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ECONOMIC INTELLIGENCE REPORT

THE RUBBER POSITION OF THE SOVIET BLOC

CIA/RR 19

19 January 1953

CENTRAL INTELLIGENCE AGENCY

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(ORR Project 24-52)

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THE RUBBER POSITION OF THE SOVIET BLOC

I. Introduction.

The position of the Soviet rubber industry is assuming increasing importance in the world, since the rubber industry of any country determines to a great extent the power and maneuverability of that country's military potential. The USSR has long recognized the importance of rubber to its economy. Realizing the degree of dependence on the Far East for rubber, the USSR early began to work on the development of rubber within its borders.

Many years were devoted to the cultivation and development of latex-bearing plants such as kok-saghyz to relieve this dependence. The success of this project is comparable to that of the US in work on guayule, and so far only negligible quantities of rubber have been attained from this work.

At the same time, the USSR has devoted strenuous efforts to establish a synthetic rubber industry, which met with better results than did the kok-saghyz project. The USSR was well started on the production and development of synthetic rubber long before such work was attempted by Western nations. Although the US, even with a slow start on production of synthetic rubber, surpassed the USSR during the war years, the USSR has made notable progress.

The USSR has concentrated on the production of divinyl (butadiene) synthetic rubber, a general-purpose type similar in usage to the US GR-S types, and Sovprene, similar to US neoprene. The USSR has benefited from access to the latest technological and scientific developments of production methods and procedures of the US and German industries through technical manuals and publications, as well as, in some cases, from direct observation of Western plants. The technical progress also has been evident in the reclaiming of rubber, which constitutes a very strategic supplementary source of rubber for the production of rubber goods.

In addition to these types of rubber produced domestically, the USSR, like other countries of the world, has continued to import natural rubber from the Far East. This rubber not only serves to

provide additional quantities of raw material but also goes to make up a better product. Even the USSR, with manifest desire to be more and more self-sufficient, has realized this important fact, as is evidenced by the following statement from a Soviet technical journal 1/*:

> 'The amount of natural rubber used for the production of rubber goods in the USSR is small and, where possible, it will decrease in view of the rapidly growing and improving "SK" industry. However, synthetic rubber does not limit, but broadens the field of use of natural rubber, which welcomes "SK" as one of the valuable elastic substances.'

As in development of types of rubber, the USSR also has obtained many data on fabrication methods and procedures developed by Western countries. Many data of this type were obtained under terms of Lend-Lease.

The US supplied to the USSR a small but well-designed plant with complete equipment for the latest production of tires and full technical advice for its operation. [redacted] the procedures and methods of this plant have served as prototypes of other tire plants set up in the USSR. This situation is not unusual or surprising. Methods of fabrication of rubber goods are comparable in all countries of the world. Therefore, it is safe to assume that the USSR follows standard commercial practices which are uniform everywhere for the same end product. Where chemical breakdown analyses have been made, it has been evident that percentage composition of the rubbers in tires and the use of rubber fillers and chemicals are comparable to US practice and in the same relative quantities. 50X1

[redacted] since 1946 the Soviet production of synthetic rubber has grown by more than 3½ times (from 40,000 metric tons in 1946 to 143,000 metric tons in 1950), while production of tires has shown nearly a threefold increase (from 2,975,000 to 8,239,000 tires in 1950). 50X1

Soviet imports of natural rubber, on the other hand, have jumped almost 10 times. However, this large increase went partially toward the accumulation of a rubber stockpile. It must also be pointed out

[redacted] 50X1

that 1946 cannot be considered a normal year, since it was a low year for imports of natural rubber and came immediately after the war.

By 1948 the USSR had rehabilitated and/or reconstructed facilities damaged by the war and was well on the road to further progress of the rubber industry. In this year, also, the USSR started importing natural rubber at a heavy rate in an apparent attempt to build up a stockpile. Since 1948-49, when a considerable percentage of natural rubber is believed to have gone to build up stocks, which were almost depleted during the war years, additional quantities of rubber, but at a lower yearly rate, have remained after consumption needs were met. It is estimated that a stockpile of about 205,600 metric tons had been accumulated in the USSR by 1951. On the basis of trends of imports in 1952, it is estimated that this stockpile may have grown to a quantity of 248,100 metric tons by the end of 1952.

By 1953, [redacted] 269,900 metric tons of rubbers (synthetic, 206,000 tons; reclaimed, 61,000 tons; and domestic natural, 2,900 tons) may be produced in the USSR. Analysis of tire plants indicates a production of 11 million tires by 1953 and a total consumption of about 331,300 metric tons of rubbers of all types. 50X1

II. Rubber Production.

A. Synthetic Rubber.

1. USSR.

a. Introduction.

Synthetic rubber has been produced on a commercial scale in the USSR since the early 1930's. Prior to World War II, Soviet production consisted almost entirely of divinyl (butadiene)* synthetic rubber made from alcohol by the Lebedev process and similar in usage to US GR-S types. A small amount of Sovprene (similar to US neoprene), a synthetic rubber based on calcium carbide and used in products resistant to oil or heat, was produced in 1939-40. Production of synthetic rubber from petroleum sources was begun sometime after the war.

* The terms divinyl and butadiene refer to the same chemical compound and will be used interchangeably in this report.

The USSR planned to increase its output of synthetic rubber in the postwar period and to increase the proportion of rubber made from nonfood raw materials (that is, raw materials such as calcium carbide, petroleum gases, and alcohol from wood). The Fourth Five Year Plan (1946-50) stipulated that 1950 output of synthetic rubber would be double the prewar level and that 38 percent of this total would be derived from nonfood sources. (See Tab A.) The Fifth Five Year Plan (1951-55) similarly calls for an 82-percent increase over 1950 by 1955 and stresses the production of synthetic rubber from petroleum gases. Although there is little doubt concerning the general trend in Soviet production of synthetic rubber, the magnitude of output in the 1946-51 period is difficult to estimate.

b. Production of Synthetic Rubber.

Very little quantitative information is available for the Soviet synthetic rubber industry. The only absolute figures available for Soviet production of synthetic rubber are those given in Table 1 for the production in the years 1932-35.

Table 1

Soviet Production of Synthetic Rubber 2/
1932-35

	Metric Tons
1932	50
1933	2,200
1934	11,100
1935	25,600 a/

a. Output in 1935, based on preliminary data, was reported to be 25,589 metric tons. Judging by preliminary figures for other commodities, this tonnage should not be overstated by more than 4 to 5 percent. No absolute figures on synthetic rubber were published in the National Economic Plan for 1937 or the Third Five Year Plan (1938-42).

Most of the over-all estimates made for Soviet production of synthetic rubber since 1935 have had as a starting point information contained in two articles published in Soviet periodicals in 1940. Both of these articles announced that Soviet production of synthetic rubber in 1939 had increased over production in 1938 as a result of increased efficiency. Although neither article reported total annual production, estimates of total annual production in 1938 and 1939 may be derived from them by combining the quantitative data which they contain. The first article 3/ asserted that production of synthetic rubber in 1939 was 14.9 percent greater than in 1938 and reported that 30,900 metric tons of alcohol had been saved in 1939, thanks to improved techniques, in particular the use of a more efficient catalyst. The second article 4/ dealt in some detail with the technical reasons for the increase in efficiency and the accompanying increase in output of the synthetic rubber industry from 1938 to 1939. This article listed four "basic technological indicators" of efficiency. (The interpretation of these indicators is discussed in Tab B.) The over-all increase in efficiency from 1938 to 1939 is directly measured by a change in one of these indicators -- a decrease from 3.288 to 2.806, or a difference of 0.482, in the consumption coefficient of alcohol.

The amount of alcohol consumed per unit of rubber produced is called the "consumption coefficient." Since consumption coefficients are almost always expressed as a ratio of units of primary raw material per unit of finished product, a production of divinyl rubber for 1939 of 64,100 metric tons based on conserved alcohol is obtainable by the simple process of dividing the gross saving of 30,900 metric tons of alcohol by the 0.482 decrease in the alcohol consumption coefficient. (It should be noted that this figure is in line with the individual plant data available.)

As mentioned above, the Soviet press announced that the 1939 production of synthetic rubber was 14.9 percent greater than that of 1938, which is entirely consistent with the announced decrease in the consumption coefficient. Thus it seems reasonable to interpret the saving of alcohol claimed in the first article to mean a saving, not over what was actually used in 1938, but over what would have been used by 1938 methods to obtain 1939 output. To consider the saving as applicable within the year 1938 5/ -- that is, attributing to 1938 the production of 64,100 metric tons -- seems clearly erroneous because then the Commissar for the Chemical Industry, M. Denisov, who would undoubtedly attempt to present his industry in the most favorable light, understated by about 5,000 tons the "saving" which could be claimed for 1939: namely,

35,500 tons (73,600 x 0.482 tons). Furthermore, Denisov's statement clearly says that the 30,900 metric tons of alcohol were economized in 1939, not in 1938.

From the reported increase in rubber production in 1939 over 1938 of 14.9 percent, it may be calculated that the 1938 production was of the order of 56,000 metric tons. If one assumes the same increment of growth for 1938 over 1937, the production for 1937 is deduced as 49,000 metric tons. The 1936 production of synthetic rubber was reported as 44,000 metric tons. 5/ From these deductions, it may be seen that a normal growth pattern has taken place, considering improved technology as well as additions to capacity.

The derivation of an estimate of Soviet production of synthetic rubber in 1940 is of special importance. The Fourth Five Year Plan (1946-50) set a goal for the 1950 output of synthetic rubber at double the prewar level. It is assumed that this means twice the rate of 1940, the last full year before the German attack on the USSR.

In the absence of any absolute data for 1940 output, it is considered reasonable to apply the growth factor of 14 percent to the 1939 production figure arrived at above. Thus the 1940 production is calculated to be 73,000 metric tons of divinyl rubber. In addition, about 1,500 metric tons of Sovprene rubber were reportedly produced. 6/ The total of 74,500 metric tons of synthetic rubber produced in 1940 means that the production goal for 1950, based on the statement of the Fourth Five Year Plan (1946-50), would have been 149,000 metric tons.

Plant production analyses indicate an output of 143,000 metric tons in 1950. Thus it may be seen that the inference drawn above as to the goal for 1950 (149,000 metric tons) is reasonably substantiated by a 1950 estimate derived by plant analysis. (See Tab C.) It is estimated that during the Fourth Five Year Plan the production of synthetic rubber increased by more than $3\frac{1}{2}$ times, from 40,000 metric tons in 1946 to 143,000 metric tons in 1950. This accomplishment reflects a rapid recovery from World War II and the construction of additional plant capacity. Estimates of Soviet production of synthetic rubber for the years 1946-53 are consolidated in Table 2.*

* Table 2 follows on p. 7.

Table 2

Soviet Production of Synthetic Rubber (Estimated)
1946-53

	Thousand Metric Tons
1946	40.0
1947	50.0
1948	90.0
1949	122.0
1950	143.0
1951	172.0
1952	187.0
1953	206.0

2. Satellites.

Production of synthetic rubber in the Satellites is virtually negligible except for East Germany. Although a synthetic rubber industry has been planned in both Czechoslovakia and Poland, their combined production thus far has been only a few thousand metric tons. It is uncertain whether any production of synthetic rubber is underway in Hungary, and there is a complete lack of evidence on any present or projected production in Bulgaria, Rumania, and Albania.

Estimates of production of synthetic rubber in East Germany are based on both over-all industrial data and detailed information concerning the Schkopau plant, which accounts for the entire output in East Germany. Dismantling caused a drop in production in 1948 and 1949, but under the present rebuilding and re-equipment program the Schkopau plant has recently increased its 1955 planned goal from 60,000 to 70,000 metric tons. It is estimated that production increased steadily since 1949, as indicated in Table 3.* Poland's Six Year Plan (1950-55) foresees a goal of 13,000 metric tons of synthetic rubber by 1955, presumably to be obtained by the reconstruction of the former plant in Oswiecim.

In East Germany the production of synthetic rubber is concentrated mainly in the Buna S type (a copolymer of butadiene and styrene). About 90 percent of production is of this type, but other varieties and types are produced in smaller quantities, including Buna S-3, Buna SS,

* Table 3 follows on p. 8.

Table 3

Satellite Production of Synthetic Rubber (Estimated) a/
1946-53

Thousand Metric Tons

	East Germany	Poland	Czechoslovakia	Total
1946	23.9	N.A.	N.A.	23.9
1947	38.4	N.A.	N.A.	38.4
1948	30.7	N.A.	N.A.	30.7
1949	26.5	N.A.	N.A.	26.5
1950	41.5	2.0	0.3	43.8
1951	48.8	3.0	0.6	52.4
1952	52.0	3.3	0.7	56.0
1953	57.0	3.6	0.8	61.4

a. See Tab C.

Buna 32, Buna 85, Perbunan (Buna N), and Igetex. Czechoslovakia is producing largely neoprene rubber, and Poland is concentrating on the production of thiokol (polyalkylene polysulfides) (resistant to organic solvents -- that is, oil, gas, etc.).

B. Natural Rubber.

The Soviet Bloc has no Hevea rubber plantations (natural rubber is produced by the tree Hevea brasiliensis), the usual source of natural rubber. Attempts have been made in the USSR to cultivate latex-bearing shrubs such as kok-saghyz, guayule, milkweed, etc., as substitutes. Similar latex-bearing shrubs have been cultivated in Czechoslovakia in recent years, but annual production to date appears to be only about 100 to 125 metric tons.

Prior to the war the USSR planned to produce 30,000 metric tons by 1942, chiefly from a planned 500,000 hectares of kok-saghyz cultivation. These plans were never carried out, partly because they were unrealistic and partly because the war interfered with developments projected under the Third Five Year Plan (1938-42). Having lost a sizable portion of its acreage during the war, the USSR was producing only a few hundred tons of domestic natural rubber in 1946. There is some evidence

that at that time the USSR planned to have approximately 270,000 hectares under cultivation in 1950. At prewar yields this would have permitted an output in 1950 of at least 7,000 metric tons of domestic natural rubber. The fragmentary information available on actual postwar acreages and yields indicates that this plan was not realized, as is shown in Tab C. The estimated 1950 production is less than 2,300 metric tons, and increases in output after 1950 are not expected to be very large. In Table 4 is consolidated the production of domestic natural rubber in the Soviet Bloc.

Table 4

Soviet Bloc Production of Natural Rubber (Estimated)
1946-53

Metric Tons

	1946	1947	1948	1949	1950	1951	1952	1953
USSR	N.A.	400	800	1,500	2,300	2,500	2,700	2,900
Czechoslovakia	N.A.	N.A.	N.A.	56	110	125	135	160
Total	N.A.	400	800	1,556	2,410	2,625	2,835	3,060

C. Reclaimed Rubber.

1. Introduction.

Reclaimed rubber is a product resulting from the processing of scrap vulcanized rubber by mechanical, thermal, or chemical treatments. The types of reclaimed rubber are ground devulcanized scrap; rough, partially plasticized shoddies; and fully plasticized, smoothly refined reclaimed. Reclaimed rubber is used essentially for two major purposes: (a) to extend economically other types of rubber and (b) to provide certain desired characteristics in end items.

2. USSR.

Little information is available on postwar Soviet plant facilities and production of reclaimed rubber. A shortage of reclaimed rubber was reported in 1946, indicating that although output was somewhat higher

than during the war, it was still not sufficient to permit an increase in footwear production without a concomitant curtailment in technical goods (rubber belts, gaskets, rubber hose, etc.). The Fourth Five Year Plan (1946-50) established a goal of 56,000 metric tons to be achieved by 1950. There has been no propaganda as to the attainment of this goal, and it is doubtful that it was reached. Soviet production of reclaimed rubber is noted in Table 5. Details of individual plants are contained in Tab C.

Table 5

Soviet Bloc Production of Reclaimed Rubber (Estimated)
1946-53

Thousand Metric Tons

	USSR	Bulgaria	Czecho-slovakia	East Germany	Poland	China	Total a/
1946	21.0	N.A.	N.A.	N.A.	N.A.	N.A.	21.0
1947	23.0	N.A.	N.A.	N.A.	0.9	N.A.	23.9
1948	30.0	N.A.	N.A.	N.A.	1.9	N.A.	31.9
1949	37.0	0.1	6.0	N.A.	2.2	N.A.	45.3
1950	45.0	0.1	6.5	3.0	3.0	5.0	62.6
1951	50.0	0.1	7.0	1.8	4.0	5.0	67.9
1952	55.0	0.2	8.0	2.5	4.5	5.0	75.2
1953	61.0	0.2	9.0	3.5	5.2	5.0	83.9

a. No information is available on production or facilities in Albania, Hungary, or Rumania. Any production in these countries, however, would undoubtedly make up only a small percentage of these totals.

3. Satellites.

The Satellites also have endeavored to raise production of reclaimed rubber, and although their production is still relatively low, considerable progress has been made in Poland and Czechoslovakia. In view of the need for rubber in the Satellites, and the relative ease with which plants and materials could be made available for production of reclaimed rubber, it would seem logical that a more sizable industry would

have developed. There is no evidence, however, to support this proposition. Satellite production of reclaimed rubber, based on such evidence as plant analysis and press articles, is noted in Table 5. Details of individual plants are contained in Tab C.

III. Rubber Imports.

A. Natural Rubber.

Imports of natural rubber by the USSR and the Satellite countries are computed primarily from trade statistics of non-Bloc countries. Direct shipments to the Soviet Bloc as reported by major producing countries are easily obtainable. To these must be added re-exports and transit shipments destined for the Bloc. In addition, there is evidence of clandestine shipments not recorded in regular trade statistics, but they are not believed to be significant. Table 6 shows the apparent exports of natural rubber from the Free World to the Bloc based on the information described above. Detailed tables are contained in Tab D.

Table 6

Soviet Bloc Imports of Natural Rubber (Estimated) a/
1946-51

Thousand Long Tons

	1946	1947	1948	1949	1950	1951
USSR	9.5	35.0	100.0	105.0	82.5	62.5
Bulgaria	N.A.	0.3	0.1	0.9	0.7	0.3
Czechoslovakia	0.8	15.0	23.5	27.5	22.5	11.0
East Germany	N.A.	N.A.	0.9 b/	1.7 b/	0.5 b/	9.3 b/
Hungary	0.2	2.3	3.0	8.5	6.5	0.2
Poland	1.4	2.2	3.6	12.0	5.5	11.5
Rumania	N.A.	0.1	1.0	1.3	0.5	0.6
China	12.1	22.2	21.0	27.5	70.0	73.2
Total	24.0	77.1	153.1	184.4	188.7	168.6

a. Estimates of the Rubber Statistical Bulletin.
b. No estimate given by the Rubber Statistical Bulletin; shipments as noted. (See Tab D.)

Prewar imports of natural rubber by the Soviet Bloc countries were less than half the apparent shipments in recent years. A comparison of the rate of import discloses that imports of natural rubber into USSR increased by 160 percent from the period 1935-38 to 1948-51 as contrasted with an increase of only 25 percent for the European Satellites. Inasmuch as production of synthetic rubber within the Bloc has increased substantially during the past 15 years, these percentage increases are even more significant.

Soviet Bloc imports of natural rubber reached a high point in 1950 as a direct result of Communist China's procurement activities. China imported about three times more natural rubber in 1950 than in 1949. During 1950, available statistics reveal that all Bloc countries (except China) imported a smaller amount than in 1949. In 1951, East German, Polish, and Rumanian imports of natural rubber increased slightly, while those of other Bloc countries continued to decrease.

Imports of natural rubber by the USSR were reduced in 1951, partially as a result of shipping delays in 1951. Reports indicate that shipments during 1952 will make up for this decrease. During the first quarter of 1952, 48,846 long tons were shipped to the USSR; 69,000 tons were shipped by the half-year mark; and it is probable that close to 100,000 tons will be shipped during the entire year of 1952.

Data on trade in natural rubber within the Soviet Bloc are fragmentary. The USSR has sent small tonnage amounts to Rumania and Bulgaria. Czechoslovakia and China have a trade agreement which allows Czechoslovakia to receive rubber in exchange for other goods sent to China. The excessive imports of natural rubber by China in 1950 and 1951, believed to be considerably in excess of consumption, may in part have gone to Czechoslovakia. In addition, some of this rubber may have gone to the USSR. If rubber were re-exported, the USSR would be a logical recipient merely from a geographic consideration.

B. Synthetic Rubber.

East Germany is the largest Satellite producer of synthetic rubber. Information concerning exports of synthetic rubber to other Soviet Bloc countries is limited and conflicting. Synthetic rubber has been exported both on reparations account and through ordinary trade channels. Net imports of synthetic rubber by the USSR are particularly difficult to assess because of the lack of knowledge of the extent of Soviet exports to other Bloc countries. Trade agreement

information indicates that synthetic rubber has been exported from the USSR to Czechoslovakia, Bulgaria, Poland, and Rumania. Volume figures, however, are not available. It is estimated that more than 50 percent of East German production is consumed in Germany and that if all the remainder could be regarded as going into reparations, exports, and reserves, possible exports to the Bloc in 1951 could have been at a maximum of 24,000 metric tons. But not all East German exports of synthetic rubber go to the USSR, and, furthermore, adjustment for the export of synthetic and natural rubber from the USSR to the Satellites should be made.

Figures on imports of synthetic and reclaimed rubber by the USSR, and on imports of natural rubber, which have already been discussed, are shown in Table 7.

Table 7

Soviet Rubber Imports (Estimated)
1945-51

Thousand Long Tons

	1945	1946	1947	1948	1949	1950	1951
Natural	17	9.5	35.0	100.0	105	82.5	62.5 a/
Synthetic	9 b/	N.A.	0.1	1.0	5	16.0	21.0
East Germany c/	N.A.	N.A.	N.A.	1.0 d/	5 d/	16.0 d/	21.0 d/
Other	9	N.A.	0.1	0.01	N.A.	N.A.	N.A.
Reclaimed	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Total	26	9.5	35.1	101.01	110	98.5	83.5

a. Revised estimate of the Rubber Statistical Bulletin, Jul 1952.
b. Estimate of the Rubber Statistical Bulletin.
c. Imports from East Germany are given in metric tons.
d. [redacted] Soviet imports of synthetic rubber from East Germany for 1950 and 1951 were 15,000 and 18,000 metric tons, respectively. CIA estimates for years listed are preliminary figures, and further study of available data will yield more complete figures. 50X1

C. Rubber Products.

Inter- and intra-Bloc trade data also should be studied for rubber products -- chiefly tires. The significance of changes in levels of trade in raw rubber would be modified, depending on the quantities of fabricated products being traded in at the same time. Estimates of the level of this trade have not yet been prepared.

IV. Rubber Consumption by Major Uses.

A. USSR.

In the absence of any direct information on the magnitude of postwar consumption of crude rubber in the USSR, it is necessary to analyze the major categories of consumers of rubber and to estimate total consumption on the basis of developments in each category. To this end, rubber consumers have been divided first into two major categories: transportation and nontransportation. The former is analyzed in terms of three subcategories: (1) tire casings for automotive vehicles, aircraft, and motorcycles; (2) inner tubes for the foregoing; and (3) a residual class consisting primarily of bicycle tires and tire repair materials. The nontransportation category might be considered as a whole or broken down into the following subcategories: (1) rubber footwear; (2) soles and heels for leather footwear; (3) technical articles (for example, industrial belting, hose, cable insulation, and rubber products other than tires and tubes used in military end items); and (4) all other nontransportation uses (for example, drug sundries, toys, etc.).

