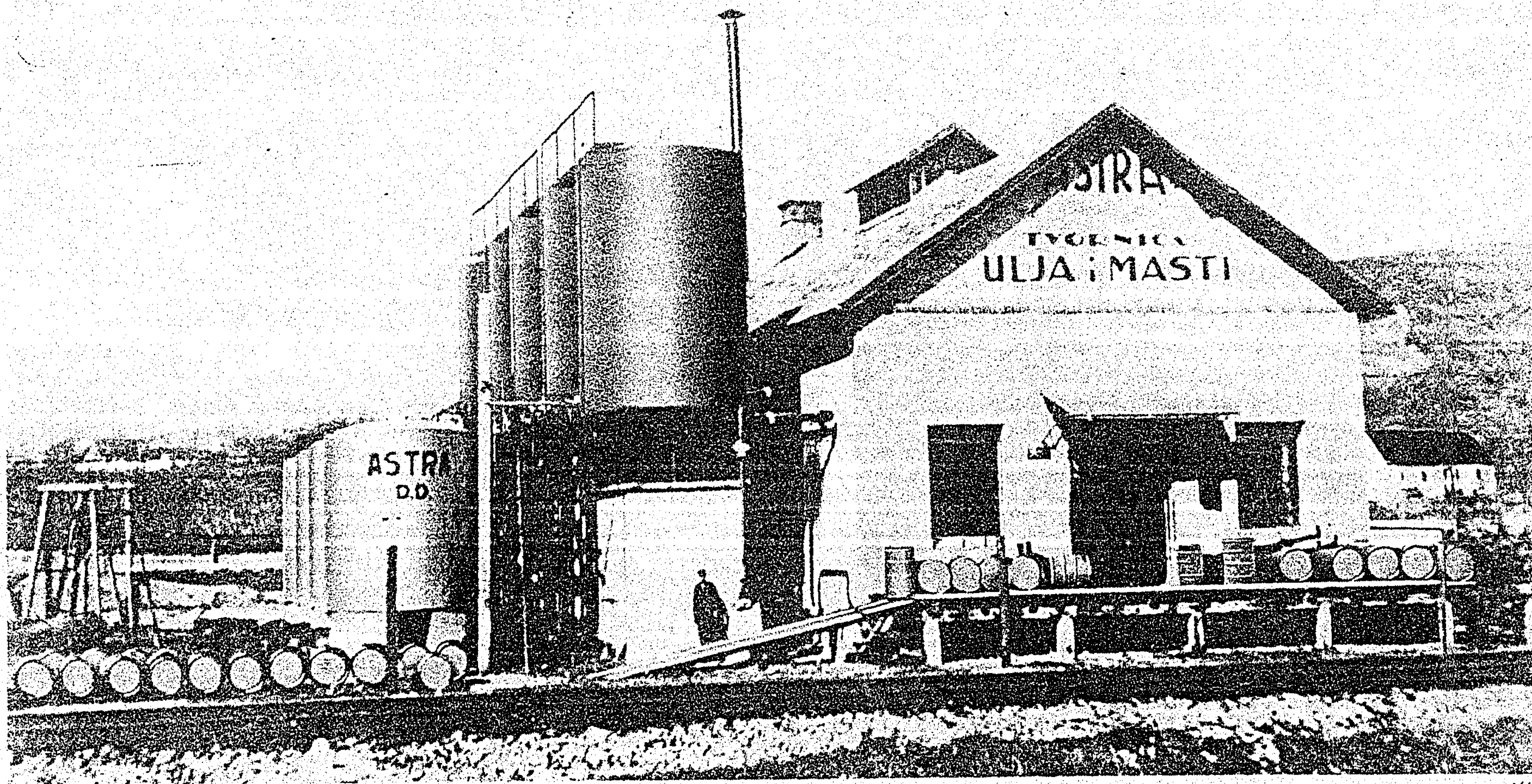




STORAGE TANKS

NO.	TYPE	PRODUCT	CAPACITY	
			M3	BARRELS
1	Horizontal Above Ground	Kerosine	28	176
2	" "	Gas Oil	28	176
3	Horizontal	Gas Oil	46	289
Total			102	641

376 Square Meters of Shed Space for Storage of Packed Products.

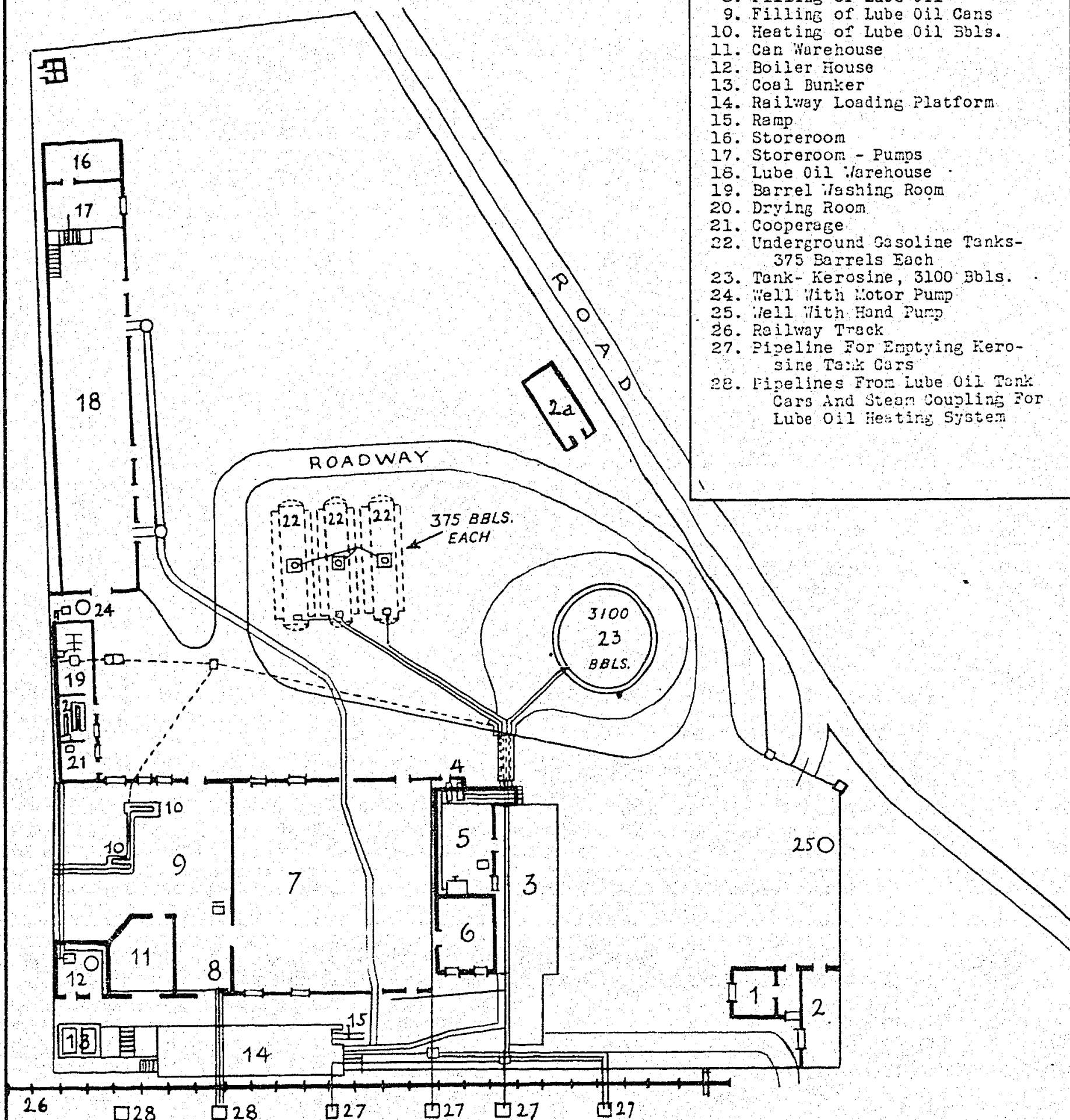


ASTRA D.D. BULK PLANT AT VRAPČE, ZAGREB

BULK PLANT STANDARD-VACUUM OF CROATIA, INC. ZAGREB YUGOSLAVIA

LEGEND

1. Office
- 2 & 2a. Garages
3. Loading Platform
4. Motor Room
5. Filling Room: Kerosine Bbls.
6. Equipment Storeroom
7. Warehouse- Lube Oil
8. Filling of Lube Oil
9. Filling of Lube Oil Cans
10. Heating of Lube Oil Bbls.
11. Can Warehouse
12. Boiler House
13. Coal Bunker
14. Railway Loading Platform
15. Ramp
16. Storeroom
17. Storeroom - Pumps
18. Lube Oil Warehouse
19. Barrel Washing Room
20. Drying Room
21. Cooperage
22. Underground Gasoline Tanks-
375 Barrels Each
23. Tank- Kerosine, 3100 Bbls.
24. Well With Motor Pump
25. Well With Hand Pump
26. Railway Track
27. Pipeline For Emptying Kero-
sine Tank Cars
28. Pipelines From Lube Oil Tank
Cars And Steam Coupling For
Lube Oil Heating System



A P P E N D I X 1

CONVERSION FACTORS USED IN THIS REPORT

The conversion factors used in this report are as follows:

Basis.- One metric ton of 1,000 kilograms is divided by the volume of one barrel (159 liters) multiplied by the density of the oil at 60° F. (15.5° C.). This reduces to the factor of 6.3 divided by the density of the oil.

<u>Product</u>	<u>Bbls/Metric Ton</u>