1. Rubber Consumption for Transportation Goods.

a. Production of Tire Casings.

The first element of an estimate of rubber consumption in this category is necessarily an estimate of the unit production of tire casings. Absolute figures on production of motor vehicle tires in the USSR have not been published since before the war, and the last year noted is 1938, when 3,548,000 such casings were produced. In the postwar period the only aggregate data concerning tire production have been in terms of percentage increases over the preceding year. Such percentage figures have been published for the years 1947 through 1950. In addition, the Fourth Five Year Plan (1946-50) stated cryptically that 1950 tire production was planned to be trebled in comparison with prewar -- a planned output that is difficult to estimate quantitatively partly because of uncertainty as to precisely what is meant by the term "prewar" and partly because

of lack of absolute figures beyond the year 1938.

Aside from these indications, there is also a large amount of information concerning tire production at specific times in particular plants, based both on reports in the Soviet press [redacted] 50X1 50X1

Attempts have been made to obtain Soviet tire production based on announced yearly percentage rates of increase. This method of estimation faces the problem of obtaining a reliable figure for 1946 to which such percentage rates may be applied. Some effort has been made to relate this 1946 tire production figure to tire cord (cotton cord) (see Tab E), which also must be based on prewar levels and postwar percentages of yearly increases. These estimates also assume for the postwar years a certain percentage of tire cord produced by the chemical industry, which would be in addition to that produced by the textile industry and for which no postwar data are available.

There is insufficient evidence to make competent estimates of tire production from information on tire cord. It is to be clearly understood that the preceding statement means "current production," not production for 1940 or earlier. Additional evidence to support this position lies in the fact that production from 1945 to date placed emphasis on different sizes than were produced in 1940 -- that is, since the war there has been a distinct effort by the Russians to motorize their army. As a result, a large part of the tire production effort is directed toward truck tires, whereas emphasis in 1940 was on the more common sizes for passenger cars and trucks.

It is believed that this basis of calculation places undue reliance on 1945 data, and 1945, it must be admitted, was an abnormal year in the economy of any nation of the world. It is not believed, therefore, that data on which estimates are based for current production can be reasonably derived from information of 1945 vintage. Furthermore, because there are no firm data on the use of synthetic fiber tire cord in the USSR, any value taken for the amount of synthetic fiber cord would be a pure guess. This pure guess added to an estimate of cotton cord derived from prewar figures to which percentage increases are applied leads to a total which is considered far too unreliable to make this method worthy of more than academic interest.

Table 8 presents figures on Soviet production of tires of all types except bicycle, by individual plant.

Table 8

Soviet Tire Production (Estimated) a/
1946-53

Thousand Units

	1946	1947	1948	1949	1950	1951	1952 b/	1953 b/
Dnepropetrovsk	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Kazan'	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Kirov	90	150	300	600	950	1,000	1,100	1,200
Leningrad	300	400	600	650	700	750	825	900
Lopasnaya	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Moscow	230	490	900	1,275	1,515	1,650	1,800	2,000
Omsk	250	300	450	700	1,000	1,140	1,300	1,400
Riga	N.A.	N.A.	N.A.	4	4.5	5	6	7
Sverdlovsk/ Uktus	75	90	180	250	300	480	500	550
Ul'yanovsk	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Voronezh	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Yaroslavl'	2,000	2,400	2,700	3,100	3,600	3,960	4,300	4,700
Yerevan	30	41	75	115	170	200	220	240
Total c/	2,975	3,871	5,205	6,694	8,239.5	9,185	10,051	10,997

a. See Tab E.
b. 1952 and 1953 production figures have been obtained by adding approximately 10 percent to 1951 and 1952, respectively.
c. In view of the fact that no figures are available for some plants, these totals as computed by the plant method are believed to be a minimum.

b. Rubber Consumption by Types of Transportation Goods.

(1) Tires.

Information on the size and weights of Soviet-produced tires indicates that they are comparable to the weight of US tires, size for

size, and this basis has been used in deriving rubber consumption figures for the USSR.

The tires produced in the USSR include sizes for motorcycles, automobiles, light and heavy trucks, airplanes, artillery, and tanks. If a weighted average of the rubber content in all sizes of tires is based on the ratio of nine heavy tires to one light tire (this ratio was deduced from the average number of serviceable motor vehicles estimated in use for the years 1950, 1951, and 1952 7/), the average rubber content thus derived is 33 pounds per tire. Most researchers dealing with the Soviet rubber economy have used this figure for estimating rubber consumption in the tire industry, and it is considered by all as reliable.

(2) Inner Tubes.

The number of inner tubes produced in the USSR is assumed to be 1.5 per motor vehicle tire as compared with less than 1 tube per tire in the US. Like the average rubber content per Soviet tire discussed in the preceding section, the amount of rubber in each inner tube is calculated on the basis of data for typical US tubes assumed to be comparable to the average Soviet truck and passenger car tube. An average of 8 pounds (1.5 tubes at 5.33 pounds per tube) of rubber has been derived, based on US weights.

(3) Residual Subcategory.

There is no direct evidence at hand regarding the output of bicycle tires or tire repair material in the USSR. Tire repair material is probably used more widely in the USSR than in the US or UK because of the poorer quality of Soviet tires, and the production of bicycle tires is probably less. UK experience suggests that rubber consumption for these purposes would be about 10 percent of the amount consumed for tire casings.* This percentage factor is used to derive rubber consumption for such purposes in the USSR.

Soviet rubber consumption by types of transportation goods is shown in Table 9.**

* The Rubber Statistical Bulletin, published by the International Rubber Study Group, London, lists the consumption of rubber for this purpose in the UK. The 10-percent factor was calculated from these data.

** Table 9 follows on p. 18.

Table 9

Soviet Rubber Consumption for Transportation Uses (Estimated) a/
1946-53

Thousand Metric Tons

	Tire Casings	Inner Tubes	Other	Total
1946	44.5	10.7	4.4	59.6
1947	58.0	14.0	5.8	77.8
1948	77.9	18.8	7.8	104.5
1949	100.2	24.3	10.0	134.5
1950	123.4	29.9	12.3	165.6
1951	137.5	33.3	13.7	184.5
1952	150.1	36.4	15.0	201.5
1953	164.6	39.9	16.4	220.9

a. See Tab E for details on consumption patterns.

c. Types of Rubber Used for Transportation Goods.

The types of rubber used in manufacturing the various classes of Soviet rubber goods cannot be definitely proved. However, from information on individual plants, from plans for the industry, [redacted] it is apparent that a determined effort is being made by the USSR to maximize the use of domestic rubber, particularly synthetic, in the production of rubber goods. 50X1 50X1

A study of Soviet rubber fabrication methods indicates a trend toward greater use of synthetic rubber in tires. [redacted] as of November 1950, tires and tubes were being built of 100 percent synthetic rubber. 50X1 50X1

Chemical analyses of Soviet tires show that some truck tire treads are being made entirely of synthetic rubber, while the carcass is made of a combination of natural and synthetic rubber.

A formula, given below, possessing the indicated percentages of rubber, is considered to represent an over-all average of the ratios of types of rubber used for Soviet transportation goods (tires, inner tubes, bicycle tires, and repair material). (See Tab E

for detailed explanations.)

	Percentage of Rubber
Natural	23
Synthetic	75
Reclaimed	2

2. Rubber Consumption for Nontransportation Uses.

a. Problem of Estimating Consumption for Nontransportation Purposes.

The figures for nontransportation use of rubber are based on the assumption that it is one-third of total usage. This percentage, which seems to be valid for Western countries, may vary from year to year. However, in view of the meager data available on the nontransportation category of Soviet production of rubber goods, it is believed to be the most reliable yardstick to use.

Attempts have been made to break down the nontransportation use of rubber into subdivisions. One such breakdown resulted in a rubber consumption pattern for nontransportation purposes which varied between 30 and 39 percent of total consumption. Thus it is believed that a one-third ratio (comparable to the trend in other countries) may be a safer estimate than an attempt to break down the consumption item by item. This one-third ratio shows the following consumption (Table 10)* of rubber for nontransportation goods in comparison with that for transportation goods.

b. Types of Rubber Used for Nontransportation Goods.

In this category, especially footwear and a variety of mechanical goods, a considerable percentage of reclaimed and/or synthetic rubber can be and is used in the USSR.

The principal consumers of natural rubber in the nontransportation field would be the producers of drug sundries, who would require only a very small amount, quantitatively speaking.

* Table 10 follows on p. 20.

Table 10

Soviet Rubber Consumption for All Uses (Estimated)
1946-53

	Transportation	Nontransportation	Total
1946	59.6	29.8	89.4
1947	77.8	38.9	116.7
1948	104.5	52.2	156.7
1949	134.5	67.2	201.7
1950	165.6	82.8	248.4
1951	184.5	92.2	276.7
1952	201.5	100.7	302.2
1953	220.9	110.4	331.3

B. Satellites.

A European Satellite consumption pattern is not presented, because the existing data are so fragmentary and of such questionable accuracy that a detailed presentation would be misleading. It is believed, however, that existing evidence does support the general assumption that rubber availability and consumption in the European Satellites have been approximately equal since the war. For purposes of calculating stockpiles, therefore, these data have been omitted.

It is estimated that Communist Chinese availability and consumption of rubber were also approximately equal through 1949. Thus, in the years 1949, 1950, and 1951, consumption is estimated at 20,000, 25,000, and 30,000 long tons, respectively. A surplus tonnage of around 100,000 long tons had been accumulated by China at the end of 1951. It seems logical to believe that some or all of this tonnage has been traded to the USSR and/or other Satellites for finished end items and/or other considerations.

The above estimates rest on considerably less evidence than those for the USSR, and further intensive research is needed on this area.

V. Stockpiles.

There appears to be a deficit of rubber in the USSR for the amount of goods produced in 1946 and 1947. However, it is noted that 17,000 long tons of natural rubber and 8,975 long tons of synthetic rubber were imported in 1945 (as against 9,500 tons of natural and no synthetic* rubber in 1946). Some of this quantity of rubber may have been on hand at the end of 1945 and may consequently have supplied additional tonnage for use in 1946. Exports of synthetic rubber from East Germany also have not been determined for 1946 and 1947 and may have contributed additional quantities. Lacking these important figures, the stockpile as indicated in Table 11 must be considered as incomplete.**

An estimate of Soviet consumption by type of rubber for each year from 1946 to 1951 is believed to be unnecessary to determine whether the calculated stockpile consists entirely of natural rubber, since it is the belief of experienced rubber industrialists that only natural rubber is stockpiled. In order to break down consumption by type of rubber, it would be necessary to estimate the admixture factor (that is, the percentage of natural, synthetic, and reclaimed) for each category and/or subcategory. It can be safely assumed, however, that Soviet strategic stockpiles consist primarily of natural rubber, and the admixture factor for some or all consumption categories can be inferred.

It may be noted at this juncture, however, that, pending further investigation of Satellite consumption, it is assumed that consumption and availability are essentially in balance for the Satellites, excluding Communist China. This implies that any stockpiles existing in the Soviet Bloc are derived from an excess of availability over consumption in the USSR and Communist China.

Table 11 sums up the rubber situation in the USSR, showing imports of natural rubber, domestic production of all types, consumption of rubber, and stockpile. The stockpile shown in this table does not include that of China.***

* There is no record of synthetic rubber exports from Free World areas to the USSR in 1946.

** Table 11 follows on p. 22.

50X1

Table 11

Soviet Rubber Situation (Estimated)
1946-53

Thousand Metric Tons

	Rubber Supply				Rubber Consumption				
Year	Natural Imports [a]	Synthetic Imports (Mainly from East Germany)	Production [b]	Total	Transportation	Nontransportation	Total	Rubber to Stockpile	Stockpile (Cumulative)
1946	9.5	N.A.	61.0	70.5	59.6	29.8	89.4		
1947	35.0	0.1	73.4	108.5	77.8	38.9	116.7		
1948	100.0	1.0	120.8	221.8	104.5	52.2	156.7	65.1	65.1
1949	105.0	5.0	160.5	270.5	134.5	67.2	201.7	68.8	133.9
1950	82.5	16.0	190.3	288.8	165.6	82.8	248.4	40.4	174.3
1951	62.5	21.0	224.5	308.0	184.5	92.2	276.7	31.3	205.6
1952	100.0 [c]	N.A.	244.7	344.7	201.5	100.7	302.2	42.5	248.1
1953			269.9		220.9	110.4	331.3		

a. Long tons. These figures include natural rubber imports only.
b. Includes synthetic rubber, domestic natural rubber, and reclaimed rubber.
c. Estimated imports for 1952 on the basis of present trends.

TAB A

TYPES AND TECHNOLOGY OF SYNTHETIC RUBBER

Soviet articles have given indication of the extent and development of Soviet production of the various types of synthetic rubber.

Both butadiene-type rubber (produced from alcohol) and neoprene (Sovprene) were produced on an industrial scale in the USSR by the end of World War II. The following excerpts from a Soviet periodical 1/* indicate the extent of research and development made by the USSR in the synthetic rubber program:

> "Although study of copolymerization began very recently, very important practical results have already been obtained. At present, particularly after the study of copolymerization of butadiene with styrene and derivatives of acrylic acid, copolymerization in a number of cases is carried out in water emulsions without metallic sodium.
>
> "In recent years, a new and scientifically very interesting fact was discovered concerning the condensation, into a rubbery substance, under special conditions, of hydrocarbon which has no combined system of double bonds. To these compounds belongs isobutylene, which could be obtained from petroleum. Synthetic rubber from isobutylene received the name of opanol and vistanex.
>
> "Until very recently ethyl alcohol, as it is known, is obtained from raw food substances, potatoes and grain, was the raw material for obtaining synthetic rubber by S.V. Lebedev's method. Soviet scientists worked on . . . obtaining rubber from (other materials).
>
> "A rational technological scheme of converting ethylene gases caused by the cracking of petroleum into alcohol was developed. Thus, cheaper petroleum could be the raw material for obtaining rubber.
>
> "Scientists and engineers developed and familiarized themselves with a technical method of obtaining ethyl alcohol from wood waste products -- sawdust and shavings. A wide construction of plants for wood hydrolysis has already been developed. The synthetic butadiene alcohol rubber industry will gradually make a complete change to ethyl alcohol from raw

50X1

non-edible material-wood. According to the new Five Year Plan, 38% of the needs of the synthetic rubber industry will be covered in 1950 by ethyl alcohol from wood.

"Now, a method of obtaining synthetic rubber directly from petroleum which was developed by Soviet scientists is on the way to being put into operation in our country on a technical scale.

"The synthetic rubber industry is of greater importance than the natural rubber industry* - because it is capable of greater development. The quality of synthetic products can be more closely controlled, and tailor-made elastomers and copolymerisates with any desired set of properties can be produced at will."

A technological study of the Soviet synthetic rubber program 2/ reported that low, intermediate, and high styrene polymers of the butadiene/styrene type are being produced by the Russians, the low styrene types presumably for Arctic applications, the intermediate levels for general-purpose use (principally transportation items), and the high styrene types for use where thermoplastic materials are required.

This study concluded that, from a study of the information available, the technological status of synthetic rubber in the USSR is approximately equivalent to that in the US:

"In view of the rather noteworthy performance of Russian rubber in carcass stocks (on GR-S treads) and realizing that Russia has the technical know-how required for the production of synthetic polymers having butadiene/styrene ratios more suitable for tire treads than some of the earlier polybutadiene types, it is reasonable to conclude that the Russians could, through proper selection of polymers, produce an all-synthetic rubber tire suitable for use on small-sized civilian and military vehicles."

Sovprene, a special-purpose rubber, requires calcium carbide (acetylene) and chlorine. Raw materials for the requirements of this rubber production are available.

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* Presumably the program for development of domestically cultivated shrubs and plants producing a latex-like substance.

Butyl rubber is a copolymer of isoprene and isobutylene. The technology for the production of butyl rubber involves temperatures at as low as minus 140°C. The technical problems in the maintenance of this temperature are such that the production of butyl rubber is a highly specialized process. It is believed by rubber experts in the US that this technology, because of its complication and cost, is not likely to be used by the Russians.

For example, large quantities of methyl chloride, a refrigerant, are required for the maintenance of the low temperature in this technology. There is ample evidence to support the belief that methyl chloride is in short supply in the USSR. This one factor -- short supply of methyl chloride -- tends to substantiate further the doubt that the Russians are employing this particular specialized rubber technology. The fact that butyl rubber is used for highly specialized purposes and is not compatible with natural rubber and general-purpose synthetics lends further credence to the belief that the Russians are not producing this highly specialized synthetic.

No information has been seen showing Soviet interest in, or applications of, extenders in their production of synthetic rubber. (Extenders are various grades of petroleum oils that are added at the end of the synthetic manufacturing process. These extenders can be used to increase the production of any plant from 20 to 35 percent without increases in construction or equipment other than driers.) The use of extenders has been common practice in the US since early in 1951, and US rubber companies state that there is no reduction in the quality of the finished products.

TAB B

COMPUTATION OF SOVIET PRODUCTION OF SYNTHETIC RUBBER FOR THE BASE YEAR 1939

As indicated in the text of this report, estimates of Soviet production of synthetic rubber since World War II may be derived by applying the percentages given in the Fourth and Fifth Five Year Plans to an estimate of prewar production obtained by the use of data disclosed in two articles published in Soviet periodicals in 1940.

The first of these articles, which appeared in Industriya on 10 March 1940, revealed that the production of synthetic rubber in 1939 was 14.9 percent greater than in 1938 and that 30,900 metric tons of ethyl alcohol had been saved in 1939, thanks to improved techniques, in particular the use of a more efficient catalyst. The second paper by A.V. Petrenko of Glavkauchuk (Chief Directorate for Rubber) appeared in Kauchuk i Rezina, No. 4/5, 1-5 (1940). This paper was more technical in nature and presented four "basic technological indicators," the interpretation of which by those unskilled in the field of chemical technology has led to much misunderstanding and disagreement as to the production of synthetic rubber for 1939, which can be deduced from the data given by Petrenko and the information given in the Industriya paper.

The following passage has been translated from the Petrenko paper:

> "The use of the new catalyst made possible during 1939 a decrease in the consumption coefficient of alcohol of 0.482 tons per ton of (kauchuk*) rubber in comparison with 1938. A large quantity of rubber was produced by the synthetic rubber plants from this alcohol which had been saved.
>
> "The work of the synthetic rubber plants in 1939 gave the following basic technological indicators compared with 1938.

* The Russian word kauchuk means "pure rubber" and is a cognate of caoutchouc. The Russian word rezina, on the other hand, means "compounded rubber."

Table 1

"Indicators	1939	1938
1. The yield of divinyl based on decomposed alcohol, percent.	36.25	32.52
2. Alcohol in tons per ton of synthetic rubber.	2.806	3.288
3. The losses of pure divinyl in percent of the total divinyl in the contact gas.	6.34	10.38
4. The production of refined rubber in percent of the total output of alcoholic synthetic rubber over the year.*	57.1	44.5

* At the end of the year the output of refined rubber amounted to 70.4 percent."

Let us examine the four indicators given above. The first reveals an increase in divinyl yield. Yield is defined as the percentage of the raw material which is converted into a product. The second indicator indicates the consumption in tons of alcohol per ton of rubber produced. As was indicated in the body of the paper, this value is the consumption coefficient of alcohol. The third and fourth indicators are "in-process" loss and efficiency values, respectively, and will be discussed in detail below.

In order to interpret these data properly, one must first know something about the chemical processes involved as well as the methods of calculation used for deriving the indicators mentioned above and their proper use.

Butadiene, or divinyl, is produced by the thermal decomposition of ethyl alcohol under certain conditions of temperature and pressure and with the aid of a catalyst. As the state of knowledge of this production improved, new techniques and improved catalysts have brought about a continually improving chemical efficiency. Chemical efficiency is defined as useful output/input x 100 or actual production/theoretical production x 100. In other words, if the useful output is exactly equal to the input or the actual production is exactly equal to the theoretical production, then the chemical efficiency of the system is 100 percent.

In the production of butadiene rubber, there are two places in the system where significant losses occur. The first of these losses takes place in the conversion of alcohol to monomeric butadiene and the

purification of the monomeric butadiene, and the second loss is in the polymerization process, in which the monomeric butadiene is converted to the polymer. In the first step (conversion of alcohol to monomeric butadiene and purification of the monomer) the losses are small, but in the second step (polymerization) the losses are significant.

The reaction of the production of butadiene from ethyl alcohol proceeds according to the following scheme:

$$2\ C_2H_5OH = H_2C=\underset{H}{C}-\underset{H}{C}=CH_2 + H_2 + 2H_2O \qquad (1)$$

According to the laws of chemistry, the above equation must balance both chemically and algebraically. Chemically speaking, the equation is in balance because in the left member there are 4 carbon atoms, 12 hydrogen atoms, and 2 oxygen atoms, and in the right member there are 4 carbon atoms, 12 hydrogen atoms, and 2 oxygen atoms. The molecular weight of ethyl alcohol is 46.068, of butadiene 54.088, of hydrogen 2.016, and of water 18.016 (using the 1942 International Atomic Weights of carbon, hydrogen, and oxygen as 12.010, 1.008, and 16.000, respectively). Thus the chemical equation now becomes a mathematical equation:

$$2 \times 46.068 = 92.136 = 54.088 + 2.016 + 36.032 = 92.136 \qquad (2)$$

The equation is balanced. From this equation, one may see that by decomposing two molecules of ethyl alcohol, one may obtain one molecule of butadiene. Now, if the rules of stoichiometry are applied, it is seen that from 92.136 parts by weight of alcohol, 54.088 parts by weight of butadiene are formed according to theory. In other words, if the system operates at 100-percent efficiency, 1.703 parts of alcohol are required to produce one part of butadiene by weight (92.136:54.088::1.703:1). This means that, theoretically, 1.703 tons of alcohol are required to produce 1 ton of rubber if all the butadiene produced from the 1.703 tons of alcohol is polymerized without loss to rubber.

Let us deal first with the derivation of the rubber production of 1939 from the data given in the articles cited above. We have the following factual data:

1. A "saving" of 30,900 metric tons of alcohol was effected in 1939 over 1938.
2. 14.9 percent more rubber was produced in 1939 than in 1938.
3. The consumption coefficient for 1939 was 2.806 units of alcohol per unit of rubber produced, and for 1938, 3.288 units of alcohol per unit of rubber produced.

We must determine:

1. The amount of alcohol consumed in 1938 and 1939.
2. The amount of rubber produced in 1938 and 1939.

Therefore,

Let x = amount of alcohol in tons consumed in 1938; then

$$\frac{x}{\text{consumption coefficient}} = \frac{x}{3.288} = y, \text{ the amount of rubber produced in 1938} \qquad (1)$$

And let z = amount of alcohol in tons consumed in 1939; then

$$\frac{z}{\text{consumption coefficient}} = \frac{z}{2.806} = a, \text{ the amount of rubber produced in 1939.} \qquad (2)$$

But we are told by the Soviet press that the rubber production in 1939 was 14.9 percent greater than in 1938, or

$$a = 1.149y \qquad (3)$$

Substituting this value in equation (2), we see that

$$\frac{z}{2.806} = 1.149y \qquad (4)$$

If we now solve for y in equations (1) and (4), we find:

$$y = \frac{x}{3.288} = \frac{z}{3.224} \qquad (5)$$

and solving for x,

$$x = \frac{3.288z}{3.224} = 1.02z \qquad (6)$$

which means that in 1938, 2 percent more alcohol was consumed to produce 14.9 percent less rubber than in 1939, or, conversely, in 1939, 2 percent less alcohol was consumed to produce 14.9 percent more rubber than in 1938.