Propane	12.4
Butane	11.0
Natural Gasoline	9.16
Aviation Gasoline	8.5
Motor Gasoline	8.5
Light Aromatics (Benzol, Toluol, and Zylenes)	7.2
Ethyl Alconol	8.0
Methyl Alcohol	8.0
Kerosine	7.9
Diesel Oil)	
Gas Oil)	7.2
Lubricants	7.0
Residual Fuel Oil	6.5
Paraffin Wax	7.5
Asphalts	6.0
Synthetics (average)	8.0
All Products, (average)	7.5
<u>Crude Oils</u>	
Albania	6.6
Austria	6.8
Czechoslovakia	6.8
Estonia (Shale Oil)	7.0
France	7.0
Germany	7.0
Hungary	7.7
Italy	7.7
Poland	7.4
Rumania	7.5
Russia	7.28
Crude Oils (Locality unspecified)	7.0
Shale Oils (Locality unspecified)	7.0
Yugoslavia	7.5

Conversion factors are of necessity subject to variations from time to time and from place to place. If meticulous accuracy is necessary, conversion factors must be derived from actual specifications.

A P P E N D I X 2SOURCES OF PORT AND HARBOR MAPS FOR YUGOSLAVIA

Maps of ports and harbors having importance for petroleum handling in Yugoslavia are not reproduced in this report, inasmuch as qualified persons have ready access to detailed charts published by the Hydrographic Office, Bureau of Operations, Navy Department, at Washington and charts of the British Admiralty. For convenience, references are given here to maps of various ports. In the following list, BA designates the British Admiralty.