Now if we interpret that the saving of 30,900 metric tons of alcohol in 1939 over the 1938 consumption announced by the Soviet press means that in 1939, 30,900 tons less alcohol were consumed than in 1938, then the alcohol consumption for 1939 could be expressed as

$$z = x - 30{,}900 \tag{7}$$

and if we substitute the value for x derived in equation (6) into equation (7) we find:

$$z = 1.02z - 30{,}900 \tag{8}$$

and solving for z,

$$30{,}900 = 1.02z - z = z(1.02 - 1) = 0.02z \tag{9a}$$

$$z = \frac{30{,}900}{0.02} = 1{,}545{,}000 \text{ tons of alcohol consumed in 1939.} \tag{9b}$$

This value divided by the consumption coefficient for 1939 of 2.806 gives a rubber production for 1939 of 550,600 metric tons, A FIGURE WHICH IS OBVIOUSLY ABSURD.

On the other hand, if we divide the difference in the consumption coefficients for 1938 and 1939 (3.288 - 2.806 = 0.482) into the announced saving of 30,900 metric tons of alcohol in 1939 over 1938, a rubber production of 64,108 tons is derived for 1939. If this premise is correct, then 64,108 tons of rubber multiplied by the amount of alcohol consumed per ton of rubber produced in 1939 (2.806) gives an alcohol consumption of 179,887 tons for 1939. Thus we now assign a value to z:

$$z = 179{,}887 \text{ tons of alcohol consumed in 1939} \tag{10}$$

We now go back to the Soviet press and recall that the production of rubber in 1939 was 14.9 percent greater than in 1938, and we substitute in equation (3) the value for a, the rubber production in 1939, which we have calculated above, so that

$$64{,}108 = 1.149y \tag{11}$$

and solving for y, we find:

$$y = 55{,}794 \text{ metric tons of rubber produced in 1938} \tag{12}$$

If we now multiply this value by 3.288, the amount of alcohol consumed per ton of rubber produced, we find that 183,451 tons of alcohol were consumed in 1938, or

$$x = 183{,}451 \text{ metric tons of alcohol consumed in 1938} \qquad (13)$$

Now we have established in equation (6) that

$$x = 1.02z$$

and if we substitute the values for z and x calculated above (equations (10) and (13), respectively), we find:

$$183{,}451 = 1.02(179{,}887)$$

$$\frac{183{,}451}{179{,}887} = 1.02$$

$$\underline{\underline{1.02 = 1.02}} \text{ Q.E.D.}$$

From the above series of arguments, it is obvious that the division of the alcohol saved, an absolute figure given by the Russians themselves, by the decrease in alcohol consumed per ton of rubber produced, a figure reported by the Russians, does in fact give a reasonable value for the production of rubber in 1939.

If one now considers the indicators cited by Petrenko concerning the decreases in losses in the butadiene production stage and the increase in efficiency of the polymerization stage, the reasonable values for the 1939 rubber production of 64,100 metric tons and for the 1938 production of 56,000 metric tons become virtually unimpeachable.

Now, according to Petrenko, 2.806 metric tons of alcohol were required per ton of rubber produced in 1939. This relationship may be expressed mathematically as follows:

$$2.806 \text{ tons of alcohol} = 1 \text{ ton of rubber} + \text{losses} \qquad (1)$$

According to the rules of mathematics, one cannot equilibrate alcohol with rubber; so the equivalency of 1 ton of rubber in alcohol must be substituted in equation (1), so that

$$2.806 \text{ tons of alcohol} = 1.703 \text{ tons of alcohol} + \text{losses} \qquad (2)$$

The left-hand member of this equation may be properly termed "input," and the first term in the right-hand member may be called "useful output." Earlier in this explanation it was pointed out that chemical efficiency was defined as "useful output/input x 100." Thus the chemical efficiency of the production of rubber from butadiene produced by the Lebedev process as outlined above may be represented as

$$\frac{\text{useful output}}{\text{input}} \times 100 = \frac{1.703}{2.806} \times 100 = 60.7\%$$

Petrenko points out that the polymerization step mentioned above was carried out at a 57.1-percent efficiency and that the losses in the conversion of alcohol to monomeric butadiene step amounted to 6.34 percent. It is obvious that if the 6.34-percent monomer loss had actually been polymerized, at the same efficiency as the balance of the monomer, then 57.1 percent of the 6.34 percent would have been converted to rubber. In other words, one must convert the 6.34-percent loss into terms of efficiency. If the loss of monomer had not existed, then less alcohol would have been required to make the 1 ton of rubber which we have postulated. The conversion of loss to efficiency can be done by multiplying the 6.34 percent by the established efficiency of 57.1 percent:

$$6.34 \times 0.571 = 3.62 = 3.6\%$$

The now converted loss may be added to the 57.1-percent efficiency of the polymerization process to give an over-all efficiency of 60.7 percent, the same as was calculated above. The two "in-process" efficiencies added together give the over-all efficiency.

Applying the same line of reasoning to the 1938 data given in the Petrenko paper, one may show:

$$\frac{\text{useful output}}{\text{input}} \times 100 = \frac{1.703}{3.288} \times 100 - 51.8\% \text{ over-all efficiency}$$

The polymerization efficiency is given as 44.5 percent, and the loss in the conversion and purification step was 10.38 percent. Application of the same procedure as was described above gives:

$$(10.38\% \times 0.445) + 44.5\% = 49.1\% \text{ over-all efficiency}$$

The difference of 2.7 percent may be accounted for by reference to Petrenko's statements regarding the improvement of various stages of

the process: for example, the increase in yield of divinyl, change in the balance of the products of the catalytic decomposition of the alcohol, return to the system of pseudobutylene, etc. All of these improvements could account for the small unaccounted loss of 2.7 percent in 1938 and make the material balance exact in 1939.

It may be seen from the above argument that the values quoted by Petrenko as the average consumption of alcohol per ton of rubber produced takes into consideration all "in-process" efficiencies and are therefore "absolute consumption coefficients." The difference between the consumption coefficients for 1938 and 1939 divided into the total amount of alcohol saved by the improved techniques will give an absolute value for the rubber production for 1939 directly: namely, 64,100 metric tons.

It should be noted that this utilization of the consumption coefficient as the units of primary raw material per unit of finished product is the same procedure as is used in the US. It should further be noted that the only limitation which need be placed on the above calculations is the accuracy of the Soviet figures.

TAB C

DERIVATION OF SOVIET BLOC RUBBER PRODUCTION BY THE PLANT METHOD

I. Production of Synthetic Rubber.

The plant study method involves the collation of a mass of data [redacted] and a critical evaluation of those data to determine the output of individual plants. There are obvious limitations to this type of analysis. Data are fragmentary and often are not up-to-date and in this respect have a downward bias. This bias may be offset, however, by the judgments involved in calculating individual plant output. Experience in the use of this technique has demonstrated that it can be used to estimate production with a reasonable degree of accuracy. Cross-checks are provided by Soviet percentage figures. However, Soviet percentage rates of increase should be used with caution. 50X1

The following percentage rates of increase reported by the Soviet press for the various postwar years are given below:

	Percentage of Yearly Increase
1946	Not given
1947	Not given
1948	79 a/
1949	36 b/
1950	18 c/
1951	20 d/

a. Pravda, 20 Jan 1949.
b. Ibid., 18 Jan 1950.
c. Ibid., 26 Jan 1951.
d. Ibid., 24 Jan 1952.

For postwar years, individual plant studies reveal much data pertaining to capacities and output of synthetic rubber.

In support of the plant analysis method, the following evidence is submitted:

1. There is ample corraborative evidence that the SK plants at Kazan', Voronezh, Yefremov, and Yaroslavl' have a capacity of 30,000 metric tons each.*

[redacted] 50X1

3. [redacted] the four plants named above account for 120,000 metric tons of design capacity. 50X1

4. The plant at Voronezh has been increased by 10,000 metric tons through the installation of German Buna S rubber production equipment.

5. At Yerevan the original Sovprene equipment installed in 1940 provided for a 10,000-ton capacity of Sovprene. Since that time the capacity of this plant has been increased to 30,000 metric tons.

6. Two other plants known to be producing synthetic rubber are located at Sumgait and Temir-Tau, the capacities of which, based on the 10,000-ton units referred to above, must have a minimum capacity of 10,000 metric tons each of Buna S or divinyl rubber. [redacted] 50X1
[redacted] 50X1
[redacted] There are at least two other plants known to be under construction at present. 50X1

The known plants account for a design capacity of 180,000 metric tons per year. The estimate of actual production of 172,000 metric tons in 1951 is altogether consistent with the capacity of these units. The estimate for the 1952 production of 167,000 metric tons takes into consideration the plants presently under construction or completed about

* See individual plant analyses, pp. C-15 -- C-46.

[redacted] 50X1

which we have no firm evidence. Owing to the fact that rubber production is considered of top priority in the USSR, the close proximity of estimated production to design capacity is reasonable. Knowing the Soviet penchant for Stakhanovite activities, it is quite possible that these plants may be operated in excess of design capacity for stop-gap until new capacities are brought into production. 50X1

50X1

Of the eight Soviet plants producing synthetic rubber in 1951, four are known to be producing divinyl-type rubber; one, Sovprene; and one, Buna-S. The type of production in the remaining two plants has not been definitely established. Estimated production by plant is shown in Table 1.*

II. Production of Natural Rubber from Shrubs.

The production of natural rubber from latex-bearing flora has been calculated on the basis of acreage and yields as analyzed from the best information available. (See Table 2.)*

A list of processing plants has also been consolidated (Table 3)* with estimated production by plant. These production figures for the individual plants are preliminary and are based on fragmentary information. They should be considered with that qualification. However, it was felt that such a listing should be made in order to clarify status of plants sometimes listed as synthetic rubber plants by inexperienced analysts. For all practical purposes, the production estimates based on acreage and yields should be used.

III. Production of Reclaimed Rubber.

Information on production of reclaimed rubber by individual plants is fragmentary and incomplete. For only a very few plants are there any postwar details.

* Table 1 follows on p. C-5; Table 2, on p. C-9; Table 3, on p. C-11.

The Fourth Five Year Plan (1946-50) forecast a goal of 56,000 metric tons per year of reclaimed rubber to be produced by 1950. No announcements by the Soviet press concerning results obtained in this field have been noted.

Table 4* shows the location of plants producing reclaimed rubber in the Soviet Bloc.

* Table 4 follows on p. C-12.

Table 1

Soviet Bloc Production of Synthetic Rubber*
1946-53

Metric Tons

Location	Plant	Type of Rubber	1946	1947	1948	1949	1950	1951 a/	1952 a/	1953
USSR										
Kazan'	SK-4 (Divinyl) Kirov (741)	Butadiene from alcohol	15,000	15,000	20,000	30,000	30,000	30,000	30,000	30,000
Kemerovo b/	SK-3 Ruda									
Krasnoyarsk		N.A.	0	0	0	0	0	5,000	7,000	10,000
Kursk b/	SK-6 Resina									
Sumgait	SK-7	Butadiene from petroleum sources	0	0	0	0	0	7,000	8,000	10,000
Tambov b/	SK-5 Gigant									
Temir-Tau	SK-2	Whether Sovprene or butadiene from acetylene acetaldehyde is not determined	0	0	0	0	0	5,000	8,000	12.000
Usol'ye		N.A.	0	0	0	0	0	0	0	N.A.
Voronezh	SK-2 (Buna S) Kirov	Butadiene from alcohol, plus styrene	N.A.	N.A.	10,000	22,000	38,000	40,000	44,000	49,000
Yaroslavl'	SK-1 (Divinyl) Yarak (739)	Butadiene from alcohol	22,000	25,000	30,000	30,000	30,000	30,000	30,000	30,000

* Footnotes for Table 1 follow on p. C-7.

Table 1

Soviet Bloc Production of Synthetic Rubber
1946-53
(Continued)

Metric Tons

Location	Plant	Type of Rubber	1946	1947	1948	1949	1950	1951 a/	1952 a/	1953
USSR (Continued)										
Yefremov	SK-3 (Divinyl)	Butadiene from alcohol	N.A.	5,000	15,000	20,000	25,000	30,000	30,000	30,000
Yerevan	SK-1 (Sovprene) Kirov (742)	Sovprene; possibly also butadiene and/or butadiene-styrene	2,500	5,000	15,000	20,000	20,000	25,000	30,000	35,000
Total USSR			40,000	50,000	90,000	122,000	143,000	172,800	187,000	206,000
East Germany										
Schkopau	Bunawerke	Buna S (mainly); other varieties	23,997	38,400	30,700	26,500	41,500	48,853	52,000	57,000
Poland										
Debica	Stomil	Butadiene from alcohol	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Zarow (Saarau)	Silesia	Thiokol	N.A.	N.A.	N.A.	N.A.	2,000	3,000	3,300	3,600

Table 1

Soviet Bloc Production of Synthetic Rubber
1946-53
(Continued)

Metric Tons

Location	Plant	Type of Rubber	1946	1947	1948	1949	1950	1951 a/	1952 b/	1953
Czechoslovakia										
Ostrokovice	Bata	Chloroprene (neoprene)	N.A.	N.A.	N.A.	N.A.	300	600	700	800
Teschin		Butadiene from alcohol	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Total Satellites			23,997	38,400	30,700	26,500	43,800	52,453	56,000	61,400
Grand Total			64,000	88,400	120,700	148,500	186,800	224,453	243,000	267,000

a. 1951 and 1952 production estimates were each extended by approximately 10 percent to equal 1953 estimated production.
b. There is no evidence that these plants have produced synthetic rubber in postwar years.

Table 2

Production Estimates of Soviet Natural Rubber from Shrubs

I. Area (Hectares) a/*

Year b/	Kok-saghyz	Other	Total
1940	61,900	4,600	66,500
1949	60,000	8,500	68,500
1950	70,000	12,000	82,000
1951	90,000	15,000	105,000

II. Yield as Roots (Raw) (Centners per Hectare) c/

1940	N.A.	N.A.	N.A.
1949	7	16	8.0
1950	9	18	10.0
1951	8	15	9.0

III. Production d/ (in Centners) e/

1940	N.A.	N.A.	11,000
1949	7,896	7,098	14,994 f/
1950	11,844	11,050	22,898
1951	13,536	11,060	24,596

IV. Plan

Year	Acreage (Ha)	Production (Metric Tons)
1950	270,000	7,200

* Footnotes for Table 2 follow on p. C-10.

Table 2

Production Estimates of Soviet Natural Rubber from Shrubs
(Continued)

a. 1 hectare (ha) equals 2.471 acres.
b. 1940 area obtained from Sotsialisticheskoye Zemledeliye, 25 Apr 1946; area noted for 1949, 1950, and 1951 based on newspaper reports.
c. Estimates of yield are based on reports of plans and accomplishments as modified by US agricultural experts with long experience in the USSR.
d. Calculated on basis of different quantities of rubber derived from various types of rubber plant roots. The percentage of rubber production to the total root yield varies from 1.5 to 10 percent for different varieties. These percentages are based on official publications as modified by judgment of analysts.
e. 10 centners equal 1 metric ton.
f. Production in 1946 was only a few hundred tons and by 1948 was still less than a thousand tons.

Table 3

Soviet Bloc Production of Natural Rubber a/
1946-53

Metric Tons

Location	Region	1946	1947	1948	1949	1950	1951	1952	1953
USSR									
Dankovo	VII								
Livny	VII				100	100	100		
Madagis	V			100	100	200	200		
Maykop	IV			100	200	200	200		
Makoshino	III								
Moscow	VII			100	300	400	500		
Plavsk	VII								
Shurab	XB		200	200	200	300	300		
Tambov	VII								
Tash-Sari	XB		200	200	300	500	500		
Uman'	III			100	300	500	500		
Zhlobin	IIB					100	200		
Total			400	800	1,500	2,300	2,500	2,700	2,900
Poland					56 b/	110	125	135	160
Other Satellites									
Grand Total			400	800	1,556	2,410	2,625	2,835	3,060

a. Spaces left blank in this table indicate that data are not available.
b. [redacted] 650 tons of kok-saghyz roots from shrubs grown in Czechoslovakia were shipped to Polish plants, which produced approximately 56 tons of crude rubber. The locations of these processing installations in Poland are not known.

50X1

S-E-C-R-E-T

Table 4

Soviet Bloc Production of Reclaimed Rubber a/*
1946-53

Metric Tons

Location	Plant	1946	1947	1948	1949	1950	1951	1952 b/	1953 b/
USSR									
Cheboksary	Factory for Industrial Technology No. 320								
Ivanovo	KIP						1,000		
Kalinin									
Kazan'									
Kiev/Darnitsa	Krasnyy Resinochik					2,000	2,800		
Kursk									
Leningrad						15,000	15,000		
Lopasnya						6,000	6,000		
Moscow	Provodnik					6,000	6,000		
	Krasnyy Bogatyr								
Tashkent									
Tbilisi									
Uritsk						1,000	2,000		
Vitebsk									
Yaroslavl'	Yarak					15,000	18,000		
Total		21,000	23,500	30,000	37,000	45,000	50,000	55,000	61,000

* Footnotes for Table 4 follow on p. C-14.

Table 4

Soviet Bloc Production of Reclaimed Rubber a/
1946-53
(Continued)

Metric Tons

Location	Plant	1946	1947	1948	1949	1950	1951	1952 a/	1953 b/
Satellites									
Bulgaria									
Sofia	Bakish (Georgi Dimitrov)				90	90	100	150	200
Rumania									
Baicoi	Banloc								
Czechoslovakia									
Gottwaldov/Zlin	Bata				6,000	6,500	7,000	8,000	9,000
East Germany									
Gotha Hoerselgau Meuselwitz Schoenebeck	Gummitechnik Gotha Vereinigte Gothania Heimer, Pilz & Soehne						180		

Table 4

Soviet Bloc Production of Reclaimed Rubber a/
1946-53
(Continued)

Metric Tons

Location	Plant	1946	1947	1948	1949	1950	1951	1952 a/	1953 b/
Satellites (Continued)									
East Germany (Continued)									
Waltershausen/Thuringia Zipsendorf	Schlauch & Gummi Regeratwerke						1,600		
Total						2,977	1,780	2,500	3,500
Poland									
Krakow Poznan Bolechowo	Semperit Stomil								
Total				1,900	2,200	3,000	4,000	4,500	5,200
China						5,000	5,000	5,000	5,000
Grand Total						62,560	67,784	75,150	83,900

a. Spaces left blank in this table indicate that data are not available.
b. 1951 and 1952 production estimates were each extended by approximately 10 percent to obtain estimated production for 1952 and 1953.

TAB C

APPENDIX A

SOVIET BLOC SYNTHETIC RUBBER INSTALLATIONS

USSR

1. Kazan'

Location: In SE part of town between RR line and village of Voskresenskoye. 1/*

Labor: Plant is said to have employed 10,000 workers in 1941 in three shifts. 1/ There were 1,250 employees in addition to about 300 to 400 overhead workers. 2/

Production: Construction of plant began in 1932, and parts began operating in 1936. 3/ The SK-4 plant was planned for an annual production of 40,000 tons of commercial rubber; however, the production averaged 30,000 tons per year owing to the shortage of alcohol. 2/ The works SK-1 to SK-4 were originally planned with capacities of 10,000 tons, which were increased to 15,000 tons in 1936. Since 1938 capacities were expanded to 30,000 tons for SK-1 to SK-3, while SK-4 could have increased to 40,000 tons per year. 2/ It was reported that this plant was equipped during the war with evacuated machinery from SK-2 plant. Subsequent to cessation of hostilities, the plant utilized German machinery and personnel. 4/ Soviet press reported that workers of Plant 741 Kirov resolved to complete the prescribed work quota by 5 December 1947. They decided to produce at least 8% more synthetic rubber, reduce

50X1

USSR (Continued)

1. Kazan' (Continued)

the amount of alcohol in production of rubber, which will make it possible for other plants to produce 1 million pairs of overshoes and to increase working efficiency by 31.4% in comparison with 1946. 5/ German specialists from Bunawerke (Schkopau) deported to USSR are reported to be working in Kazan' in the setting up of plant similar to and copied by the Russians of Bunawerke at Schkopau. It was stated that construction would take from 3 to 5 years for completion of the plant. 6/

Raw Materials: Receives alcohol from plant at Chad, Molotov Region. 7/ The energy supply came from the electrical works in Kazan' from which steam was also supplied. In the winter the supply of steam was much too small. The workshops in this plant were able to manufacture only small equipment. 2/

2. Kemerovo (55°21'N-86°02'E) Region IX AAF 161
SK-3 (Sovprene)

Location: S of main street of Kemerovo, opposite old chemical plant W of RR line to Novosibirsk. 1/ In Prokop'yevsk or Stalinsk. 2/ Kemerovo Chemical Plant, Kombinat 325, on outskirts of Kemerovo. 4/ Located between ATZ plant and Zavod 510. 5/

Production: Reported to be under construction in 1942, and Germans believed operation in 1942 foreseen. 3/ Construction of plant started in 1945; completed in 1947. Dismantled machinery from Bunawerke at Auschwitz was stored in open (indicating probably planned synthetic rubber plant). 4/ Plant was reported still under construction (in May 1948). 1/ [redacted] 50X1

[redacted] 50X1

USSR (Continued)

2. Kemerovo (Continued)

[redacted] 50X1

Comment: A plastics plant is located here, and this may be the plant referred to as a synthetic rubber plant.

3. Krasnoyarsk (56°02'N-92°48'E) Region XI AAF 159

Location: Across the river from Krasnoyarsk in Zlobina, 4 km E of RR station. 1/

Production: Synthetic rubber combine was established 1941-42. 2/ Construction of a synthetic rubber plant was to begin in 1947. 3/ Work began this year on eight buildings in a 2 sq km area. 1/ Only the foundations were completed by September 1948; to become a rubber manufacturing plant; will take three more years to complete. 4/ 5/

4. Kursk (51°39'N-36°10'E) Region VII AAF 234

Location: In the small village of Vvedenskoye, 11 km SE of Kursk. 1/ Approximately 8 km SW of Kursk, about 500 m W of Kursk-Medvenka highway, and about 800 m N of Kursk-Ryshkovo RR line. 2/ 3 km SW of Ryshkovo, surrounded by farmland on all sides. 5/

Production: According to PWs who were captured in Kursk area in 1943 and worked in plant grounds till PW camp was closed down, the wall surrounding plant was already standing when first German troops marched through in 1941, and outer walls of the

USSR (Continued)

4. Kursk (Continued)

now finished buildings had been built to a height of 4 m. Construction was continued in 1945. Besides the finished buildings, there are a number of finished foundations; more are planned. 2/

According to publications of Soviet government, construction was undertaken in 1936. (This was confirmed by a Russian chief engineer.) 3/ The project at that time included one installation for synthetic rubber according to IGF procedure, capacity 10,000 tons. Further construction was undertaken only in 1946. (Note: None of facilities noted indicate synthetic rubber included.) 4/

Plant supposedly made trial production for a short time at the end of 1947. [redacted] 50X1

[redacted] 50X1

[redacted] 2/ The full production of this plant is to go into effect in the summer of 1948. 2/ 50X1

Plant is still under construction and machines are just being installed. PWs, who claim to know, state machinery being installed is usually used in the manufacture of synthetic rubber. 5/

[redacted] synthetic rubber plant RTI was scheduled to begin production on 1 May 1948. Equipment arrived from Berlin Buna Synthetic Rubber Plant by train between May 1945 and October 1945. Installation nearly completed. (Nov 47) 6/ 50X1

Lab production started beginning of 1948. Workshop believed to manufacture small quantities of buna from limestone and coal. 7/

Some PWs report that there are two factories 3 km apart. Construction was said to have begun before the war, but was suspended, and in May 1945 started again. In October 1948 the first rubber raw material is said to have been worked. 8/

USSR (Continued)

4. Kursk (Continued)

[redacted] the plant was officially opened in September 1948, but was not up to full production. 9/ 50X1

Comment: Although this location has been reported repeatedly as being a synthetic rubber plant, equipment and details on plant installation do not substantiate this. Further information is needed to establish the presence of actual synthetic rubber manufacturing facilities.