<u>Consecutive</u>		<u>Chart</u>	<u>Title</u>
3047	B.A.	2711	Gulf of Quarnaro (Kvarner) Cape Promontore to Dugi Island. (Plans: Port Bado; Porto Albona; Bakar Bay and Kraljenica (also shows Susak Area).
3050	B.A.	2774	Dugi Island to Drvenik Channel. (Plans: Pašman Strait; Porto Zara; Porto Tajer and Rogoznica; Primošten Harbor).
3051	B.A.	1581	Approaches to Port Šibenik; Murter Bay.
3053	B.A.	1612	Ports and anchorage in Dalmatia. (Ports Trogir, Split and Makarska; Vis, and Vrboska and Jelsa Harbors; Omis Road; Stari Grad Bay; Pakleni Channel.
3056	B.A.	1582	Harbors on the eastern coast of the Adriatic. (Approaches to Ston Mali and Klek Bay, Aleksandrova Harbor and Neretva anchorage; ports of Dubrovnik and Cavtat; Neretva River entrance and anchorage).
3058	B.A.	1463	Ports and anchorages in Dalmatia and Albania. (Molunat Harbor to Malaluka Bay, showing approaches to Kotor; Port Molunat Harbor; Budva Harbor; Bar Roads; Port St. Giovanni di Medua.)
3059	B.A.	419	Anchorage and channels in the Gulf of Kotor. (Meljine Bay and Kumbur Channel; Kotor Harbor).

I N D E X

- Alcohol as motor fuel, 42-43.
- Distilleries, 43, 61.
- Production, 43.
- Arko Alcohol Co., 61.
- Artificial crude, T-8; T-9; 25, 39.
- Asphalt, Consumption, T-40. Deposits and prospects, 17. Supplies, T-8.
- "Astra" Dioničarske Društvo, T-10; 34.
- Barge transportation, 7, 43, 44, 48, 58.
- Baros, Port. See Susak.
- Beograd alcohol distillery, 43.
- Beograd-Cukarica (Shell), Bulk plant. See under Čukarica.
- "Bitumen" Hrvatsko Dioničko Društvo za Iskorišćavanje Zemnog Plina i Ulja, T-10.
- Black oil bunkering station, 57-58.
- Bosanski-Brod Refinery. See Brod Refinery.
- Bottled gas, 23.
- Brod alcohol distillery, 43.
- Brod Refinery, M-6. Daily throughput, T-25; L-26; P-27. Statist. summary, T-24. Location and description, 29.
- Bujavica gas field, 22-23, with M. Analysis, T-23.
- Bulk plants, M-6; 43-44; T-45; 46, L-47; 48; T-50-51; T-53; T-57, 58; T-59; T-60; L-64; L-66; L-67; L-68; L-71. See also Storage facilities.
- Bunkering station, Lipci, 57-58.
- Caprag refinery (Sisak), M-6. Daily throughput, T-25; Location and description, 29; Storage facilities, T-30-31; L-32-33; P-35.
- Carbon black plant, Kutina, 23.
- Cases for petroleum products, 44, 46.
- Central office for generators, 42.
- Cervenka alcohol distillery, 43.
- Companies, Marketing, 39; T-40.
- Companies operating in Yugoslavia, identification, T-10; 11.
- Concessions to Gewerkschaft Elwerath, 7.
- Consumption, 7, 39; T-40-41.
- Conversion factors used in this report, T-73, 7 note (b).
- Creosote storage, Sušak, L-47; 48.
- Cross-sections, Stratigraphic, Selnica, Peklenica, 20-21.
- Crude oil.
 - Artificial, T-9; 25, 39.
 - Prospects, 13, 14, 16-17, 20.
 - Qualities of domestic, 21-22.
 - Seeps, M-12; 17.
 - Supplies, Domestic, T-8; 25. Medjimurje field, 1939, T-22. Selnica field, T-18-19; 21.
- Crude oil (continued)
 - Supplies, Imported, T-9; 25.
- Čukarica Bulk plant, 60, with T; L-64.
- Curb pumps, 7, 44.
- Dalmatian coast, asphalt and oil prospects, 17.
- Danica Petroleum Co., 29.
- Danube River, 7. See also Barge transportation.
- Diesel/Gas oil; T-8; T-9; 39; T-40; T-41.
- Dinarske Flysch, 16.
- Distilleries, Alcohol, 43, 61.
- Distributing, General, 7, 39-61.
- Djenovici. See Kotar Area, 57-58.
- Drava River, 14.
- Dravograd (Shell) Bulk plant, 60-61; L-66.
- Dravograd Rafinerija Mineralnog Ulja-Goli, 25, 34.
- Dravograd Refinery, M-6. Daily throughput, T-25. Location and description, 34.
- Drilling and production results, Raky wells, T-19; Singer wells, T-18.
- Drums for petroleum products, 44, 46.
- Dubrovnik, Port, 51; L-52. Tanks, T-53; T-57; P-55.
- Filling stations, 7, 44.
- Fiume, M-6. Petroleum facilities, 48; M-49. Port, M-49. (For further information see "The Petroleum Facilities of Italy", 49.)
- Flysch of Pannonian Basin, Prospects, 16-17.
- Folded structures, Pannonian Basin, M-16.
- Fuel for motor vehicles. See Motor vehicles.
- Fuel oil, T-8; T-9. Consumption, T-40; T-41.
- Fuels, Domestic, Govt. office for control, 42-43.
- Fuels, Liquid, Consumption, T-40; T-41.
- Fuels, Substitute, 42-43.
- Gas. See Natural gas.
- Gas, Bottled, 23.
- Gas/Diesel oil, T-8; T-9; 39; T-40; T-41.
- Gas generators, Govt. office for control 42.
- Gas oil. Consumption, 39; T-40-41.
- Geology, M-12, (N.Yugoslavia); 13. General statement, 16-17, with M; Drilling records, Selnica, T-18-19. Maps and cross-sections, 20-21.

Gewerkschaft Elwerath. Concessions, 7, T-10; 11, in Medjimurje area, 20. (also called "Jugo-Petrol").
Gewerkschaft Raky-Danubia, 7; T-10.
Goilo structure, 7; M-12. Wells, 14. Production, 23.
Goilo gas field, M-12; M-22. Analysis, T-23.
Greases, Domestic supplies, T-8.
Imports, T-9. Consumption, T-40-41.
Gruz. See Dubrovnik.

Hand-dug shafts, M-12.
Harbors and Ports. Maps, Sources, 75.
Hinko Meyer & Co., 46, 61.
History of oil operations, 13, 14.

Imports of crude and products, T-9.
Ipoil Dioničarsko Društvo, 7; T-10; 25, 34, 37.
Ipoil Refinery. See Osijek Refinery.
Ivanovic & Co. and "Astra" Dioničarsko Društvo, T-10; 25.
Ivanovic interests, 34.

"Jugo-Petrol" (Gewerkschaft Elwerath), 7; T-10; 11, 20.
Jugoslovensko Istraživačko, Akionarsko Društvo, T-10.
Jugoslovensko Shell Dioničarsko Društvo 7, T-10; 25, 45, 50.

Kakanje prospect, 17.
Kerosine, Supplies. Domestic, T-8; Imported, T-9; Extensive use, 39; Consumption, T-40-41; 51.
Kotor Area, 57; 58 with M of petroleum facilities.
Kumbor Channel. See Kotor Area.
Kutina, Carbon black plant, 23.

Land titles, obscure situation, 7.
Lighters for oil transportation, 58.
Lignite mines, Spreca Basin, 16.
Lipci, Bunkering station, 57, 58 with M. Ljubljana alcohol distillery, 43.
Lopera prospect, 16.
Lubricating oils, Supplies, T-8; Imports, T-9; Consumption, T-40-41.

Majevica Mountain region, Prospects, 16-17.
Maps, Port and Harbor, Sources, 75.
Marketing position of marketing companies, T-40.
Marketing, Retail, 44 with T.
Marof alcohol distillery, 43.
Medjimurje oil fields, M-12; M-14 and cross-sections.
Geology, 20, 21 with T, M.
History, 14, 17, 20, 22, 23.

Medjimurje oil fields (continued)
Production, Total (Medjimurje), 1900-1939, T-22; Total (Selnica), 1900-1938, 21.
Quality of crude, 21-22.
For further details see Peklenica field; Selnica field.