5. Sumgait SK-7

Location: Location [redacted] is Baku. 1/ 50X1
SK-7 is probably Azerbaydzhan synthetic rubber plant. Located in Black City on north edge of Budennyy refinery. 2/

Production: Using petroleum gases, plant was under construction during early years of WW II. Reportedly in operation in 1942 and was to have a capacity of 12,000 tons per year. 1/
Recently a research plant for the production of rubber from petroleum gases according to the improved Bysov method has been built in Baku; in Sumgait near Baku a plant for manufacturing 12,000 tons per year has now been built; the rubber will be manufactured from petroleum gases through ethylene and alcohol; furthermore, isobutyl, butyl, and amyl alcohols, as well as sulfuric acid, will be produced. 1/
[redacted] it was under construction in 1939, with production of butadiene-type rubber planned from oil. 3/ 50X1
[redacted] 50X1
[redacted] no definite information has proved that it is not operating. 4/ 50X1
Synthetic rubber (used at Krasnyy Oktyabr fabricating plant) believed to have come from

USSR (Continued)

5. Sumgait (Continued)

Baku, according to PW. 5/
Factory No. 142 produces synthetic rubber. Only part of works complete. 6/

Raw Materials: Synthetic rubber production based on petroleum has been intensified; ethylene from refinery gases is converted into ethyl alcohol, which is transformed by catalytic process into butadiene and the latter is then polymerized under pressure. This process (synthetic rubber based on petroleum sources), which has been employed for 10 years at Sumgait refinery, is now to be utilized to a greater extent. 7/
Technical processes worked out at Letter factories were subsequently applied at SK factories for industrial use. Among them, Baku synthetic rubber plant using the Byzov method of latex manufactured from petroleum by-products. 8/
Now, a method of obtaining synthetic rubber directly from petroleum which was developed by Soviet scientists is on the way to being put into operation in our country on a technical scale. 9/
(Note: This appears to indicate that the Sumgait plant was not in operation in 1948.)

6. Tambov (52°43'N-41°27'E) Region VII AAF 166 SK-5

Location: 4.5 km NE of RR station. 1/ 4.5 miles N of Tambov RR station and 1 mile NNE of civilian airfield. 3/

Production: Reported half completed by the end of 1941; full operation in 1942 foreseen. Capacity reported at 20,000 tons per year. 4/ Equipment removed during war was reported being reinstalled and replaced. 5/ Building under construction (June 1948); equipment not fixed and production not started. 6/ [redacted] 50X1
[redacted] at least part of synthetic rubber plant 50X1

USSR (Continued)

6. Tambov (Continued)

existed and was in operation before the war. Was planned to be in operation in early 1950. 2/ Jap PW reported area consisted of about 14 buildings, 6 of which were under construction (June 1946-May 1947). 3/

7. Temir-Tau (50°05'N-72°56'E) Region XA AAF 238
SK-2 (Sovprene) No. 727

Location: 40 km WNW of Karaganda. 1/ Located just S of point where RR Karanganda-Akmolinsk crosses the Nura River; situated on W side of RR line and at S end of Samarkand. 2/ Immediately S of carbide plant. 9/

Labor: Since 1948, 1,200 Russians per shift, two 8-hour shifts daily. 9/

Production: Because of presence of water, limestone, Karaganda coal, and consequently electricity, development of the industrial town next to Samarkand was planned in the First Five Year Plan (1928-33). In 1930 the site was surveyed, and during 1931-33 forced labor was brought in to build the town and work in industries. 3/
In 1941, Karigres, the Karaganda Electro Power Plant, was completed. In 1943 the SK plant, which changed its name in July 1947 from wartime code number 727, began to operate. The SK plant was built from equipment of the synthetic rubber plant in Gor'kiy, which was transferred to Temir-Tau (the carbide plant in its entirety) during the war. Besides the carbide plant and the main synthetic rubber plant (under construction), other installations included a lime kiln, a carbon electrode plant, a machine parts plant, a research laboratory, and various other plants and sections.

50X1

USSR (Continued)

7. Temir-Tau (Continued)

SK-2 factory in Karaganda was completed in 1942 for the production of Sovprene rubber, and plant utilized German engineers and workers after the cessation of hostilities. It is now possibly engaged in Buna production (butadiene?). Reportedly produces for aircraft needs. 4/

It was reportedly planned to re-equip the factory by installing acetylene-acetyaldehyde groups. Production was expected to start in 1949. 5/

Synthetic rubber plant under construction in 727 area was reported to be 20% complete and expected to be completed in 1949. 6/

Project (synthetic rubber plant) begun February 1948 and slated to be completed by Soviet convicts by the end of 1950. 7/

Project reportedly scheduled for completion by mid-1950, with expansion already being considered. German-made machinery in area in October 1948 ready to be installed. Adjoining carbide plant to furnish raw materials. 8/ According to Russian engineer will produce crude rubber. By November 1949 supposed to be operating, but because of financial difficulties, will be 1 May 1950 before operational. [redacted] 50X1

[redacted] plant is to be extended to S and to E, and buildings are to be built in NE corner. Areas are being surveyed and leveled. 9/ 50X1

Raw Materials: Heard that plant for synthetic rubber, located adjacent to 727 Carbide Plant, was scheduled to be completed by 1950 and would then use all the carbide that this plant produced. Approximately 130 tons of carbide produced daily at that time. 10/

8. Usol'ye — Region XI AAF 200

Location: In the vicinity of Irkutsk and Cheremkhovo, on Angara River in East Siberia. 1/

USSR (Continued)

8. Usol'ye (Continued)

Production: A synthetic rubber plant was scheduled. 1/

Raw Materials: A synthetic rubber plant, using carbide, was reported. 2/

9(a). Voronezh (51°40'N-39°12'E) Region VII AAF 234
SK-2 Kirov (Old Section)

Location: SE of town of Voronezh, 600 m E of Voronezh River. 5/

Labor: 3,000 Russians in three 8-hour shifts daily in old part of plant. 15a/ From 1945 to 1947, an average of 750 PWs worked in old part of plant in one shift on construction. Between 1945 and 1947 the number of Russians was steadily increased from 300 to 1,000. After October 1947, PWs no longer worked there, and average of 2,000 Russians worked in old part of plant. 15b/

Production: One of the original four synthetic rubber plants of the USSR, with capacity of 10,000 tons per year; increase in 1936 to 15,000 per year; and since 1938 had capacity of 30,000 tons per year. Reportedly went into production in 1932. 1/

Construction of Kirov synthetic rubber plant at Voronezh was begun in 1930 or 1931 with the aid of US engineers, and completion of construction was planned in 1936. Parts of the plant are believed to have begun production in 1932. 1942 output is reported at 9,600 tons, with 10,000 tons planned. 2/

Plant was partly evacuated, presumably to Tomsk. 3/

Pravda, 25 September 1947, reported that Voronezh plant named Kirov was once one of largest producers of synthetic rubber in the country. It was completely destroyed during the occupation but after large-scale restoration work has now gone back into operation. Plant was about 40% destroyed by the war, and all machinery removed. Mass

USSR (Continued)

9(a). Voronezh (Continued)

production is based on the Lebedev method. 4/ [redacted] construction of plant commenced in 1928 and that it was in operation until 1941. Production started again at the end of 1947 on a small scale. [redacted] 50X1 50X1 50X1

[redacted]

The plant suffered heavy damage from artillery fire during war. Reconstruction of plant began in 1945 and was completed in July 1947. During the time of observation, plant was undergoing repair of war damage and was not in operation. When production started in July 1947, all PWs were transferred. 6/

During the war, plant was severely damaged (about 50%). Reconstruction began in 1944 and is expected to be completed in August 1947. One building which originally consisted of only 3 stories now has 11 stories. According to a pictorial display depicting the plant's future production, posted on the bulletin boards on 7 November 1946, the plant was scheduled to start production in August 1947. It is believed that this was accomplished ahead of schedule, being generally completed in November 1946, 4 months before the target date of March 1947. Occasional lack of construction material was the only bottleneck, preventing an even earlier completion of the project. 7/

Soviets dismantled the machinery during the war and destroyed the plant buildings. Reconstruction started after the war. The old machinery was

USSR (Continued)

9(a). Voronezh (Continued)

partially reinstalled. Enlargements and modernization started in early 1948. [redacted] 50X1
[redacted] only raw caoutchouc at the old plant. 50X1
It was planned to convert the old plant, in order to obtain the same type of process as the former Schkopau buna plant being reconstructed here. 13/ [redacted] one 50X1
chemical section was in operation and alcohol and petrol tanks, as well as subterranean oil storage (all undamaged) were in operation. 9/
[redacted] several small 50X1
bales of synthetic rubber, without visible markings or trademarks, being transported from one section to another. 11/
Old plant is only in experimental stages. No expansion projects are planned for old plant, but heard from co-workers that new plant is to be expanded during 1950-51. 11/
Produces synthetic rubber product in granular form. [redacted] product 50X1
serves as base in making buna, and a better product will be made in new factory together with production of consumer goods. [redacted] 50X1
[redacted] 50X1
[redacted] 14/ Old plant produces 50X1
1,700 tons of synthetic rubber per month. (New plant not producing as yet.) 15a/
Production in old part of plant began in October 1947. 15b/ Equipped with machinery to make rubber from raw products to finished products. When all other installations fail, this building can produce about 25% of plant capacity (believed to be old plant). 15c/
In old part, black rubber in sheets and white rubber in blocks were produced. 16/
Finished or rolled rubber plates were 1.10 to 1.20 sq m and 3 cm thick. Rubber itself had a yellow color. After rubber plates were packed in cellulose sacks, they were loaded on

USSR (Continued)

9(a). Voronezh (Continued)

trucks and sent into city. Production rate was said to have been two loads of 3-ton trucks a day. 17/ Finishing plant for raw rubber contained approximately 40 to 50 boilers, in which liquid was transformed into rubber. Raw rubber was stacked in lumps around iron bars, which were hanging from cover of boiler. Plant was completed in fall of 1947. Only one-third of plant was working when source left, other 2/3 being under construction (June 1949). [redacted] synthetic rubber was made from spirits made from corn. Approximately 10 tank cars with spirit and 4 tank cars with crude oil for the boilers arrived per week. 18/ 50X1

Rubber process included paste (yellow-white) prepared and produced in workshop in large containers. From there, pumped through pipes to workshop, where alcohol was mixed in, and then through pipes to large distributor station, later filtered, cleaned, and then cooled and stored for future production of rubber plates and rubber blocks. After cooling, paste pumped to rubber rolling mill, where rolled and packed to ship to SK-1 Leningrad. Believed to be working in August 1947 at 60% capacity. 19/ Production about 75 tons of synthetic rubber from alcohol in 24-hour period. Production had not begun in new buna works. Daily delivery of about 4 tanker wagons, each of 50 cu m ethyl alcohol 96% pure, part from Voronezh and part from Hungary. Divinyl was also delivered two or three times a month in 20 to 25 barrels of 200-liter capacity each; one tanker wagon of hydrochloric acid and one tanker of another acid (name unknown) were delivered once a month. The unknown acid was used in catalysis. Soda solutions (saline?) were delivered by tanker wagon in unknown quantity. About one 60-ton RR wagon of a greyish mineral received per month. This was ground to dust and

USSR (Continued)

9(a). Voronezh (Continued)

used in catalyzers. Ether in balloons came by lorry. 20/

In December 1948, plant operated at 80% capacity. Raw materials included 10 to 15 wagons weekly of alcohol, clay-like material, white, which was mixed with water and pressed through machine and looked like macaroni. Daily supply of 15,000 kg crude oil, six tank wagons per week; paraffin. 21/

Kirov plant used alcohol from potatoes and corn. Chemical divinyl used in production of synthetic rubber. [redacted] 4 liters of 96% alcohol were used to produce 1 kg of synthetic rubber. 22/ 50X1

Raw materials included ethyl alcohol, about 10 to 15 RR tank wagons daily. Sulfuric acid and hydrochloric acid also arrived. Catalyst was earthy, crumbling, yellowish gray substance; about 5 to 10 tons were delivered daily by rail. For new buna plant, only raw material consignment was ethyl benzene (aethyl benzol) in September 1949 in six RR tank wagons. Production in new buna section was to start in 1949. 23/

500 pieces of black rubber 2 x 2 x 0.04 m each were produced daily. 25/ Approximately 15 to 18 40-ton RR wagons (of rubber) left works daily. Rubber was dispatched in form of 50 cm sq x 25-30 cm thick blocks of black, white, and red color. 24/

Rapid processing method. Director of Voronezh "Kirov" plant, Matveyev, stated: "In order to accelerate rubber production tempo, we are introducing a rapid rubber-processing method which yields manufactured rubber in an unending stream. This method will increase the yield from every machine by 25 to 30%. Stakhanovite workers of plant have shown interesting short cut through which the chemical reaction necessary to obtain synthetic rubber is accelerated from 10 to 11 hours." 26/

USSR (Continued)

9(a). Voronezh (Continued)

Raw Materials: Alcohol, which arrived by RR tank, was said to have originated in Hungary and Rumania from corn or grain. About four to five RR tank cars arrived each day full of alcohol, which was stored in containers. 8/
About 400 tons of coal are needed daily and received by RR (for fuel). 10/ Weekly about eight RR POL carloads of unknown liquid arrive at plant. 11/ Old plant uses 10 to 12 60-ton tank cars of pure alcohol (? time unit). [redacted] 50X1
[redacted] this alcohol is superior to vodka. 50X1
[redacted] large amounts of lime but no 50X1
scrap rubber. 12/
Production was based on utilization of alcohol.
[redacted] PW that they repeatedly 50X1
found alcohol in old, underground pipelines and that in 1947 a Russian soldier drowned in alcohol when he fell in an underground shaft. 5/
Alcohol is the basic raw material used in plant and is transported to plant in RR tank cars. 15b/
Approximately 200 tons of alcohol arrive at the plant daily. 27/

Power: The plant received electric power from a power plant located about 7 km to S, on E bank of Voronezh River. 6/ Electric power is supplied by the power plant in Voronezh located about 400 m S of the plant. 10/

9(b). Voronezh (New Section)

Location: In SE part of town about 300 m E of power plant, which is immediately adjacent to river. 1/ NE of SK-2 (Old Section) and adjoining. 8/
New factory is being built to N and short distance from a rubber plant which was already working and which was called SK. 9/

USSR (Continued)

9(b). Voronezh (Continued)

Production: Construction of plant annex was started in April 1948 and not completed at end of observation. The machinery of the new installation was part of the dismantled machinery from the buna plant in Schkopau, Germany. The machines were installed by the Russians. Section 16, part of new section of plant, was scheduled to start by the end of September 1949 (presumably a basic product for latex rubber). 1/

A buna plant under construction adjoined the caoutchouc plant on the west. The machinery came from Halle. All of the machinery from buna plant of Schkopau near Halle arrived in fall of 1948, accompanied by the former first engineer of the Schkopau plant, who later supervised the construction of the new buna plant. (Descriptions of several departments indicates alcohol tanks also in new section of plant.) 2/

PW estimated that 80% of Schkopau plant was transplanted here. Newspapers in German language, distributed to PW, stated that only 4% of that plant had been dismantled. [redacted] 50X1

PW that re-installation was made after photographs taken at the original site. 3/ A new plant allegedly dismantled from Schkopau has been in construction since October 1948. 4/ Plant is scheduled to start production in 1949. Construction of plant was started in April 1948; the project involves reconstruction of dismantled synthetic rubber plant from Schkopau. Alcohol pipe lines extend from old part to new section. Area to N also belongs to plant, and [redacted] 50X1

[redacted] plant is to be 50X1

expanded in that direction. 5a/ [redacted] 50X1

[redacted] upon completion 50X1

of construction of plant, synthetic rubber will be produced using the German buna process. The old factory, known as SK-1, produces synthetic rubber according to the US process. [redacted] 50X1

USSR (Continued)

9(b). Voronezh (Continued)

[redacted] plant is to be finished and in operation no later than the day of "October Revolution" 1950. 5b/ Buna plant still under construction and no production underway. Production was to begin early in 1950, according to verbal announcements of foremen and government order made public to all workers. Equipment included benzol pumping station and tanks. 6a/ 50X1

[redacted] full-scale production was resumed soon after May 1949. Until that time, old plant was being rebuilt and new plant was under construction. Construction of new plant began during February 1948. Reconstruction and repair of old plant began in June 1946 and was completed in December 1947. No expansion projects are planned for old plant, but [redacted] new plant is to be expanded during 1950-51. 6b/ 50X1 50X1

All machinery and equipment being installed is from buna plant in Schkopau. New part of plant is 70% completed. Construction began in April 1948; installation of equipment began in June 1948. Operation and production scheduled for October 1949. 7a/

New section, known as SK-2, was begun in April 1948 and is still in process of construction. Covers over 1 sq km, including part of dismantled plant from Schkopau. Four workshops are completed, three of which have machinery and boilers installed. Source doubts that operations will begin this year as was planned. Essential machine parts are missing and specialists lacking, even though the 60 PWs were retained for that type of work. 7b/

Six large steel and brick buildings have been completed as of May 1949; additional buildings are planned. Plant is expected to be completed in September 1949. No production as of May 1949.

USSR (Continued)

9(b). Voronezh (Continued)

[redacted] 60 freight carloads of material were brought from Bunawerke Schkopau the first of which arrived in December 1946, and the last, containing 2 carloads of precision instruments, arrived in early May 1949. 7c/ Production was to have started on a set quota on 15 June 1949, but in opinion of source, production will start about middle of July 1949. 7d/ Production in new plant is scheduled for November 1949 on occasion of October Revolution celebrations. 50X1

Polymerization department (in new section). [redacted] polymerization machine as large boiler fastened to iron framework on top of which there is a large stirring apparatus. Each boiler when empty weighs 11 tons and has capacity of 12.2 cum. Of the 48 polymerization machines which are installed, 24 are in operation. In addition to the 48 already installed, place exists for 24 more which will reportedly arrive in the near future. Shop equipped with many boilers which are almost entirely underground. Potential rubber is mixed by polymerization machines. Fluid which is processed arrives by means of underground and aboveground pipes and leaves in spindle-shaped masses which are spun around metal rods. Semi-finished product is transported by rail to rolling mill. In one shop a material consisting mainly of asbestos is processed. Material is formed into rods and forwarded to boiler house and is used in processing of rubber. Tanks are filled with alcohol by means of pipes. Cooling installations spray water over tanks in summer. 50X1

[redacted] 50X1

First rubber produced in buna sections was a red-brown elastic material, soft and hard to tear apart. However, the buna plant had no gross production [redacted] (September 1949), 50X1 and production was said to have started shortly

USSR (Continued)

9(b). Voronezh (Continued)

afterwards. 11/
A part of buna section started production in September 1949. [redacted] 50X1
[redacted] 50X1
Immediately adjacent to Kirov plant, a new plant is under construction for the manufacture of synthetic rubber. One part presumably produces Russian-type synthetic rubber (divinyl ?), while the other is said to be of the same type as that produced at Bunawerke Schkopau (butadiene-styrene). 14/

Raw Materials: New plant is to produce rubber through the use of carbide, which was to be a more economical and an easier process. 10/ Production or operational system in buna plant consisted of action said to be based on carbide procedure. 11/ For new buna plant, only raw material was consignment of ethyl benzene (aethyl benzol) in September 1949 in six RR wagons. Production in new buna section was to start in September 1949. In new plant for production, trials in September 1949 consisted of ethyl benzene steam and nitrogen introduced into spray heads and through copper-lined, jacketed heated vessel. 12/

9. Voronezh (Notes arranged as best as possible by years)

Production: It was reported that in 1946 a monthly quantity of 45 tons of rubber was produced. 1/
In 1947, according to Russian workers, monthly production rate was 150 tons (1,800 tons per year rate). 2/
Average amount of synthetic rubber produced per day alleged to be about 15 tons (4,500 tons per year rate). 3/
[redacted] 50X1

USSR (Continued)

9. Voronezh (Continued)

[redacted] about three 50,000-liter RR tank cars (presumably alcohol) were used in the plant daily. (At 20 tons per day, 6,000 tons per year rate; at 150,000 liters of alcohol used daily, if 4 liters used to produce 1 kg of rubber, plant would be producing 37,500 kg per day or at the rate of 11,100 of rubber per year.) 4/ 50X1
In 1947, production was 50% of production capacity. 5/

In 1948, Russian plant workers said daily output was 50 tons of synthetic rubber of inferior quality (15,000 tons per year rate). 6/ Production was about 75 tons of synthetic rubber from alcohol in 24-hour period (22,500 tons per year rate). 7/
In December 1948, plant was reported producing at 80% of capacity. 8/

In 1949, [redacted] total planned production aimed at is 225 tons of synthetic rubber per day (67,500 tons per year rate, on basis of 300 working days per year). [redacted] Department 6 (Old Section presumably) can deal with one-third of planned production (22,750 out of 67,500 tons). Departments 7 and 13 are each to have a like capacity, but war damage to these departments has not yet been repaired. 7/ Four sheds each containing 6 oil-fired furnaces, each furnace supplying heat to 24 retorts, which contained alcohol which was heated and then made to contact the catalyst. The first two sheds began operation in August 1947, and furnaces of the third were not completed [redacted] (September 1949) but would be in operation by 1950. The fourth shed had American furnaces with gas-heated pre-heaters separated from the furnaces; this shed was to begin operation at the end of 1949. 9/ 50X1 50X1 50X1

USSR (Continued)

9. Voronezh (Continued)

Comment: Information available on this combine indicates that the original SK-2 plant at Voronezh (butadiene rubber from alcohol) was rehabilitated after the war and that commercial operation started around September or October 1947. The new section of the synthetic rubber plant (butadiene-styrene rubber) is believed to have started production in late 1949. (Sovetskaya Belorussiya No. 23, 31 January 1950, reported that production began in October 1949.) Another section of the plant was still under construction at that time, and the date of operation is not determined.

[redacted] one section of the polymerization department was already operating at that time (basis of 24 polymerization machines used in the production of 1,700 tons of synthetic rubber per month in old section of plant), and one section (24 machines, still idle at that time, to be used in the new section due to go into production that year) was then ready for operation with all equipment installed. A third section had space allocated for equipment (24 more machines for which delivery is awaited) which was expected to "arrive in the near future." With a production of 1,700 tons per month (20,400 tons per year) reported in the old section, and, allowing for two more sections of same production for each, this would give the installation a potential production of 61,200 tons per year. 50X1

[redacted] total planned production aimed at for the Voronezh synthetic rubber plant is 225 tons of synthetic rubber per day (67,500 tons per year based on 300 working days per year), which is in line with potential production reported on the basis of equipment and production rate as of 1949. 50X1

USSR (Continued)

10. Yaroslavl' (57°38'N-39°53'E) Region VII AAF 154
SK-1 Yarak (Plant No. 739)

Location: About 500 m S of Danilov RR and RR bridge across Volga on R shore of river. 1/ In the NE part of Yaroslavl' and N of RR station Privilzhie of RR line Yaroslavl'-Vologda, situated in the area between the Volga River and the main road to Tutayev. 2/

Production: Kombinat was completed in 1932. Construction of these factories SK-1 to SK-4 were originally 10,000 tons per year, which was increased to 15,000 tons in 1936, and since 1938 increase was made up to 30,000 tons per year. 3/
There was one air raid in 1941 or 1942 which destroyed two workshops of the synthetic rubber plant. [redacted] 50X1
[redacted] 50X1
A group of synthetic rubber factories are located in Yaroslavl'. 4/ Plans were drawn up around 1930 for four synthetic rubber plants, including the one in Yaroslavl'. Production in Yaroslavl' began in 1932 (in MT):

1932	27
1933	2,189
1934	11,200

[redacted] parts of this plant were evacuated to Sverdlovsk 5/ in 1942-43, 6/ while [redacted] it was evacuated to Chelyabinsk between January and March 1942, 7/ and [redacted] it was virtually destroyed in June 1943 but that by October 1943 was again in full production. 8/ 50X1 50X1 50X1 50X1
Yaroslavl' synthetic rubber plant reported to have capacity of 40,000 tons of radical-type butadiene rubber. 9/
Test factory said to produce synthetic rubber. 10/
Reported in 1948 that Yaroslavl' synthetic rubber

USSR (Continued)

10. Yaroslavl' (Continued)

plant produced 130 of prewar level. 11/
Yaroslavl' synthetic rubber works planned to produce in 1949 6% more rubber than amount planned for 1950 and to lower expenditures of raw materials per ton of rubber by 4.5% in 1949 in comparison with 1947. 12/ Buna plant was constructed after WW II and is equipped with dismantled machinery from Saxony. Raw material, alcohol, is brought in by rail. 13/

Raw Materials: Potato spirits from Kostroma area. 14/
Source of basic ingredients of rubber, such as oil, stearin, and lime, is not known. 15/

11. Yefremov — Region VII AAF 167

Production: The first four SK plants were planned with 10,000 tons per year capacity, which was increased to 15,000 tons in 1936, and since 1938 to 30,000 tons. Yefremov reportedly went into operation in 1933. Yefremov was in the battle zone during the war. 1/
[redacted] a small part of the factory was evacuated to Novosibirsk in 1941, and the remainder of the plant is said to have been completely destroyed. 2/ 50X1
Since April 1948 the Bunawerke Schkopau (East German synthetic rubber plant) has shipped the alcohol from their plant to the buna plant in Yefremov, where it is transformed into buna through the addition of 10% paraldehyde by means of the Lebedev process. 3/ Alcohol in two forms (as a by-product in hydrogenation of aldol, a pre-product of butol, needed for the production of butadiene gas which in turn is required to produce latex liquid and ultimately buna; and hydrogenation alcohol, stemming from hydrogenation of acetic aldehyde, which in turn is fabricated from carbide by way of acetylene) are both sent to USSR. Hydrogenation alcohol, containing small

USSR (Continued)

11. Yefremov (Continued)

amounts of paraldehyde, is an essential base in the Lebedev method. One of the plants where Bunawerke alcohol is worked up to butadiene is located at Yefremov. 4/

12. Yerevan — SK-1 (Sovprene) Kirov (Plant No. 742)

Location: 2½ km S of Yerevan main RR station. 1/ 6 km E of main RR station. 2/ SSE of Yerevan, E of large railroad line, and about 4 km from town center. 3/

Labor: 1,200 workmen in three 8-hour shifts 4/; together with carbide plant, 4,000 workers. 5/

Production: The first synthetic rubber plant by the Sovprene process was started about 1939-40. In 1939 the Sovprene plant at Yerevan began production. 6/
The cheaper US method for the production of rubber from acetylene was studied in the laboratory and appraised; the first unit using this process was placed in operation in 1939 in Yerevan and had a capacity of 10,000 tons. The works has divisions for limestone, carbide, oxygen, chlorine, acetic acid and derivatives, bichromate, acetylene, and rubber (p. 14).
Thus the Sovprene rubber plant in Yerevan has a division equipped with a carbide plant for the manufacture of 60,000 tons a year (carbide). This portion of the plant was the first to go into operation; however, its total production capacity has not yet been reached (p. 10). 7/
Plant went into operation in 1939 with capacity of 14,000 tons, and the capacity was to be 28,000 tons after complete operation (1942) (p. 15). 7/
Plant was built to produce Sovprene and was still in operation at the outbreak of war. Employing power from the Transcaucasian power system, plant

USSR (Continued)

12. Yerevan (Continued)

preliminary engaged in the production of rubber for military use. 8/

Yerevan plant began production in 1942. 9/

Factory was built after the Revolution, construction work being done during two Five Year periods. Factory continues to expand. 5/

Began production in 1939 with estimated production capacity of 10,000 tons, producing rubber from nonfoodstuff raw materials. Produces 15 to 20% of all synthetic rubber in the USSR. 10/

Plant was demolished by Russians during war, and rebuilding started in 1945. [redacted] 50X1

[redacted] plant was in full production. 50X1

[redacted] lime kilns produced carbide 50X1
for use in rubber production and also some was shipped out. 12/

A new factory of 10,000 tons capacity per year is to be constructed at Yerevan beginning in the summer of 1948. 11/

Construction was started some years ago, and the plant was completed in early 1948. The following industrial installations are in the vicinity of the plant: a cable plant, a tire plant, and a plant producing plastics.

The India rubber plant of Yerevan was an important installation in 1941, and it is assumed that it was considerably enlarged and modernized after the war. The plant did not suffer any war damages. 3/

[redacted] 50X1

The new SW section under construction is also an India rubber plant. The bare structures of most buildings were completed by February 1947. However, the work was progressing very slowly, since very little construction machinery was used. The construction site included a large storage

USSR (Continued)

12. Yerevan (Continued)

dump of dismantled German machinery, still partially packed in boxes. 12/

Rubber was packed in linen sacks and shipped to an unknown destination. 12/

General layout of plant suggests it is buna-type rubber works with calcium carbide as basic raw material. It is reported that chloroprene is produced. Chloroprene plant is situated immediately W of monovinyl-acetylene plant and is stored in small tank farm at S end of works. 13/

Engineers of factory (Yerevan) have incorporated a number of proposals on rationalization directed toward improvement of technology of production. These have considerably simplified technological process of production of synthetic rubber from nonfoodstuff raw materials -- from coal and limestone. Also has produced economies of fuel and electrical energy. The only factory in the USSR which produces rubber from nonfoodstuff raw material has doubled its daily output of rubber by comparison with 1946. 14/

Rubber plant was enlarged from 1945 until early in 1948. Spongy yellowish crude rubber was produced in two workshops. 15a/

[redacted] production was not running on schedule at time of observation (November 1945-October 1947), and it was planned to intensify production rate after end of building work. A German industrial expert came to plant in 1947. 15b/ 50X1

It is believed that the enlarged rubber combine now partly equipped with new installations arose from prewar rubber plant Kirov SK-1 (Sovprene). This plant was for a long time an experimental installation for the production of synthetic rubber on the basis of acetylene produced from calcium carbide. However, normal production had started already before the war.

USSR (Continued)

12. Yerevan (Continued)

PWs were assigned to improve the old plant around first quarter of 1946. All old and important apparatus were removed to be replaced by better ones either shipped from Germany or from US and Canada. Acetylene generators (two installations) were scheduled to produce 16,000 tons of acetylene per year. Monovinyl-acetylene department should produce 12,000 tons per year. Department for chloralkali-electrolysis and further processing of chloric gas planned to be 10,000 tons per year. There also were installations for production of chlorbenzol and chloropren. 15/

Apparatus of important departments were removed and replaced by new ones since 1946. This plant conversion lasted for about 2 years before partial production could start. According to PW reports, the new installations were set up mainly in already existing buildings. Only some new buildings were built. The buna-producing department as well as the synthetic department working on crude-oil basis is quite recent installation. These departments have certainly been housed in already existing workshop buildings. [redacted] 50X1

[redacted] 50X1

[redacted] Possibilities for 50X1 production of plastics on basis of produced vinyl compounds and acetylene derivatives are so variable in Yerevan combine that it is impossible to identify actually processed material from indications of these reports. 15/

Soviet Army News published an article on 15 May 1947 referring to the hydroelectric plant on the Sevan River. It reported that the plant would enable fourfold increase in output of Yerevan synthetic rubber plant.

The Sergey Miroyevich Kirov Plant, which is enrolled on the Board of Honor of Stalin Rayon Party Committee, during 1948 achieved output level scheduled for 1950. This year the plant fulfilled its

USSR (Continued)

12. Yerevan (Continued)

10-month quota by 110.3%, producing 58% more than it made in corresponding period of last year. In addition to these achievements, plant lowered output costs by 3.5% more than plan stipulated and achieved 100% of its plan for quality and assortment of its output. 16/

Kirov Rubber Works in Yerevan undertook to produce 14% more rubber in 1949 than amount planned for 1950, to diminish expenditure of raw material per unit of staple production manufactured by 10% as compared with standards applying to plan for 1950, to raise labor efficiency in 1949 by 5% as compared with standards applicable to 1950, and to reduce cost price of production in 1949 by 2.4% over and above that laid down by the plan for 1950. 17/

The Five Year Plan provided for the production of synthetic rubber in Armenia SSR to "expand 4 times." 19/

Raw Materials: Almost all the carbide produced at Yerevan Carbide Plant is sent to the synthetic rubber plant 742. The quality of the carbide is not high. 18/

Factory 742 received from Baku plant 438 products for the manufacture of synthetic rubber, including ethyl benzol. 18/ (Ethyl benzol is an intermediate product for the manufacture of styrene.)

SATELLITES

Bulgaria

13. Sofia

Location: In Sofia. 1/

Production: Supposed to start operation in 1949. 1/

SATELLITES (Continued)

Czechoslovakia

14. Ostrokovice

Location: At Bata plant near Zlin/Gottwaldov. 1/

Production: Reportedly started production at the beginning of World War II, producing about 3,000 tons in 1942. 1/
Most of the plant was destroyed during the war, and it has since been said to be operating on only a semi-industrial basis because of lack of technical equipment, producing only about 1 ton per day. 2/
Reported to produce calcium carbide, between 3,000 to 5,000 kg per day, all of which is consumed in the production of synthetic rubber. Synthetic rubber production was about 20,000 kg* a day in 1950 and 1951. 3/

15. Teschin

Location: In Teschin area. 1/

Production: Synthetic rubber plant produced approximately 3,500 tons of buna in 1950. The expected production quota for this factory in 1951 has been set at 4,200 tons. Only 855 tons of 1950 production remained in Czechoslovakia, the remainder going to the USSR, Poland, and Hungary. Of the 1951 quota, only 1,000 tons will be utilized in Czechoslovak industries. 1/

[redacted] 50X1

[redacted] production of synthetic rubber (buna) was put under Soviet control, and for this reason only 450 tons were released to CSR industry instead of the promised 1,000 tons. 2/ 50X1

* This appears to be an error, probably typographical, since the quantity of carbide would make it appear that production of synthetic rubber could be only about 2,000 kg per day.

SATELLITES (Continued)

East Germany

16. Schkopau — Bunawerke

Location: Three-quarters of a mile NW of Schkopau and $2\frac{1}{2}$ miles NW of town of Merseburg. 1/

Labor: Actual buna production engages only 3,000 to 4,000 workers. 2/

Production: East German production of buna (1946) was 23,997 tons. 3/

Production quota for 1948 has been increased to 48,000 tons from 40,000 tons in 1947. Monthly production during 1947 averaged 3,000 to 3,300 tons. 4/

Bunawerke was notified on 15 April 1948 that parts of works would be dismantled starting at beginning of May 1948 and lasting until the end of June 1948. Dismantling struck solely the new buildings of the final polymerization stage. The new buildings of the polymeriza- stage which were totally dismantled during this time took care of 60% of the final-stage processing of buna output. The result of the dismantling was a sharp drop in buna production from 4,000 tons per month to 2,000 tons. The bulk of buna production goes to the USSR and Czechoslovakia, with only about 8 to 10% remaining in Germany; part of this has in the past gone to West Germany to be used in the manufacture of tires. 2/ Production during first 6 months of 1947 averaged 2,910 tons per month (17,460 for 6 months); during second half of year, averaged 3,500 tons per month (21,000 tons), totaling 38,460 tons. 5/

The most important new development at Schkopau is that it is intended to begin production of cold rubber: i.e., low temperature polymerization. It is intended, as a beginning, to convert 25% of present buna capacity to

SATELLITES (Continued)

East Germany (Continued)

16. Schkopau (Continued)

low temperature polymerization. 6/
Production quota of 3,500 tons of buna per month (including Buna S and Buna S-3) has always been fulfilled with two operating furnaces. Seven are now in operation, with eighth to be put in soon. For 1950, average production of 4,200 to 4,500 tons of buna monthly can be expected. With eighth furnace in operation, monthly capacity of 5,000 to 7,000 tons of buna would be reached.
A new plant several stories high has been put into operation in Buna Chemical Works, which will help increase the output of synthetic rubber during the second year of the Five Year Plan. 8/
1951 production was 48,853 tons, 101% of plan. 9/
Average production during 1950 was 3,317 tons. 10/
Reportedly changes in the original Five Year Plan (1951-55) have been made with total production by that date to reach 65,200 to 75,000 tons per year. 11/

Hungary

17. Rakoskeresztur — Magyar Vegimunek

Location: At Rakoskeresztur. 1/

Production: Constructed by the Germans for the production of Buna N and Buna S rubbers, it was never completed to the point where it was able to produce the finished product. 1/
Plant is now reported to have been converted to the production of dyestuffs. 2/

SATELLITES (Continued)

Poland

18. Debica — India Rubber Plant "Keru" 1/ "Stomil" 2/

Location: Near Rzeszow in Krakow district. 1/ Located about 1 km W of Debica, known as Stomil plant. 2/

Production: Included in plans for 1948 were funds of 39 million zlotys to be used for construction of a synthetic rubber factory in Debica. 3/
There was originally a plant here prior to World War II, listed under I.G. establishments as plant used in production of polybutadiene rubber. Old German information stated that factory was for artificial rubber of spirit base. Product is called "Ker." A minimum of 1.5% Ker is required for processing of raw India rubber. 4/
Present production of synthetic rubber is small and centered in Debica. 5/

19. Radosc — Reported Synthetic Rubber Plant

Location: 14 km SE of Warsaw, in area 1.5 km W of Warsaw-Lublin RR line opposite Piaskow Street in Radosc. 1/

Production: Three factory halls have been built. 1/
Machinery for the synthetic rubber factory, which is under construction at Radosc, has been imported from IGF Works in East Germany. The factory will start production at the end of the current year. 2/

20. Zarow (Saarau), Silesia — Lower Silesian Chemical Works ("Silesia")

Location: At Zarow, which is 49 km SW of Wroclaw on Wroclaw-Jaworzyna Slaska rail junction. 1/
At Saarau, Kreis Schweidnitz, Silesia. 2/

SATELLITES (Continued)

Poland (Continued)

20. Zarów (Saarau), Silesia (Continued)

Production: Thiokol plant was built in Silesia shortly before the war began. 700 tons reportedly made in 1940. 3/ Thiokol, Gmbh, Saarau, reported production of 1,432 MT for period 30 June 1940 to 1 July 1942. It was reportedly taken over by the Polish government and nationalized by mid-1946. The plant was said to be out of operation in April 1947 and in February 1948 was reported not operating because it had been found impossible to obtain any ethylenodichloride (an important chemical component) in any Satellite area. 2/

Plant is in process of reconstruction. Production at the factory includes Thiokol A, synthetic vulcanized rubber, used for the production of rubber pipes and various washers. Present production is at the rate of about 12,000 tons a year and is used mainly in the electrotechnical industry and for the Polish Aviation Works (PZL). 1/

In June (probably 1948) the production of Thiokol latex was held up in the "Silesia" Factory because of inadequate supply of ethyl bromide. 4/

Rumania

21. Ploesti

Location: Attached to the Columbia Oil Refinery. 1/

Production: Production of about 2,000 kg per month planned. 1/

TAB C

APPENDIX B

METHODS OF ESTIMATION OF PRODUCTION OF SOVIET SYNTHETIC RUBBER INSTALLATIONS

1. Kazan'

1932. Construction of plant started.

Construction of this plant was begun in 1932 and was planned to be completed by 1937. Total capitalization was planned to be 56,140,000 rubles (in current prices), of which 40,250,000 rubles were actually invested up to 1 January 1936. 1/*

1936. Plant began operation in part.

During the year 1936, 1.2 million rubles (in current prices) were to be invested. Parts of this plant began operating in 1936, but output for that year is unknown. Annual rated capacity of this plant was not given in the construction plan for 1936. 1/

To begin operation at the end of August 1936. 2/

Original capacities of these plants (SK-1 to SK-4) were planned at 10,000 tons and were to be increased by the addition of a third unit to 15,000 tons in 1936.

Two more production plants, believed by MEW to have annual capacities of 15,000 tons each, were erected during the Second Five Year Plan (1933-37) at Yefremov and Kazan'. 3/

1938. In 1938 it was planned to expand capacities to 30,000 to 40,000 tons. Plant was completed in the period during 1933-37.

50X1

1. Kazan'(Continued)

1940. [redacted] 1940 capacity at 15,000 tons. Enlarged in 1941; well east of battlefront. 4/ 50X1

1941. Products: 20,000 tons of synthetic rubber per year as compared with 30,000 tons planned. 10,000 workers in three shifts in 1941. 5/

At most, 50,000 tons of divinyl rubber were produced in Yaroslavl' and Kazan' plants (probably 1941). 6/

Synthetic rubber based on alcohol (divinyl process) (25,000 tons per year), 10,000 workers in 1941. 7/ Figure as given appears to indicate capacity.

1942. Plant supposedly produced 25% of Soviet rubber in 1942; planned production 1,200 tons per month (annual rate, 14,400 tons). Total then for the USSR, 57,600 tons. 8/ 20,000 tons (30,000 tons planned). Capacities estimated at 20,000 tons in 1942, with 30,000 tons planned for 1944. 5/

1943. Products: synthetic rubber, 25,000 tons yearly; planned, 30,000 tons. Had 10,000 workers in three shifts. 9/

1944. Synthetic rubber, 25,000 tons yearly. 5,000 workers in three shifts, 15% women. 9/

Was said to be equipped during the war with evacuated machinery from SK-2 plant (Voronezh). Subsequent to cessation of hostilities, the plant utilized German machinery and personnel. 10/

1945-46. There are no production reports from 1945 on. An alcohol shortage in the immediate postwar years was reported, and

1. Kazan' (Continued)

it is assumed that the plant, which had been in operation all during the war and pushed beyond its normal rate, would show a drop in production immediately after the war. This happened in Germany, where during 1943 the Schkopau plant produced 73,000 tons (60,000-ton rated capacity plant), but the next year fell down to around 43,000 tons and never regained that wartime peak of production.

Time must also be allowed to rehabilitate and repair the plant after such a long period of forced operation. These factors, together with reported construction around the plant just after the war, influenced the estimate of 15,000 tons produced at this plant during 1946.

German specialists from Bunawerke deported to the USSR are reported to be working in Kazan in the setting up of a plant similar to and copied by the Russians at Bunawerke Schkopau. It was stated that construction would take from 3 to 5 years for completion of the plant. 11/

1947. The 1947 production was estimated also at 15,000 tons, as it was felt that any increase was extremely small. There are no firm figures for these years, and actual production may have been more or less. These estimates, however, are felt to give the range.

An average of 10 large-size RR tank cars of raw alcohol were shipped to plant each week during the time of observation (1947-48). 12/

This figure on alcohol receipt (10 tank car per week at about 33 to 40 tons per car) would place rubber output, provided that this supply was the only source, at less than 10,000 tons per year.

1. Kazan' (Continued)

Soviet press reported that workers of Kirov Plant No. 741 have resolved to complete prescribed work quota by 5 December 1947. They decided to produce at least 8% more synthetic rubber; to reduce the amount of alcohol in production of rubber which will make it possible for other plants to produce 1 million pairs of overshoes, and to increase working efficiency by 31.4% in comparison with 1946. 13/

This increase, if met, would make production based on 15,000 tons for 1946 at about 16,200, or barely over 10,000 tons if 10,000 tons were used. The small rate of increase planned during 1947 appears in line with the general reasoning of the output of this plant.

1948. By 1948 it was felt that major repairs were being completed, although extent of construction is not determined. Some of this reconstruction, however, may have been for rubber fabrication factories. At the same time, more attention was probably devoted to the alcohol situation. Some alcohol shipments from East Germany were reported that year to the synthetic rubber plant in Yefremov, 14/ which would improve the supply situation of alcohol in the USSR.

50X1

1949. With the improvement in the alcohol supply situation and in rehabilitation of plant area, it is felt that the plant had a chance to realize full or nearly full production capacity. The figure of 30,000 tons is estimated.

1950-51. There is no information on production after 1949, and full production of 30,000 tons has been retained for these years. However, the information on construction work taking place there in early postwar years was not sufficient to determine whether any extension of synthetic rubber facilities were contemplated.

1. Kazan' (Continued)

It is felt, however, that in postwar years greater emphasis may be given to wider dispersion of synthetic rubber plants in the USSR, as is indeed indicated by continued construction of new synthetic rubber plants rather than increases of units in presently existing plants. This is felt to be more of a defense move than for economic considerations.

2. Voronezh

For the Voronezh plant, a staggering amount of reports from PWs [redacted] was combed, with figures of production as given checked and double-checked against each other, for the various years, and raw materials checked against these until a fairly reasonable picture of production trend was determined. 50X1

The plant went into production about October 1947 on a small scale, 1/ variously reported as 5% of prewar capacity 2/ (if this were 30,000 tons, monthly production would be only about 116 tons, which for full 3 months would be only 348 tons), 150 tons per month, 3/ and 180 tons per month 4/ (1,800 and 4,500 tons per year). It is normal for a plant not to retain full capacity in the first months of initiating production. It was felt, therefore, that production was negligible in 1947, and so was not included in Table 1, Tab C, page C-5, above.

During 1948, by mid-year, production appeared to be increasing, and production figures ranged from 20 5/ to 50 tons per day 6/ (6,000 tons per year rate to 15,000 tons per year rate). By December 1948 the plant was said to be operating at 80% of capacity. 7/ The 10,000 tons were estimated as best figure for total yearly production in 1948.

2. Voronezh (Continued)

By mid-1949, production had increased, and it appeared that the old plant section had reached about full production. [redacted] the polymerization section (one unit of 24 machines) produced 1,700 tons of rubber per month (20,400 tons per year), which appears in line with other information as to the capacity of plant. Another section (of 24 machines) was equipped, but production had not started as of mid-1949, and still another section (for which machines were awaited) had space allocated. This would give the installation a potential production of 61,200 tons per year. 8/ The Soviet press announced that the new section (section for which machines were available) started production in October 1949. 9/ Again there would not be very much production from this section in its initial months of production. [redacted] the plant received approximately 200 tons of alcohol daily. 10/ (On the basis of 2.2 tons of alcohol per ton of synthetic rubber produced, this would total around 27,000 tons per year.) Ethyl benzol (for styrene) was also reported in shipments late in 1949 in obvious preparation for the new unit production. 11/ [redacted]

50X1

50X1

50X1

a daily production of 75 tons 12/ (22,500 tons per year). Based on production capacity of old plant, and the late beginning of the new section, the figure of 22,000 tons seemed a reasonable estimate.