Melle process for alcohol mixtures, 42.
"Methan", Dioničarsko Društvo, T-10.
Morava River headwaters, Prospect, 17.
Motor torpedo-boat base, Susak, 48.
Motor vehicles, 40-41 with T. Substitute fuels, incl. alcohol, 42-43.
Bottled gas, 23.
Mur Island, See Medjimurje.
Mura River, 14.
Murinsel, See Medjimurje.

Natural gas, M-12; 14, M-22.
Analysis (Bujavica), T-23.
Bottled gas, 23.
Bujavica, M-22, 23
Carbon black plant, Kutina, 23.
Goilo, 22, 23.
Production, 22.
Seep, M-12.
Sisak, Non-commercial showing, 22.
Naval gas oil station, Sibenik, 48.
New refinery reported, Smederevo, 7, 25.

Ocean and river terminals, M-6; 46-47.
Dubrovnik, 51; L-52; P-55. Storage tanks, T-53; T-57.
Fiume, Petroleum facilities, M-49.
Kotor Area, 57; 58 with M. Storage capacity, T-57.
Kumbor Channel, 58.
Lipci, Govt. black oil bunkering station, 57-58.
Strategic considerations, 46.
Šibenik, 48.
Split, 48; L-50; 51.
Statistical summaries of data on ocean and river terminals, T-45; T-59.
Sušak, Bulk plant, L-47; 48; M-49.
Torpedo boat base, 48.
Tivat, 58, with M. See also storage facilities.

Oil fields, M-12. See Crude oil; Goilo; Medjimurje field, Peklenica field; Selnica field.
Oil prospects, 13, 14, 16-17, 20.
Oil seeps, M-12; 17.
Osijek Refinery, 29, 34. Daily throughput, T-25; P-37.

Panonia, Društvo za Zemljino ulje, T-10.
Pannonian Basin, M-16. Geology, 16-17.
Paraffin wax, Supplies, T-8.
Paraffins, Consumption, T-40.