[redacted]

50X1

[redacted] the total planned production aimed at is 225 tons per day 12/ (67,500 tons per year rate, based on 300 working days per year). Therefore, it appears that sometime in the future this third section will begin operation.

50X1

2. Voronezh (Continued)

Again, in 1950, because of the late 1949 start of production in the new section, it appeared that the yearly production total would not attain the full production capacity of these two units, and the 38,000-ton estimate was made with this in mind.

3. Yaroslavl'

1930-31. Construction of SK-1 was begun in 1930 and was planned to be completed and in operation in 1936. Total capitalization was planned to be 62,780,000 rubles (current prices), of which 58,190,000 rubles were actually invested up to 1 January 1936. During 1936, 600,000 rubles were to be invested. The construction plan of 1936 does not give the capacity of SK-1. 1/

First commercial synthetic rubber plant was built at Yaroslavl' (5,000 tons per year) in 11½ months, entirely of Soviet materials with the exception of some imported measuring apparatus. 2/

1932. On 7 July 1932 it (Yaroslavl') started operating and produced 400 kg of a good grade of rubber. By the end of 1932 it was producing about 1 ton per day. 2/ Yaroslavl' produced 24 tons of rubber during the first half of 1932. 3/

1933. Yaroslavl' produced 350 tons of synthetic rubber during the first half of 1933 and 700 tons of synthetic rubber during the fourth quarter of 1933. 3/

The first synthetic rubber plant in the USSR will produce 2,400 tons of rubber in 1933. 4/

3. Yaroslavl' (Continued)

1934. The capacity of each plant (of original five plants planned) is 5,000 to 10,000 tons per year, the plan being to produce about 40,000 tons of synthetic rubber (in entire USSR) in 1934. 2/

1935. The synthetic rubber works at Yaroslavl' are celebrating their third anniversary. This plant was the first to manufacture synthetic rubber in the USSR. The output has grown 18 times in the course of these 3 years, while expenditure of alcohol per ton of rubber has been reduced by 35.5%. During the first half of 1935 the factory produced about 5,000 tons of high-grade rubber. 5/

1936-39. Extremely little information is available to this office on production from 1935 to 1940.

Construction of these factories, SK-1 to SK-4, were originally 10,000 tons per year, which was increased to 15,000 tons in 1936; since 1938, increase was made up to 30,000 tons per year. 6/

1940-42. SK-1 synthetic rubber; planned capacity, 10,000 tons divinyl rubber (32%). 7/

Production: 30,000 tons of synthetic rubber per year. 8/ Production of synthetic rubber was planned for 10,000 to 30,000 tons yearly. 9/ Production of rubber was planned output of 800 tons per month. 10/

[redacted] 1942 figure at 25,000 to 30,000 tons per year (production or planned capacity not clear). [redacted] in 1941 the asbestos section of the Yaroslavl' combine was moved to Asbest, that parts of the tire plant were moved to Omsk, that the remainder of the plant was virtually destroyed by air attack, and

50X1
50X1
50X1

3. Yaroslavl' (Continued)

that by 1944 (date of report) return and reconstruction of plant were not established. 11/

There was one air raid in 1941 or 1942 which destroyed two workshops of the synthetic rubber plant, part of RR station Privilzhie, and several homes near the station located close to the synthetic rubber plant. No reconstruction was started before source departed in February 1949. 12/

1943-44. Synthetic rubber based on alcohol (divinyl), 25,000 tons per year. Damaged in June 1943; restored several months later. 13/

[redacted] 50X1

[redacted] the plant was in operation in June 1942 but that parts presumably were evacuated to Asbest near Sverdlovsk. 14/ [redacted] the plant was virtually destroyed in June 1943 but by October 1943 was again in full operation. 15/ 50X1 50X1

Production: 30,000 tons (production or capacity not clear). 16/ Yaroslavl' synthetic rubber plant reported to have capacity of 40,000 tons of radical-type butadiene rubber. 17/

[redacted] the prewar capacity is estimated at 20,000 tons, using the ethyl alcohol process. 18/ 50X1

1945-46. No information is available that contributes much to determining possible production in these early war years, but it was felt that production would have

3. Yaroslavl' (Continued)

declined in order to permit repair and rehabilitation. Some production may have taken place during time of repairs, as is indicated by some reports. Production has been tentatively estimated at 22,000 tons in 1946.

1947-48. With reconstruction going ahead, it was felt that production would increase slightly in 1947 and by 1948 should be almost back to full production. The production during 1947 has been estimated at 25,000 tons, with 30,000 tons estimated for 1948.

The plant had suffered some war damage, which particularly concerned its northern part. However, operations never were interrupted, and rubble clearing and reconstruction as well as enlargement of plant were performed during source's stay in Yaroslavl'. A boiler house was newly built as enlargement of plant, the main section of which was completed and was in operation since the spring of 1947, but their inside installations were still missing in May 1948. 19/

There were three fire-destroyed buildings of which source had heard that at least one was to be reconstructed, but nothing was done so far to clear rubble. A fire took place in the fall of 1947, destroying at least one building, which was not reconstructed [redacted] Some machines were excavated and repaired, and the fire site eventually was also entirely cleared from rubble. 19/ 50X1

A dismantled buna plant from Germany is to be added to works. 20/

3. Yaroslavl' (Continued)

Close to the rubber plant was an alcohol factory. [redacted] factory was to be enlarged. Factory employed, among others, two German top scientists, who escaped in 1947 from the plant supposedly because they did not want to take part in experiments which were against the interests of Germany. 21/ 50X1 50X1

[redacted] the plant to be employing new methods of production which allegedly reduce alcohol needs by 4.5% and have increased production by 33%. 22/ Reported in 1948 to have produced 130% of prewar level. 23/ 50X1

If the reported increase of rubber in 1948 could be taken in conjunction with the 20,000 tons estimated for 1940 production, this would place 1948 production at around 26,000 tons.

1949-51. Production of synthetic rubber at the Yaroslavl' plant has been estimated to reach full production of 30,000 tons in 1949, and this figure has been continued for each of the years 1950 and 1951. In view of plans and reported extensions, it is possible that this production has been increased. With the absence of reliable information on such enlargement or extent of such plans, no higher estimates have been made.

The Yaroslavl' synthetic rubber plant has promised to complete its annual production plan by Stalin's birthday [redacted] to increase labor productivity by 16.5% in comparison with last year, to make an additional 2.5 50X1 50X1

3. Yaroslavl' (Continued)

million rubles worth of goods during 1949 by reducing the per unit requirements of raw materials, and to save 4 million above-plan rubles by introducing new technological measures. 24/

Yaroslavl' synthetic rubber plant planned to produce, in 1949, 6% more rubber than amount planned for 1950 and to lower expenditures of raw materials per ton of rubber by 4.5% in 1949 in comparison with 1947. 25/

In the same area of rubber combine, 500 m W of TEZ 1 power station and to S is a factory called Test Factory 215, which was said to produce synthetic rubber. 26/

[redacted] 50X1

[redacted] construction of a laboratory building at the Rubber Factory in Yaroslavl', which was begun in the autumn of 1948. The laboratory was a three-story building; each floor contained eight rooms. Sealed crates of equipment (labels from Dresden) were in the yard. No equipment was installed in the building [redacted] 50X1 50X1 50X1

[redacted] 50X1

[redacted] a director of the factory was in Schkopau, Germany, inspecting the Bunawerke and that the factory will be organized on the same lines as Bunawerke and most probably will produce rubber. The factory is being considerably extended. 28/ 50X1

3. Yaroslavl' (Continued)

Among the enterprises of Yaroslavl' Oblast, which in 1949 reached the production level set for 1950, is a synthetic rubber plant. 29/

4. Yefremov

1932-34. The first four SK plants (Yaroslavl', Voronezh, Yefremov, and Kazan') were planned with 10,000 tons per year capacity, which was increased to 15,000 tons in 1936, and since 1938 to 30,000 tons. Yefremov reportedly went into operation in 1933. 1/

By the end of 1932 it (Yaroslavl') was producing about 1 ton per day. Two other plants have been built and are now operating, one at Voronezh and the other at Yefremov. The latter plant, known as Synthetic Rubber Plant 3, has just been completed, making its first 100 tons of synthetic rubber. 2/

Alcohol used as raw material. 3/

1934-37. There is no information available to this office on production of synthetic rubber in this plant since that mentioned above, and extremely little for any year.

1938. This plant started operating after 1938. In the production of synthetic rubber, alcohol obtained from potatoes is used. 4/

1941. Affiliated installations (at Yefremov): oxygen, nitrogen, installation for production of longevity preparations, nesodes D and Agelrite. Products: synthetic rubber (butadiene from 86% alcohol;

4. Yefremov (Continued)

polymerization in liquid phase and gas phase); liquid rubber; polydienol. 5/ Production: 28,000 to 30,000 tons per year of synthetic rubber. 6/

Information is extremely vague and scanty on this plant. Sometime between 1941 and 1943 the plant was partially evacuated, and the rest was totally destroyed, [redacted] only two plants were operating in 1942, this must have happened around 1941, and the figures given above probably refer to planned capacity.

50X1
50X1

1943-44. Presumably evacuated to Novosibirsk. Remainder of the plant is said to have been totally destroyed. 7/

Reconstruction not established (late 1944). 8/

1945-46 No information is available in 1945-46, and it is doubtful that the plant could have been rehabilitated and reconstructed by this date.

1947. By 1947, some work was being done, although whether actual production of synthetic rubber was reached is not known. A tentative production of 5,000 tons has been estimated.

Factory SK-3 is in Yefremovskiy Election District No. 590. Mention is made of workshop laboratory and of locksmith. In the auditorium of the club of this factory, more than 1,500 manual workers, engineers, technicians, and white collar workers gathered for pre-election meeting. 9/

This brief press item would indicate that work was being done at the plant at that time.

4. Yefremov (Continued)

1948. References to amounts of alcohol being shipped from East Germany to this synthetic rubber plant [redacted] the plant was in operation are the only information available since 1947. Estimate has been made of 15,000 tons for that year and gradual increases during the succeeding years, as follows: 50X1 50X1

	Tons
1949	20,000
1950	25,000
1951	30,000

It is noted that shipments of paraldehyde mix from East Germany have continued. However, the two references noted below are the only substantiation of the destination being the Yefremov plant.

Plant is similar to CK-1 and CK-2 plant and is engaged in the production of butadiene. 10/

Since April 1948 Bunawerke Schkopau has shipped the alcohol from their plant to the buna plant in Yefremov, where it is transformed into buna through the addition of 10-percent paraldehyde by means of the Lebedev process. 11/

Alcohol in two forms (as (a) a by-product in hydrogenation of aldol, a preproduct of butol, needed for the production of butadiene gas, which in turn is required to produce latex liquid and ultimately buna, and (b) a hydrogenation alcohol, stemming from hydrogenation of acetic aldehyde, which in turn is fabricated from carbide by way of acetylene), are both sent to the USSR. Hydrogenation alcohol.

4. Yefremov (Continued)

containing small amounts of paraldehyde, is an essential base in the Lebedev method. One of the plants where Bunawerke alcohol is worked up to butadiene is located at Yefremov. 12/

5. Yerevan

1945. Production of synthetic rubber 2,000 tons per year. Process of fabrication is the same as that used by German buna plant (carbide, acetylene, and butane). 1/

In the light of the extremely meager information available on synthetic rubber production in the USSR during postwar years, but taking the few shreds available that reconstruction and rehabilitation were being made, an estimate near this figure seems fairly logical.

[redacted] caoutchouc works on W side of Erivan, which was damaged by earthquake (?) in 1938, are being reconstructed and enlarged. 2/ 50X1

[redacted] the plant was demolished during the war, 3/ so that it appears some damage was incurred during the war, and reconstruction was being done in postwar years. 50X1

1946. Output of carbide was one furnace per shift: eight wagons of 1 or 1½ tons of carbide ready for use in the manufacturing process. 4/

While this is scanty information on which to base any production figures, it does aid in giving scope of production. Based on 8 to 12 tons of carbide per shift,

5. Yerevan (Continued)

or 24 to 36 tons per day, on a 300-day basis, this would yield (at about 3.6 tons carbide required for each ton of neoprene) about 7,200 to 10,800 tons of carbide per year, or 2,000 to 3,000 tons of neoprene rubber.

1947. Again a figure of carbide used for the production of rubber tends to indicate production of rubber, estimated at about 5,000 tons. The information on most of these years, overlap, so that a medium figure has been taken for individual years.

120 tons of carbide are produced in a 24-hour period at carbide installation, [redacted] 50X1 50X1

Engineers of the factory have incorporated a number of proposals on rationalization directed toward improvement of the technology of production. These have considerably simplified the technological process of the production of synthetic rubber from nonfoodstuffs raw materials -- coal and limestone -- and also has produced economies of fuel and electrical energy. The only factory in the USSR which produces rubber from nonfoodstuffs raw materials has doubled its daily output of rubber by comparison with 1946. 6/

Using the medium of somewhere between 2,000 and 3,000 tons produced in 1946, this would place the 1947 production at around 5,000 tons. The 120 tons of carbide produced on a 300-day basis would yield about 10,000 tons of rubber. However, since reconstruction was going forward, and using further information available on 1948 as viewed against 1946 probable production, this intermediate point has been derived.

5. Yerevan (Continued)

1948. A comment from various PW reports on the situation at the Yerevan plant in the early postwar years sums up the general conditions existing immediately after the war:

> The enlarged rubber combine now partly equipped with new installations arose from the prewar rubber plant Kirov SK-1 (Sovprene). This plant was for a long time an experimental installation for the production of synthetic rubber on the basis of acetylene produced from calcium carbide. It was the only plant of its kind in the USSR. For years the greatest efforts were made to develop rubber production from other basic materials, such as carbide, crude oil, and natural gas. Until the war, this problem could not be solved satisfactorily, and it seems that certain progress could be reached only after vigorous US aid had started and dismantled German material had been installed. PWs were not assigned to improve the old plant until the first quarter of 1946. All old and important apparatus was removed, to be replaced by better ones shipped either from Germany or from US and Canada. This plant conversion lasted for about 2 years before partial production could start. According to PW reports, new installations were set up mainly in already existing buildings. Only some new buildings were built. 7/

Additional information on carbide production gives a basis for yearly estimate of 15,000 tons. Since there is no firm basis for this yearly production, it was felt that these estimates were somewhere in the range of magnitude.

> Prefabricated carbide in gray pieces (50 to 100 kg) was stored. Carbide was transported by a little factory

5. Yerevan (Continued)

locomotive which pulled 12 cars (each containing 1 ton). Twelve such shipments arrived daily at the shop. In the furnace, 1 ton of carbide was molten in 1 hour in one chamber: that means 3 tons in one furnace. Carbide in 1-ton pieces was smashed; 1 ton had to be smashed in a quarter of an hour. 8/

This carbide consumption rate would yield about 12,000 tons of rubber.

1949. Production is estimated at 20,000 tons, based on reports on continuing increases in production.

The Sergey Miroyevich Kirov Plant, which is enrolled on the Board of Honor of Stalin Rayon Party Committee, achieved during 1948 the output level scheduled for 1950. This year (1949) the plan fulfilled its 10-month quota by 110.3%, producing 58% more than it made in the corresponding period of last year. In addition to these achievements, the plant lowered the output costs by 3.5% more than the plan stipulated and achieved 100% of its plan for quality and assortment of its output. 9/

Kirov rubber works in Yerevan undertook to produce 14% more rubber in 1949 than amount planned for 1950, to diminish expenditure of raw material per unit of staple product manufactured by 10% as compared with standards applying to plan for 1950, to raise labor efficiency in 1949 by 5% as compared with standards applicable to 1950, and to reduce cost price of production in 1949 by 2.4% over and above that laid down by the plan for 1950. 10/

5. Yerevan (Continued)

1950-51. No information is available on 1950 and 1951 production, and it is estimated that 1950 was around the same as 1949, with a gradual increase to 25,000 tons in 1951. Continuing expansion may be expected, in light of Five Year Plan goal (1951-55), to increase synthetic rubber production by 82% during the 5-year period.

TAB C

APPENDIX C

SOVIET BLOC NATURAL RUBBER INSTALLATIONS

USSR

1. Chelkar

   Location: Kazakhstan. 1/*

   Production: Existed in 1940 for chondrilla, with capacity of 50 tons. 1/

2. Chimkent

   Location: Uzbekistan. 1/

   Production: Existed in 1940 for tau-saghyz, with capacity of 100 tons. 1/

3. Dankovo

   Location: Province of Ryasan. 1/

   Production: Put into operation in 1940 for kok-saghyz, with capacity of 300 tons (plus 700 tons of alcohol). 1/

4. Livny

   Location: Province of Kursk. 1/ Orel Oblast. 2/

   Production: Put into operation in 1940 for kok-saghyz, with capacity of 300 tons. Expansion construction for 1,300 tons per year should have commenced operation in December 1940; the start of operation has not yet been announced. 1/ Small experimental plant of 200 tons per year. 2/

50X1

USSR (Continued)

5. Madagis

Location: Azerbaydzhan SSR. 3/

Production: Name of settlement occupied by personnel of synthetic rubber factory, a concern where high quality raw rubber of considerable value is treated. 3/ Plant producing rubber from guayule, most valuable rubber plant. Reported to be first natural rubber factory in Azerbaydzhan SSR. 4/

6. Maykop

Location: Krasnodar Kray. 1/ Adygey Autonomous Oblast. 5/ 1.1 km SSW of RR station, directly S of Cast Iron Plant Frunze. 6/

7. Makoshino

Location: Province of Chernigov in Ukraine. 1/

Production: Planned for 1941 for kok-saghyz, with capacity of 300 tons. 1/

8. Moscow

Production: Existed in 1940, experimental plant for rubber and gutta-percha. Alkali-process, flotation plant proposed. 1/

9. Moscow "Kleituk" Glue Factory

Production: Factory changed over from production of joiners glue to the extraction of rubber from kok-saghyz in 1941. 7/

USSR (Continued)

10. Plavsk

Location: Province of Tula. 1/

Production: Plan for 1941 for kok-saghyz. 1/ Planned capacity 200 to 300 tons per year. 2/

11. Shurab

Location: Province of Leninabad, Tadzhik SSR. 7/

Production: Natural rubber factory in operation since the beginning of 1946. 7/

12. Tash-Sari

Location: (Bei Turkestan in Kazakhstan) 1/ Tashkent Oblast, Uzbek SSR, Kazakhstan, and Central Asia Region. 8/

Production: Existed in 1940 for chondrilla, with capacity of 300 tons. Flotation plant proposed. 1/ Natural rubber (kok-saghyz), 14 MT per day in 1933. 9/ Annual production, 2.2 MT in 1932; 5.6 MT, in 1934; 88 MT, in 1935; to reach 1,000 MT soon. 10/

13. Uman' 30°13'E-48°45'N SG-1 Factory

Location: In Ukraine. 1/ Kiev Oblast, Ukraine SSR.

Production: Existed in 1940, for kok-saghyz and gutta-percha, with capacity of 1,000 tons. 1/ Uman' natural gutta-percha factory under Glavkaouchuk administration. Poorly qualified personnel; too few technicians. Started operations in 1939. Factory equipment and part of buildings destroyed. Reconstruction begun in 1935.

USSR (Continued)

13. Uman' (Continued)

Production resumed after war in third quarter of 1947, but equipment is bad. Uses kok-saghyz roots from plantations in area. 11/

14. Zhlobin

Location: White Russia. 1/

Production: Planned for kok-saghyz according to plan for 1941. 1/

15. Miscellaneous

Others reported have included:

Terter	- Azerbaydzhan	- Works No. 4 (?)
UFA	- Bashkir?	- Reported existing in 1940. 1/
Sinel'nikovo	- Ukraine	- Planned for 1941 for resin-rubber. 1/

The following were included among nine works reportedly planned for 1942:

Azerbaydzhan	For tau-saghyz
Azerbaydzhan at Karabakhskiy Khrebet	For guayule
Kuybyshev	For gutta-percha
Kursk	For kok-saghyz (under construction since 1936)
Mogilevo	For kok-saghyz
Romny	For kok-saghyz

16. SATELLITES

Production: [redacted] 650 tons of kok-saghyz roots from shrubs grown in Czechoslovakia were shipped to Polish plants, which produced approximately 56 tons of crude rubber. 12/ Locations of these processing installations in Poland are not known. 50X1

TAB C

APPENDIX D

SOVIET BLOC RECLAIMED RUBBER INSTALLATIONS

USSR

1. Cheboksary — Factory for Industrial Technology No. 320

   Location: Chuvash ASSR, Volga Region. 1/*

   Production: Rubber reclaiming factory under construction. 1/ Reported under construction using solution method. 2/

2. Ivanovo — Synthetic Sole Combine KIP

   Production: Reported to have capacity of 2,500 tons, using the heat method. 1/ By 1939 it was reported to be a small-scale regeneration unit in Ivanovo. 1/ In the KIP works in Ivanovo, peat tar has been used as the plasticizer. The regenerate produced here mixes well with the adjuvants, mills well, and calenders well. 1/

3. Kalinin

   Location: Located E of city, on right bank of Volga. 1/ In Rubber Sole Plant Kreps. 2/

   Labor: 1,500 employees in 1941. 1/

   Production: Rubber reclaiming installation here. 2/ Plant reportedly went into operation in 1939 with a capacity of 6,000 tons, by the heat method. 2/

50X1

USSR (Continued)

4. Kazan'

Production: A regeneration plant was reported under construction here since 1939. 1/

5. Kiev/Darnitsa Krasnyy Rezinshchik

Location: About 12 km W of Kiev. 2/ About 800 m E of eastern perimeter of Darnitsa, about 300 m S of a road leading in E direction to unknown destination. 3/

Labor: In 1945, 20 to 30 workers, plus 250 to 350 PWs; in 1946, 80 to 100 men, plus 350 to 400 PWs; before the war, 1,200 workers. 4/

Production: Reportedly went into operation in 1940 with capacity of 6,000 tons by the solution method. This plant, however, was in the area occupied by the German Army (in 1942?). 1/ Plant manufactures rubber sheets 0.40 m x 0.10 x 0.01. Produces latex mixed with carbon and dust converted into rubber sheets 500 mm x 300 mm x 10 mm, about 80 sheets daily. 5/ [redacted] some rubber balls in PW Camp 7062/3 in 1948, which allegedly had been made in the camp for the plant by sick PW from materials supplied by the plant. 6/ Daily production of Kiev/Darnitsa plant was from 20 to 50 tons of reclaimed synthetic rubber. 7/ 50X1

6. Leningrad Krasnyy Treugolnik

Production: The first regeneration unit was built in Russia in 1905 in Treugolnik plant in St. Petersburg (Leningrad). Reportedly went into production in 1937, with a capacity of 15,000 tons, by the heat and acid methods. 1/ Factory is mentioned in press in 1950. 2/

USSR (Continued)

7. Lopasnya

Location: 1 km SW of Lopasnya. 1/ On S side road from Lopasnya station near Moscow, approximately halfway between. 3/

Labor: 400 Russians in three shifts and 30 to 35 PWs. 1/ About 1,000 civilians on three shifts and 80 PWs (on day shift only). 3/

Production: According to the plan (1934) a regeneration plant in Vladykino near Moscow having a capacity of 20,000 tons per year was projected (apparently was substituted by the plant in Lopasnya). Reportedly went into operation in 1940 with a capacity of 18,000 tons, using solution method. 2/ [redacted] the plant was constructed before World War II. Old rubber items, mostly old vehicle tires of the German Army, arrive by RR. Crude rubber is produced in bales (30 x 70 x 15 cm); estimated daily production, one RR box car of rubber bales. 1/ About 400 truck tires are processed daily, including some captured enemy material. Produces estimated five RR carloads of pressed rubber plates per week reclaimed from old tires. 3/ Capacity, 6,000 tons. 4/

50X1

8. Moscow — Krasnyy Bogatyr

Location: Located in Moscow-Sokol'niki. 1/ In NE suburb of Moscow, 5 miles NE of Kremlin and 1-1/2 miles S of Belokamennaya RR station. 2/

Production: Equipment for reclaiming installation left behind when plant was partially evacuated to Tomsk. 3/

USSR (Continued)

9. Moscow — Provodnik

Production: Up to 1937, used acid method for reclaiming rubber from galoshes. Equipment was antiquated, end product unsatisfactory. Reclaiming by acid process was 5,000 tons in 1938; 6,000 tons per year in 1941. 1/

10. Tbilisi

Production: Regenerating plant for natural rubber. 1/ Construction of rubber regenerating plant began in 1936; completion planned in 1937. Total capitalization unknown, but during 1936, 1 million rubles (current prices) were to be invested. Annual rated capacity of the plant was to be 6,000 tons of reclaimed rubber. 2/ Reported under construction since 1939. 3/

11. Vitebsk

Production: Reported. 1/

12. Yaroslavl'

Location: At Yaroslavl', about 300 km from Moscow. 3/

Production: In addition to producing new rubber, this plant reuses old worn-out tires, a large stock of which is always piled up within the compound. 1/ Tires are produced from synthetic rubber and from rubber reclaimed from old tires. The latter are put into some sort of machine which shreds rubber and leaves only fabric. 2/ The Yaroslavl' Tire Repair Workshop of Rosremshina (Rostov Tire Repair Workshop) Trust has begun experimental repair of tire casings with waste from production of tires. In early 1930's a US company designed and supplied a rubber reclaiming

USSR (Continued)

12. Yaroslavl' (Continued)

plant to USSR Rubber Trust, designed for capacity of 25 tons of reclaimed rubber per day, with 270 working days of three 7-hour shifts each per year. Design allowed for future expansion so that one or two more 25-ton units could be added beside the present plant if desired. Of 25-ton present capacity, proportion was to be 75% galoshes, 18% tires, 0% tubes, and 7% mechanical goods. After 10 years these proportions would be 45% galoshes, 45% tires, and 10% mechanical goods. The maximum amount of scrap to be stored at any one time was to be 4 months' supply. 3/ The older regeneration plants use the acid method. The plant in Yaroslavl' used the alkali method. Reportedly another unit in addition to one of 6,000 tons per year was under construction since 1939. 4/ Production capacity, 3,050 tons; eventually, 8,250 tons planned.

13. Kursk

Tashkent — Information on these three plants is not available.

Uritsk

SATELLITES

Bulgaria — Bakish (Georgi Dimitrov)

14. Sofia

Location: At Voenna Rampa, a suburb of Sofia. 1/

Production: Listed under raw materials were 300 to 400 kg of reclaimed rubber daily, presumably made by this plant.

SATELLITES (Continued)

Bulgaria (Continued)

14. Sofia (Continued)

A central rubber reclaiming factory was to be built in 1950 in an unknown location. 1/ The Bakish plant received Soviet-made airplane tires for reclaiming. 2/

Czechoslovakia

15. Gottwaldov/Zlin — Bata

Production: The reclaiming unit of the plant has been modernized several times and considerable amount of new construction was added in 1948. This reclaimed rubber unit is said to be the only one of its kind in Czechoslovakia and is built to produce sufficient rubber for all the rubber factories in Czechoslovakia. 1/ The plan for 1949 provided for 6,142 tons of reclaimed rubber to be produced from collections of scrap. 2/

East Germany

16. Gotha — Gummitechnik Gotha

Production: Production plan of VVB Kautas for year 1951 was reported at 540 tons for Gummitechnik plant. 1/

17. Hoerselgau — Vereinigte Gothania

Production: Production plan of VVB Kautas for the year 1951 was reported at 600 tons of reclaimed rubber for the Vereinigte Gothania works. 1/ The Gothania-werke, located in Hoerselgau, will add a used rubber reclamation unit. (Work on this unit has already begun.) 2/

SATELLITES (Continued)

East Germany (Continued)

18. Meuselwitz — Heimer, Pilz & Soehne

Location: In Meuselwitz. 1/

Labor: The plant employs about 250 persons. 1/

Production: This firm produces elastic rubber products and heavy-duty rubber couplings and also operates a rubber reclamation plant. Produces about 15 tons of rubber monthly. It is planned that this firm will be expanded in order to supply raw materials for East German rubber factories. It is partly rebuilt, having suffered bomb damage, and is now in good condition. 1/

19. Schoenebeck

Production: Production plan of VVB Kautas for the year 1951 was reported at 650 tons of reclaimed rubber to be produced by the Schoenebeck plant. 1/

20. Waltershausen/Thuringia — Schlauch & Gummi

Production: Production plan of VVB Kautas for the year 1951 was reported at 330 tons of reclaimed rubber to be produced by the Waltershausen/Thuringia plant. 1/

21. Zipsendorf — Granis & Baermer 2/

Location: Located in Zipsendorf. 2/

Labor: Approximately 250 persons are employed in the plant. 2/ Approximately 4,000 workers. 3/

SATELLITES (Continued)

East Germany (Continued)

21. Zipsendorf (Continued)

Production: Production plan of the VVB Kautas for the year 1951 was reported at 1,650 tons of reclaimed rubber to be produced by Zipsendorf plant. 1/ This firm specializes in the reclamation of old rubber and the manufacture of shock mountings for vehicle and marine motors. It produces 20 tons of reclaimed rubber monthly and 7 million Deutsche Mark (East) in shock mounts yearly. 2/ Production program for 1951 is 1,650 tons of reclaimed rubber. Actual production in 1951 will be approximately 2,000 tons, since by reducing the refining processes to a maximum of four processes, production can be increased. Difficulties exist regarding only grinding discs for the "condux" mills. 3/

Poland

22. Bolechowo

Production: Rubber reclaiming plant built by workers of State Rubber Industry Plant No. 2 in Poznan. For reclaiming from waste materials and old used tires. 1/

23. Krakow — Semperit

Production: Reclaimed rubber. 1/

24. Poznan — Stomil Tire Factory

Location: On E side of Warta River in Poznan. 1/

Production: Reclaimed rubber. 2/

TAB D

SOVIET BLOC RUBBER IMPORTS

Natural rubber exports by the major producing countries of Southeast Asia to the USSR are reported regularly. Re-exports and transit trade, however, are usually more difficult to obtain. For the purpose of this report, the estimates of the Rubber Statistical Bulletin (RSB) are used for figures of natural rubber supply, since they are believed to represent more reliable data for all the years given than would be shown in other statistics.

Detailed natural rubber exports by the major rubber producing countries of the Far East to the Soviet Bloc countries are shown in Tables 1 to 6.*

Information on intra-Bloc trade is fragmentary, and it has not yet been possible to consolidate such details into reliable net import figures for the rubber supply of the Soviet Bloc.

* Table 1 follows on p. D-2; Table 2, on p. D-3; Table 3, on p. D-5; Table 4, on p. D-7; Table 5, on p. D-9; Table 6, on p. D-10.

Table 1

1946 Soviet Bloc Rubber Imports a/

Long Tons

Type of Rubber	Exporting Country	USSR	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Rumania	Albania	China	Total
Natural	Malaya	0		1,205		80				4,249	5,534
	Indonesia	0									
	Ceylon	3,015									3,015
Total Natural		3,015		1,205 b/		80	4,530 c/			4,249	13,079
RSB Estimate (Natural Rubber)		9,500		779		256	1,450			12,111	24,096
Synthetic											
US							472 d/				
Canada											
East Germany							2,100				
USSR								300 e/			
Total Synthetic				5,055 b/			2,572	300			7,927
Total Reclaimed				1,530 b/							1,530

a. Spaces left blank in this table indicate that data are not available.
b. World Trade in Commodities, Jun 1948, gave 791 tons of natural rubber, 5,055 tons of synthetic rubber, and 1,530 tons of scrap rubber as imported during 1946.
c. Polish Statistical Yearbook for 1947-48.
d. Chemical Engineer, 8 Jan 1948.
e. WDGS 451720, 20 Feb 1948.

Table 2

1947 Soviet Bloc Rubber Imports a/*

Long Tons

Type of Rubber	Exporting Country	USSR	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Rumania	Albania	China	Total
Natural	Malaya	37,024		3,509		76	3,010	118		7,384	51,121
	Indonesia	0					795				795
	Ceylon	0									
	UK Re-exports	6,022		1,734		795	551	14 b/			9,116
	Netherlands, Transit										
	Germany, Transit										
	Belgium, Transit										
	US Re-exports	0		0		0				0	
	Nigeria										
	Macao										
	Hong Kong										
	UK, Transit										
	Other										
Total Natural		43,046		5,243 c/		871	4,356 d/	132		7,384	61,032
RSB Estimate (Natural Rubber)		35,000	300	14,767		2,377	2,250	100		22,188	76,982
Synthetic											
US		120		79		2	0			0	201
Canada				1,413			693				2,106
Total Synthetic		120		1,492 b/		2	693				2,307
Reclaimed											
US				0		0				5	5
UK				110		10				0	120
Total Reclaimed				110 c/		10				5	125

* Footnotes for Table 2 follow on p. D-4.

Table 2

1947 Soviet Bloc Rubber Imports a/
(Continued)

a. Spaces left blank in this table indicate that data are not available.
b. Commerce, Bucharest, 22 May 1948.
c. World Trade in Commodities, Jan 1948, gives 15,024 tons of natural rubber, 1,776 tons of synthetic rubber, and 910 tons of scrap rubber as imported during 1947.
d. [redacted], from Polish statistics, gave 1947 rubber imports by Poland as 7,108 tons. It is not known whether this includes all types of rubber. 50X1

Table 3

1948 Soviet Bloc Rubber Imports a/*

Long Tons

Type of Rubber	Exporting Country	USSR	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Rumania	Albania	China	Total
Natural	Malaya	103,593	350	4,377			1,940	1,492		9,465	121,217
	Indonesia	0					257			998	1,255
	Ceylon	0	110 b/				511			0	621
	UK Re-exports	404		5,810		332	289			0	6,835
	Netherlands, Transit										
	Germany, Transit										
	Belgium, Transit			636		1,237	13				1,886
	US Re-exports	0		0		0	0			0	
	Nigeria			935							935
	Macao										
	Hong Kong									7,103	7,103
	UK, Transit										
	Other										
Total Natural		103,997	460	11,758	900 c/	1,569	3,010 d/	1,492		17,566	139,852
RSB Estimate (Natural Rubber)		100,000	150	23,535		3,000	3,600	1,000		21,000	152,285
Synthetic											
US		10		0			0				10
Canada		0		39			0				39
Total Synthetic		10		39							49
Reclaimed											
US				0		0				0	
UK				590		5				0	595
Total Reclaimed				590		5					595

* Footnotes for Table 3 follow on p. D-6.

Table 3

1948 Soviet Bloc Rubber Imports a/
(Continued)

a. Spaces left blank in this table indicate that data are not available.
b. Including re-export; Department of Commerce figures from Ceylon customs returns.
d. [redacted] from Polish statistics, gave 1948 rubber imports by Poland as 12,876 tons. It is not known whether this includes all types of rubber. E0X1 50X1

Table 4

1949 Soviet Bloc Rubber Imports a/*

Long Tons

Type of Rubber	Exporting Country	USSR	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Rumania	Albania	China	Total
Natural	Malaya	63,414	342	4,641		285	7,909	1,132		6,990	84,713
	Indonesia	0					709			3	712
	Ceylon						125			1,265	1,390
	UK Re-exports	482	174	3,917		275	149	18		800	5,815
	Netherlands, Transit	21,540	246	8,521		4,476	978				35,761
	Germany, Transit			17,463		3,663					21,126
	Belgium, Transit			725		215	0				940
	US Re-exports	0		0		0	0				
	Nigeria			1,212							1,212
	Macao										
	Hong Kong									16,412	16,412
	UK, Transit	2		383		2	35				422
	Other	50 b/									50
Total Natural		85,488	762	36,862	1,700 c/	8,916	9,905 d/	1,150		25,470	168,553
RSB Estimate (Natural Rubber)		105,000	925	27,500		8,500	12,000	1,250		27,500	182,675
Synthetic											
US		0		0			0				
Canada				423 e/							423
Total Synthetic		0		423			0				423
Reclaimed											
US				0		0				0	
UK				799		0				0	799
Total Reclaimed				799							799

* Footnotes for Table 4 follow on p. D-8.

Table 4

1949 Soviet Bloc Rubber Imports a/
(Continued)

a. Spaces left blank in this table indicate that data are not available.
b. From Sarawak.
c.
d. Eight months, from Polish statistics, gave 1949 rubber imports by Poland as 11,084 tons. It is not known whether this includes all types of rubber.
e. Eight months.

50X1

S-E-C-R-E-T

Table 5

1950 Soviet Bloc Rubber Imports a/

Long Tons

Type of Rubber	Exporting Country	USSR	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Rumania	Albania	China	Total
Natural	Malaya	67,898	0	8,460		204	4,115	7		38,568	119,252
	Indonesia	0	0	0		0	850	0			850
	Ceylon	0	0	0		0	100			75	175
	UK Re-exports	10,075	453 b/	1,122		140	193	93 b/		1	12,077
	Netherlands, Transit	4,501	78	1,770	504	2,145	1,278	78		0	10,354
	Germany, Transit	0		16,245 b/		3,482 c/	0 c/	9 d/			19,736
	Belgium, Transit			1,299 e/		263 f/	6 g/				1,568
	US Re-exports	0		0		0	0			0	
	Nigeria			1,607							1,607
	Macao										
	Hong Kong									39,118	39,118
	UK, Transit	50 g/		217 g/		0 g/	0 g/				267
	Other										
Total Natural		82,524	531	30,720	504 h/	6,234	6,542	187		77,762	205,104
RSB Estimate (Natural Rubber)		82,500	775	22,500		6,500	5,500	575		70,000	188,350
Total Synthetic											
Total Reclaimed											

a. Spaces left blank in this table indicate that data are not available.
b. Ten months.
c. Nine months.
d. One month.
e. Eleven months' exports; transit trade of 107 tons given for 6 months of 1950.
f. Exports given as 263 tons for 11 months; transit trade of 71 tons given for 6 months of 1950.
g. Six months' transit trade.
h. [redacted] imports for Jan-Sep 1950 as 1,064 tons; [redacted]

50X1

S-E-C-R-E-T

Table 6

1951 Soviet Bloc Rubber Imports a/

Long Tons

Type of Rubber	Exporting Country	USSR	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Rumania	Albania	China	Total
Natural	Malaya	14,497	0	9,520	47 b/	0	9,410	65		22,727	56,375 c/
	Indonesia	0		63			1,206				1,269
	Ceylon	0					920			5,543	6,463
	UK Re-exports	41,620	100 b/	141	234	84	25	350 d/		0	42,643 c/
	Netherlands, Transit	7,990	70	4,143	9,095	205	1,523				23,026
	Germany, Transit										
	Belgium, Transit										
	US Re-exports	0		0	0	0	0				
	Nigeria			1,570 e/							1,570
	Macao									5,917 g/	5,917
	Hong Kong									37,284 h/	37,284
	Other	29 f/									29
											(174,378)
Total Natural		64,136	170	15,437	9,376	289	13,084	415		71,471	174,576 b/
RSB Estimate (Natural Rubber)		67,500	275	11,000		250	11,500	600		73,250	164,375
Synthetic											
US		0		0			1				1
Canada											
Total Synthetic											1
Total Reclaimed											

a. Spaces left blank in this table indicate that data are not available.
b. One month.
c. [redacted] 19,151 tons exported from Malaya to the Satellites; figures shown above total 19,042, and it may be that the additional 109 tons unaccounted for went to East Germany; UK re-exports to the Satellites reported at 1,023 (countries shown total only 934, and 89 tons are unaccounted for); total of 198 tons to the Satellites from Malaya and UK unaccounted for in country totals. 50X1
d. During Dec 1951 (Rubber News Sheet).
e. Ten months.
f. From the Belgian Congo during 8 months of 1951.
g. Six months.
h. Seven months.

TAB E

SOVIET RUBBER CONSUMPTION

I. Consumption of Rubber for Transportation Goods.

A. Tires.

Estimation of rubber consumption depends primarily on the production of tires. An estimate was made of the capacities of plants to produce tires based on information on individual plants [redacted] as stated earlier in this report. Technological reports show that the plants in the USSR follow US practice for the production of automotive tires. [redacted] a range of sizes comparable to those in the US. 50X1 50X1

Best evidence indicates that the tires produced in the USSR are of the same weight, size for size, as tires produced in the US. For example, a 6.00 x 16 tire in the US weighs approximately 23 pounds; the same size of tire produced in the USSR weighs approximately the same.

The Moscow Tire Factory was designed by the Firestone Tire and Rubber Company for the Ford Motor Company. This plant has been reported to have been the prototype for all recent tire plants within the USSR. The original plant was designed to produce two sizes of tires: the 6.00 x 16 and the 7.50 x 20 (truck) tires. There has been additional evidence that the Moscow Tire Plant is now producing tires of other sizes, including aircraft tires, using the same technology as was originally suggested in the prototype plant shipped by the Ford Motor Company under Lend-Lease. Therefore, it was assumed that the USSR would use comparable sizes of passenger and truck tires to those in the US.

A test of the validity of plant analysis as a means of deriving tire production is noted in the case of the Moscow Tire Plant.

The plant studies on the Moscow Tire Plant for the year 1951 [redacted] showed our estimate to be accurate within 3 percent. The Yaroslavl' plant studies 50X1 50X1

have been shown to be reasonably accurate [redacted] 50X1

[redacted] 50X1

Attempts have been made to compromise the number of tires produced, as indicated by plant studies [redacted] 1/* 50X1 with data derived from Soviet yearly increases. This latter method of estimation faces the problem of obtaining a reliable base figure for 1946.

The following percentage rates of increase have been reported by the Soviet press:

	Percentage of Yearly Increase
1946	Not given
1947	49
1948	38
1949	39
1950	30
1951	Not given

In order to use these percentage rates of yearly increase, it is obvious that a base for 1946 is required. There is no information on actual output of tires during that year. Some attempt has been made to relate incomplete data on tire cord production to tire production. The information available on tire cord, however, is not complete enough to warrant its use as a base for total tire production.

The installation of the Moscow Tire Plant using US technology apparently converted Soviet tire manufacture over to a greater or lesser degree to the use of rayon (or other synthetic fiber) cord. There are no quantitative data as to the number of tires produced using synthetic fiber cord.

From available evidence, the major suppliers of synthetic fiber cord (rayon, nylon, etc.) have been the Satellite countries. There are no data concerning this type of tire cord production within the USSR. In this connection, it must be pointed out that tires obtained in East Germany destined for the USSR had rayon cord in the carcass. Furthermore, samples of cord taken directly from a calendar in the same plant used rayon base.

[redacted] 50X1

[redacted] 50X1

no long-staple-fiber cotton is produced in the USSR. This means that all long-staple cotton must be imported from Egypt. In view of intensification of procurement of this type of cotton, it may be reasonably concluded that emphasis on cotton cord still exists within the USSR. This emphasis on cotton procurement may also point up the shortage of rayon and other synthetic fibers for tire cord production in the USSR.

It is also noted that although Western Europe has met with some success in the use of wire cord, there has been no evidence that the USSR has incorporated this type of technology into tire production. The explanation for this point may lie in the fact that the technology of wire cord utilization is somewhat different from that used with cotton or synthetic fiber cord and, being outside the experience of the Russians, may explain their lack of enthusiasm for this innovation in tire manufacture.

Another theory has been advanced that aircraft tire production should be considered separately from motor vehicle tires. There is no information available which justifies this separation. [redacted] 50X1

[redacted] 50X1

[redacted] plant studies and also from 50X1 captured tires show that aircraft tires are produced in the same factories as are motor vehicle tires. This evidence leads one to conclude that any percentage changes in total tire production would include all tires -- that is, both aircraft and motor vehicle.

Without day-to-day production records of the tire industry of the USSR, it is impossible to predict the sizes of tires produced over a given length of time. The technology of producing the largest size of tire used (for earth-moving machines) is exactly the same as that of producing a motorcycle tire. It may be seen, then, that the only criterion for tire production is availability of the required molds. Reasonable estimates of tire production must therefore necessarily be based on an average weight of all tires produced.

An analysis of US production of aircraft tires was made to determine the average weight per aircraft tire. Using the figures published by the Rubber Manufacturers' Association for US aircraft tire production according to size and type of tire for the first quarter of 1952 and the weights for each size and type given in the corresponding Federal Excise Tax Bulletin, the total weight of all aircraft tires pro-

duced in the US during the first quarter of 1952 was obtained. The average weight of an aircraft tire, calculated by dividing the total weight by the total number of tires, was 47.7 pounds, of which not more than 50 percent (23.8 pounds) is rubber. Thus it may be seen that the 23.8 pounds of rubber in an aircraft tire is altogether consistent with the value of 33 pounds of rubber as an average for all types of tires (aircraft and motor vehicle). It must be remembered, however, that the 23.8-pound average rubber content per aircraft tire produced in the US is valid only for the US, where there is emphasis on bombers and transport aircraft. In the USSR, where light aircraft and fighter planes are predominant, the amount of rubber used in an average aircraft tire would probably be lower.

Total tire production, or production of any product for that matter, is best arrived at by means of addition of components. The integration of the entire tire industry by the addition of the separate parts of the industry will lead to a more valid total than will a syllogistic approach assuming a series of disconnected percentage values, an error appearing in an early one to be compounded ad infinitum as one makes additional estimates based on this early error. Predetermined percentage increases within an industry are invalid for several reasons:

1. The statement of fulfillment of a plan implies that all aspects of the plan have been fulfilled; there is substantial evidence, however, that the Russians, in evaluating the fulfillment of a plan, add apples to pears and come out with pineapples -- that is, the 150-percent fulfillment of plan of production of rubber heels is weighted with the 50-percent fulfillment of plan of tires to give a 100-percent fulfillment of the rubber products production plan.

2. The suggestion that percentage-on-percentage increases be used without a firm absolute basic value within two integrals of the final figure magnifies error beyond reasonably consideration.

Based upon indications gleaned from individual plant information and upon estimates available on motor parks and Soviet production of motor vehicles, the use of heavy tires to light tires appears to be in the ratio of 9 to 1. None of the plant information so far noted has indicated a higher ratio, and the average weight of 33 pounds per tire assumed for the USSR is one which almost all researchers on this subject consider as the most reliable.