- Peklenica field.
 Crude oil, Characteristics, 21-22.
 Geology, 20-21 with M, cross-sections and T.
 History, 17, 20.
 Horizons, Depth, 21.
 Shallow wells, cross-sections, 21.
 Stratigraphic cross-section, Well No. 55, 21.
 Personnel of companies, 11, 39(a).
 Petroleum and products.
 Bulk storage. See Bulk plants; storage facilities.
 Consumption, 7, 39; T-40; T-41.
 Facilities, 7. Yugoslavia, M-6; Fiume, M-49.
 History of operations, 13, 14, 17, 20.
 Supplies, 7; Domestic, T-8; Imported, T-9.
 Phoenix Oil & Transport Co., Ltd., T-10; 34.
 Pipe line, Proposed, Dubrovnik, 51, L-52.
 Political divisions of Yugoslavia, 1942, M-15.
 Port Baroš, See Sušak.
 Ports and Harbors, Maps, Sources, 75.
 Producing, 7, 13; Statist. summary of refineries, T-24; Indigenous crude, 25.
 Prospects, 16-17; 20-21.
 Pumps, Curb, 7, 44.
 Railways, M-6; 7, 43, 44, 51, 58.
 Raky wells. See Selnica field.
 Recna Plovidba, Govt. controlled company owning all barges, 43.
 Refineries, M-6; 7. Introduction, 25.
 Statistical summary, T-24.
 Brod Refinery, M-6. Daily throughput T-25; L-26; P-27. Location and description, 29.
 Caprag Refinery (Sisak), M-6. Daily throughput, T-25. Location and description, 29. Storage facilities, T-30-31; L-32-33; P-35.
 Dravograd Refinery, M-6. Daily throughput, T-25. Location and description, 34.
 Economic status, 25, 29.
 New Refinery reported, Smedereva, 7, 25.
 Osijek Refinery, M-6; 29, 34. Daily throughput, T-25; P-37.
 Production, 7; T-8; T-24.
 "Romse" Refinery, 48; M-49.
 Status, 1937, T-25.
 Storage facilities. See that subject.
 Strategic considerations, 25, 29.
 Supplies, Domestic, T-8; 25. Selnica field, T-18-19; 21. Medjimurje field, 1939, T-22. Imported, T-9; 25.
 Tankage. See Storage facilities; Bulk plants.
 Retail marketing, 44 with T.
 River terminals. See Ocean and river terminals.
 Roads, Main and secondary, M-6.
 "Romse" Refinery, 48; M-49. (For details see "The Petroleum Facilities of Italy", p. 49).
 Royal Dutch Shell group, 7; T-10; 11, 25, 29, 30-35, 39, 44, 48, 51, 55, 60, 61.
 Rosanj prospect, 16.
 Rumania, Imports from, T-9.
 Salt in Spreca Basin, 16.
 Sava River, 7.
 Seaplane base, M-58.
 Seeps, M-12; 17.
 Selnica field, M-12; M-14; M-20.
 Crude oil, characteristics, 21-22.
 Production, T-18; T-19; 21-22.
 Geology, 20-21, with M, T, and cross-sections.
 Horizons, Depth, 21.
 Raky wells, Drilling and producing results, T-19. M's and cross-sections, 20-21.
 Shallow wells, cross-section, M-12, 21.
 Singer wells, Drilling and producing results, T-18, M and cross-sections, 20.
 Stratigraphic cross-sections, 20-21.
 Service stations, 7, 44.
 Shallow wells, M-12; 21.
 Shell Refinery. See Caprag Refinery.
 Šibenik, Port, 48.
 Singer wells. See Selnica field.
 Sisak alcohol distillery, 43.
 Sisak, Gas-showing, Non-commercial, 22.
 Sisak Refinery. See Caprag Refinery.
 Smederevo. New refinery reported, 7, 25.
 Socony-Vacuum Oil Co., T-10; 25, 29, 39.
 Split, Port, M-6; 48; L-50; 51 with T.
 Standard Oil Co. (N.J.), T-10.
 Standard Vacuum of Croatia, Inc., 7; T-10; 11, 25, 26, 29, 43, 44, 71.
 Standard Vacuum of Croatia Refinery. See Brod Refinery.
 Storage facilities, M-6; 7; 44 with T; T-45; Statistical summary, T-62-63.
 Beograd-Čukarica, T-60; L-64.
 Bulk plants, M-6; 43-44; T-45; 46, L-47; 48, 50, 51; T-53; T-57; 58; T-59; 60, 61; L-64; T-65; L-66; L-67; L-68; L-71.
 Caprag, T-30-32.
 Dubrovnik, T-52-53; P-55; T-57.
 Inland, 60-61.
 Kotor Area, T-57; 58.
 Kumbor Channel, 58.
 Ocean and river terminals, statistical summary, T-45; T-59.
 Possible other facilities, 58-59.
 Split, L-50; T-51.
 Statistical summary, Yugoslavia, T-62-63.

Storage facilities (continued)
 Sušak (Port Baroš), L-47.
 Zara, 60.
 Substitute fuels, 42-43.

Tank cars, Railway, 7; 43; 51; 58.
 Tank trucks, 43; 51.
 Tankage, See Bulk plants, Storage facilities.
 Tankers for crude oil, 48-49; 51; 58.
 Tavid prospect, 16.
 Terminals, Ocean and river, Statistical summaries, T-45; T-59.
 Titles to land, Obscure situation, 7.
 Tivat, See Kotor Area, 57-58.
 Torpedo boat base, Sušak, 48.
 Transportation, M-6; 43. See also
 Barge transportation, Lighters, Tank cars, Railways, Tank trucks.

Tuzla prospect, 16; 17.

Uljanik Petroleum Dioničarsko Društvo, T-10; 14.

Verpazar (Lake Shkodres) prospect, 14.
 Vukovar, Transshipping point, 43.

Wildcat wells, M-12.

Yugoslavia, Central, Natural gas fields M-22.

Yugoslavia, Petroleum facilities, M-6.

Yugoslavia, Political divisions, 1942, M-15.

Zagreb alcohol distillery, 43.

Bulk plants, 61; L-67-68; L-71; P-69.

Zara, Small storage plant, 60.