B. Tubes.

Plant studies indicate that more than one tube is required per casing in the USSR, and for the purpose of this study, 1½ tubes per

casing have been assumed. The average weight of the tire tube was 7.61 pounds, or 11.41 ($1\frac{1}{2}$ tubes) pounds of tube per casing, or 8 pounds of rubber required for $1\frac{1}{2}$ tubes in the USSR. Therefore, 41 pounds of rubber are required for each complete unit.

C. Other Transportation Uses.

Bicycle tires and tubes and tire repair material are included in the transportation use of rubber, since the composition and types of rubbers would be comparable to that for other tires and tubes. No information on this use is available for the USSR. In the absence of such data, an estimated quantity of 10 percent of the total amount of rubber required for motor vehicle tires has been used. This ratio of rubber required for these purposes is comparable to that used in the UK.*

Based upon studies of tire producing plants for the years 1946-51, it was possible to build up an estimated production of tires from all but a few small plants. The total production for each of the years, multiplied by the assumed average of 33 pounds of rubber per tire, plus requirements for tubes and tire repair materials, indicates that 67 percent (2/3), plus or minus 2 percent, of the rubber consumed in the USSR goes into transportation goods. (For the year 1947 the value was 68.6 percent, which is within a reasonable check on the 1950 figure of 65.8 percent.) It is therefore felt that the 67-percent figure for transportation uses is reasonably firm.

D. Types of Rubber Used for the Production of Transportation Goods.

In estimating the quantities of various types of rubber (natural, synthetic, and reclaimed), procedures and experience of US industry technology have served as a reliable guide. The following facts are noted:

1. US industry uses limited amounts of reclaimed rubber in truck tires. About 53 percent natural rubber is used, the balance being synthetic rubber.

2. In building automobile tire sizes, US industry uses approximately 8 percent natural, 59 percent synthetic, and 33 percent reclaimed rubber.

* The Rubber Statistical Bulletin regularly reports usages of rubber by major uses in all monthly issues.

3. US practice is believed to have been used extensively in the USSR. Recently, reports indicate definitely that the USSR has made a determined effort to reduce natural rubber consumption during the past several years. The trend to maximize the use of synthetic rubbers has been much more strenuous than in the US.

Experience and US practice have proved that serviceable tires can be made from compounds containing 90 percent synthetic rubber, with, however, attendant difficulties in processing. It is also known that a better tire can be made and with easier processing if only 50 percent synthetic rubber is used, the remainder being natural and reclaimed. Each of these compounds represents an extreme which seems unnecessary and/or uneconomical in present-day tire building practice in the USSR.

Chemical analyses of Soviet tires show that some truck tire treads in the USSR are being made of 100 percent synthetic rubber, while the carcass is made of a combination of natural and synthetic rubber.

Based on the experience of US tire experts, the ratio of types of rubber (synthetic, natural, and reclaimed) is variable according to requirement. The regulating factors in the utilization of specific formulae are as follows: availability of the particular type of rubber desired; the mechanical properties of the compounds; the conditions under which the rubber part is to be used (road conditions, speed, load factor, etc.); size of tire; types of equipment available for the production of the separate components of the tire; etc. This variability in ratio of synthetic to natural to reclaimed can range from 100 percent natural to 100 percent synthetic, with small amounts of reclaimed present as desired. Based upon US experience, a satisfactory average hydrocarbon content would be 75 percent synthetic, 23 percent natural, and 2 percent reclaimed rubber for calculation purposes. This ratio has been substantiated by the rubber industry of the US. It is interesting to note that [redacted] 50X1
50X1
analyses of captured 50X1
tires check this assumption almost exactly. Of the criteria listed above, the major factor influencing the proportion of synthetic to natural to reclaimed will be the physical equipment used to produce the components of the tire. This formula, on the following page, will produce an easily processed compound and a serviceable tire with a greater use of synthetic rubber:

Percentage of Rubber by Types

Natural	23 percent
Synthetic	75 percent
Reclaimed	2 percent

This ratio is considered applicable to all types of transportation goods (tires, tubes, bicycle tires, repair material). It must be clearly understood that this formula is an average composition.

Tables supplied by the S/TR, CIA, 2/ showing the average number of serviceable motor vehicles in use through the years 1950, 1951, and 1952 (Table 1)* indicate that in 1951 there were approximately nine trucks to one passenger car. This ratio is also valid for the year 1952. An additional report supplied by I/CG, CIA, [redacted] shows 11.5 trucks to 1 passenger car. These were independent reports [redacted] We therefore consider the 9 to 1 ratio quite reasonable. On the basis of six tires per truck against four tires per car, this ratio is apparently wrong. However, when a passenger tire goes out of service, it is at a point of uneconomic repair and is therefore discarded, whereas the truck tire going out of service is usually repairable and can be returned to service. Therefore, automatically the 9 to 1 ratio readjusts itself. 50X1 50X1 50X1

Using the previously stated ratios of types of rubber for the production of transportation goods, the quantities of rubbers that would be used are indicated in Table 2.**

* Table 1 follows on p. E-8.
** Table 2 follows on p. E-9.

Table 1

Average Number of Serviceable Motor Vehicles in Use in the USSR a/

	1950	1951	1952
Trucks, 2-Ton and Under	542,750	723,875	898,250
Trucks, 2.5-Ton and 3-Ton	509,900	678,950	841,700
Diesel Trucks	32,850	44,925	56,550
Total	1,085,500	1,447,750	1,796,500
Light Passenger Cars	89,625	119,812	148,874
Heavy Passenger Cars	29,875	39,938	49,626
Total	119,500	159,750	198,500
Grand Total	1,205,000	1,607,500	1,995,000

a. Notes:
1. Buses are included with trucks.
2. Serviceability estimated at 65 percent of total park; for estimate of total park, divide above figures by 0.65
3. A later estimate of the size of the diesel truck inventory, based on production data, indicates that the present number of diesel trucks in use probably does not exceed 25 percent of the figure given above. The serviceability of the diesel equipment, in view of the newness of this equipment, probably is much higher than the 65 percent used as an average for the motor vehicle park as a whole.
4. The above truck figures include military vehicles, which represent about 30 percent of the total truck park.
5. Annual mileage figures for these vehicles are estimated to be 20,000 miles for trucks and 10,000 miles for passenger cars. For derivation of these figures, see 2/.

Table 2

Soviet Rubber Consumption by Type
Used for Transportation Goods

Thousand Metric Tons

Year	Natural	Synthetic	Reclaimed	Total
1946	13.7 a/	44.7 b/	1.2	59.6
1947	18.0	58.3 c/	1.5	77.8
1948	24.0	78.4	2.1	104.5
1949	31.0	100.8	2.7	134.5
1950	38.1	124.2	3.3	165.6
1951	42.4	138.4	3.7	184.5
1952	46.4	151.1	4.0	201.5
1953	50.8	165.7	4.4	220.9

a. Only 9,500 tons of natural rubber were recorded as received by the USSR in 1946. However, since 17,000 tons were received by 1945, some of this amount may have been carried over into 1946.
b. Estimated production of synthetic rubber in the USSR for 1946 is only 40,000 tons. It should be noted, however, that about 9,000 tons were imported in 1945, some of which may have been carried over, and an unknown quantity of synthetic rubber was received by the USSR from East Germany in 1946.
c. Only 50,000 tons of synthetic rubber was believed to have been produced by the USSR in 1947. Additional quantities, exact amount unknown, were received from East Germany.

A study of prewar trends in the use of synthetic rubber has yielded the following information as reported by German studies. 3/

In 1936 and in the 1937 plan the following proportions of synthetic rubber were to be used in the various types of rubber products:

	Percentage of Synthetic Rubber	
	1936	1937 Plan
Tires	53.6	85.5
Rubber Shoes	38.4	76.8
Rubber Soles	97.1	100.0
Technical Rubber Goods	43.5	79.3
Average	58.0	85.4

II. Consumption of Rubber for Nontransportation Goods.

The information on the breakdown of rubber articles in the nontransportation field is so limited that no reliable figures can be derived.

On the basis of US, British, and French experience, it is generally conceded that the allocation of rubber between transportation and nontransportation end product is 2/3 to 1/3 in favor of the transportation user, as was shown above. It must be noted that other elastomers (polyvinylchloride, polyisobutylene, etc.) may be used for nontransportation purposes as a substitute for rubber. Estimates on rubber consumption for nontransportation purposes are based wholly on indications rather than on quantitative data.

A. Rubber Footwear.

Some attempts have been made to break down the various groups of nontransportation products in order to arrive at a more reliable estimate of rubber consumption. There are no indications as to the types of rubber footwear produced, each type of which requires a different proportion of rubber. The Soviet press has announced percentage rates of increase for footwear on postwar years. The goal for 1950 was given in the Fourth Five Year Plan both relative to prewar levels and also in actual figures: namely, 88.6 million pairs.

Published information states that 13 million pairs of rubber footwear were produced in the first third of 1947. The rubber

shoe industry is seasonable, and there is no proof that 39 million pairs were produced over the entire year. Based on percentage figures, certain estimates for footwear production and rubber consumption have been obtained. (See Table 3.)* It is pointed out, however, that two researchers using the same data have derived different estimates for the same years, probably because all estimates are dependent on a basic figure for 1945 or other postwar years.

According to Malenkov's statement in his keynote address at the 1952 Communist Party Congress, 125 million pairs of rubber footwear are to be produced in 1952.** Using the consumption coefficient from Analysis 1 (0.63) in Table 3, above, 35,700 metric tons of rubber would be required, but according to the consumption coefficient in Analysis 2 (1.2), 68,000 metric tons of rubber would be needed to produce the 125 million pairs of rubber footwear in 1952. The consumption coefficients are defined as the pounds of rubber required to make one pair of rubber footwear.

Owing to the fact that there is no information concerning the breakdown by types of the estimated 125 million pairs of rubber footwear, it is impossible to arrive at a consumption coefficient for rubber footwear using the same techniques as were applied to determine the average rubber content of tires. However, there is information at hand that indicates that this figure can vary between 0.5 and 2.5 pounds per pair according to type of footwear. Further research will undoubtedly develop a competent consumption coefficient for rubber footwear.

B. Soles and Heels.

Attempts also have been made to derive the amount of rubber consumed in the production of soles and heels. This consumption estimate has been attempted by using ratios calculated on the basis of the last announced statistics (1935) and applying that ratio to the estimated current output of leather footwear, based on percentage

* Table 3 follows on p. E-12.

** New York Times, 7 Oct 1952, p. C3. An article on the new Five Year Plan gives forecast for 1952 production of rubber footwear in actual figures but no percentage rate of increases over the preceding year. The article stated that this 1952 figure represented "80 percent more than in 1940."

Table 3

Soviet Production of Rubber Footwear (Estimated)
1946-51

Year	Yearly Increase (Percent)	Analysis 1 4/ Footwear Produced (Million Pairs)	Analysis 1 4/ Rubber Required (Thousand Metric Tons)	Analysis 2 5/ Footwear Produced (Million Pairs)	Analysis 2 5/ Rubber Required (Thousand Metric Tons)
1940	N.A.	N.A.	N.A.	68	37.29
1946	97	23.6	6.7	N.A.	N.A.
1947	68	39.6	11.2	50	27.4
1948	37	54.3	15.4	69	37.77
1949	28	69.5	19.7	88	48.37
1950	18	82.0	23.3	103	56.56
1951	11	91.0	25.8	114	62.17

increases.* Since advanced technology has produced other materials (that is, plastics, etc.) for the footwear industry in Western countries, this method has obviously become obsolete.

C. Other Non-Transportation Goods.

Very little work has been done on arriving at consumption figures for mechanical rubber goods, mainly because there is practically no information on output of the various types of goods included in this category. It is considered one of the most important categories of non-transportation goods, since it supplies industry with such products as conveyor and transmission belts; molded, wrapped discharge, and suction hose; chemical oil suction and oil discharge hose; rubber tank and pipe lining; rubber printing roller blankets; rubber steel mill fillers; rubber packing; extended and lathe-cut rubber goods; and paper mill rollers.

* New York Times, 7 Oct 1952, in giving actual figures of 1951 and 1952 production of leather footwear, coincides almost exactly with estimates made by the Department of State for these shoes.

Because of the lack of information and the danger of magnifying error in breaking down the various categories for which little information is available, the allocation of 2/3 of rubber consumed for transportation goods and 1/3 for nontransportation products is still considered to be the most reliable basis for the calculation of rubber consumption by the USSR.

D. Types of Rubber Used for Nontransportation Goods.

Rubber footwear is produced where possible from lower-grade rubbers. The maximum of reclaimed rubber would be used in the manufacture of rubber shoes, with the balance being largely synthetic rubber to meet the requirements of the trade. No conclusive data concerning the allocation of types of rubbers used have been found for drug sundries or mechanical goods.

Next 17 Page(s) In Document Denied

0167-0163-10M

USAF TARGET MOSAIC - SERIES 10

CONFIDENTIAL

YEFREMOV SYNTHETIC RUBBER PLANT SK3
YEFREMOV

U.S.S.R.

CENTER OF TARGET
H-050 V-050
Lat. 53°09'11"N Long. 38°07'23"E
Elev. 520 ft. above mean sea level

SCALE 1:10,000
1ST EDITION AUGUST 1951

DATES OF PHOTOGRAPHY JULY 1942 - JULY 1943

Base 100 ACIS 8-51
Litho by ACIS 11-51

PREPARED UNDER THE DIRECTION OF THE CHIEF OF STAFF, USAF,
AND PUBLISHED BY THE USAF AERONAUTICAL CHART AND
INFORMATION SERVICE, WASHINGTON 25, D. C.

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YEFREMOV SYNTHETIC RUBBER PLANT SK3
YEFREMOV

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0234-0010-10M

USAF TARGET MOSAIC - SERIES 10

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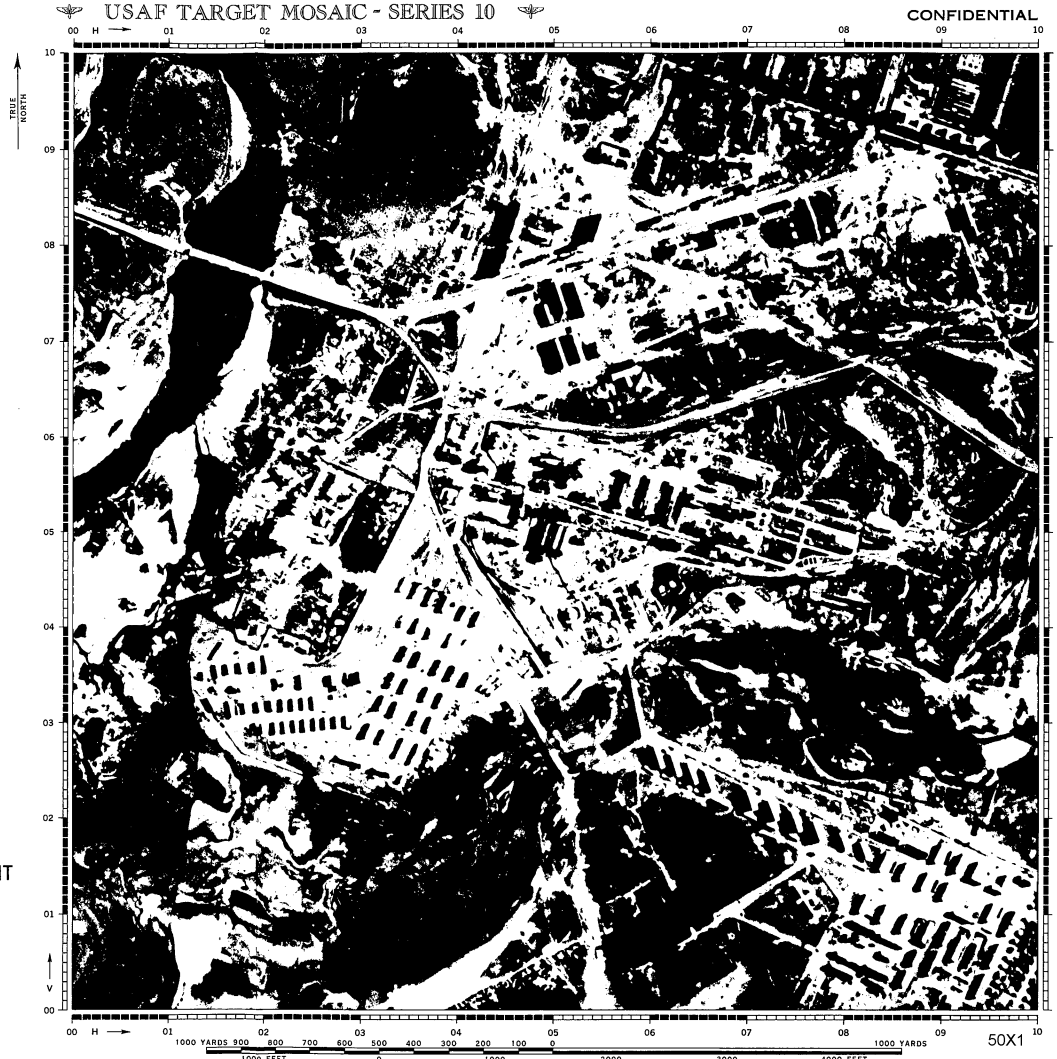

VORONEZH SYNTHETIC RUBBER PLANT
VORONEZH (9590.18)

U.S.S.R.

CENTER OF TARGET
H-056 V-055
Lat. 51°37'39"N Long. 39°14'18"E
Elev. 360 ft. above mean sea level

SCALE 1:10,000
1ST EDITION AUGUST 1949

DATES OF PHOTOGRAPHY JUNE - JULY 1942
Base 100 ACS 8-49
Litho ACS 1-51

50X1

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VORONEZH SYNTHETIC RUBBER PLANT
VORONEZH (9590.18)

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0325-0021-10M

USAF TARGET MOSAIC - SERIES 10

CONFIDENTIAL

YEREVAN SYNTHETIC RUBBER AND CHEMICAL PLANT "KIROV" 741, YEREVAN (9870.3)

U.S.S.R.

CENTER OF TARGET

H-050 V-050

Lat. 40°07'49"N Long. 44°29'51"E

Elev. 3120 ft. above mean sea level

SCALE 1:10,000

1ST EDITION NOVEMBER 1950

DATES OF PHOTOGRAPHY MAY 1942 - OCTOBER 1942

Base 100 USDA - PMA 11-50

Litho ACS 2-51

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0325-0021-10M

YEREVAN SYNTHETIC RUBBER AND CHEMICAL PLANT "KIROV" 741 YEREVAN (9870.3)

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0154-0008-10M

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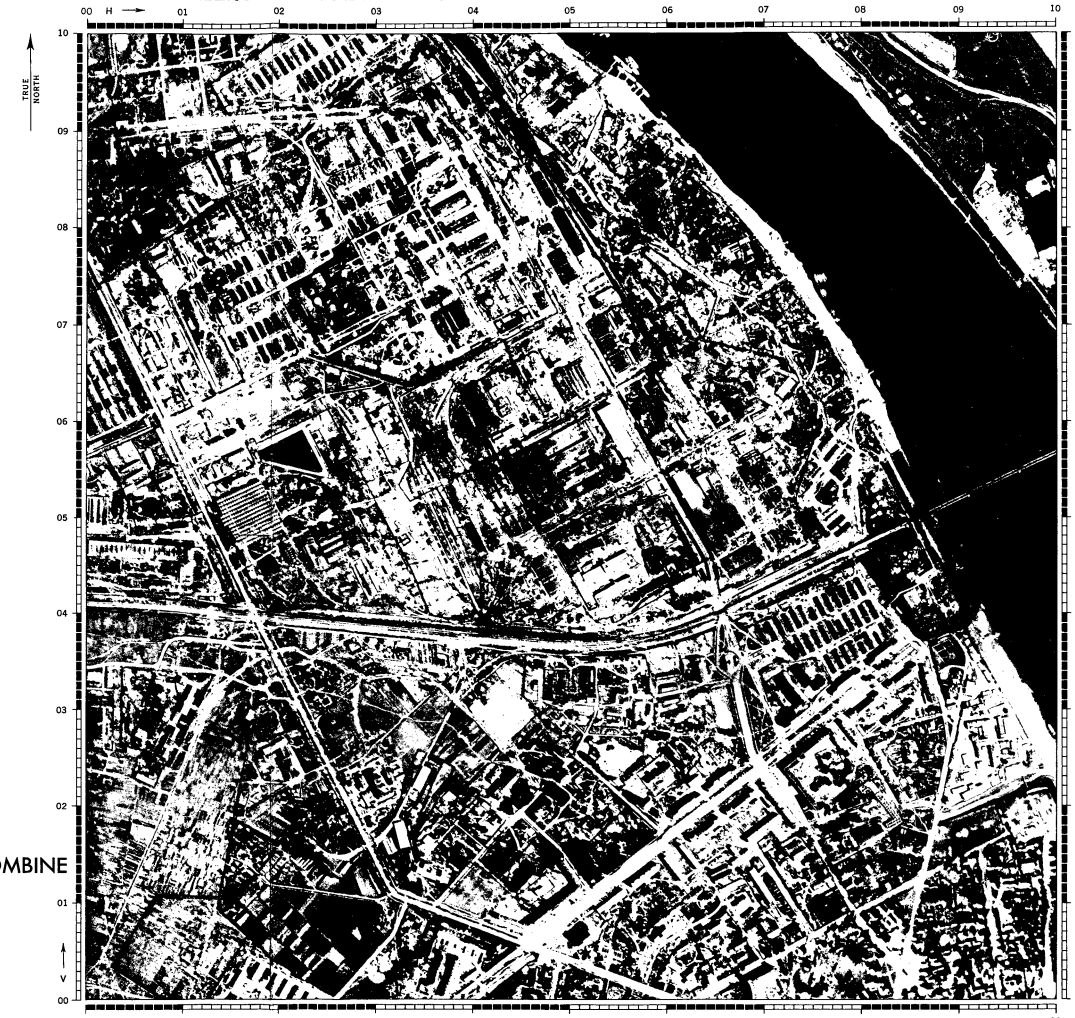

YAROSLAVL RUBBER AND ASBESTOS COMBINE "YARAK", YAROSLAVL (9770.5)

U.S.S.R.

CENTER OF TARGET
H-050 V-050
Lat. 57°38'50"N Long. 39°52'07"E
Elev. 310 ft. above mean sea level

SCALE 1:10,000
1ST EDITION OCTOBER 1950

DATES OF PHOTOGRAPHY OCTOBER 1941 - AUGUST 1942

Base 100 ACS 10-50
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Base Mosaic Compiled October 1950

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1000 FEET 0 1000 2000 3000 4000 FEET
0 1 KILOMETER

50X1

0154-0008-10M

YAROSLAVL RUBBER AND ASBESTOS COMBINE "YARAK"
YAROSLAVL (9770.5)

0165-0007-10M

USAF TARGET MOSAIC - SERIES 10

CONFIDENTIAL

50X1

KAZAN SYNTHETIC RUBBER PLANT, SK 4
KAZAN (5810.20)

U.S.S.R.

CENTER OF TARGET
H-040 V-054
Lat. 55°44'49"N Long. 49°08'03"E
Elev. 220 ft. above mean sea level

SCALE 1:10,000
1ST EDITION NOVEMBER 1950

DATES OF PHOTOGRAPHY JULY 1942 - AUGUST 1943

Base 100 ACS 11-50
Litho ACS 1-51

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KAZAN SYNTHETIC RUBBER PLANT, SK 4
KAZAN (5810.20)

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