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THE SUPPLY AND DISTRIBUTION OF TIN IN THE SOVIET BLOC

CIA/RR PR-29

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CENTRAL INTELLIGENCE AGENCY

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CONTENTS

Appendixes

CIA/RR PR-29
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THE SUPPLY AND DISTRIBUTION OF TIN IN THE SOVIET BLOC*

Summary and Conclusions

The production of tin in the Soviet Bloc is confined to the USSR, Communist China, and East Germany, which had a combined output in 1951 estimated at about 15,000 to 16,000 metric tons. Of this output the USSR produced about 60 percent; Communist China, about 40 percent; and East Germany, less than 1 percent.

By a determined effort the USSR had developed a tin industry producing in 1951 an estimated 9,300 metric tons. Extravagant claims of tin resources in the USSR have been made by the Russians. Although it is believed that substantial reserves have been located, especially in East Siberia and the Soviet Far East, the amount of commerically exploitable ores is probably limited at present. Two smelters are known to be in operation in the USSR: one at Podol'sk, near Moscow, and another near Novosibirsk. The Fifth Five Year Plan (1951-55) calls for an increase of 80 percent in tin output. Although Soviet production of tin probably will continue to increase, the achievement of this goal is considered questionable.

Potentially, Communist China is the most important tin-producing area in the Soviet Bloc. Chinese reserves of tin have been estimated to be about 1.5 million metric tons -- of the same magnitude as those of the Federation of Malaya, which are the largest known reserves in the world. China reached an annual peak output of 14,200 metric tons in 1939 but fell to a low of 1,500 metric tons by 1945, largely as the result of uncontrolled inflation, and was producing at a rate of 4,000 to 5,000 metric tons annually at the time when Communist forces occupied the tin-mining area in South China (Yunnan and Kwangsi provinces). The 1951 output of Communist China has been estimated at about 6,000 metric tons. Given improved mining and milling practices, expanded smelting facilities, an increased labor supply, and sufficient time, it is believed that Communist China could exceed past production records.

Limited quantities of tin are produced in East Germany from low-grade ores, amounting to less than 1 percent of the estimated Soviet Bloc output. It is not probable that substantial increases in output will be achieved.

With the exception of Communist China, the countries making up the Soviet Bloc have traditionally obtained a large part, or all, of their tin supplies through imports. In 1951 the Soviet Bloc received from the rest of the world estimated imports of 7,000 to 8,000 metric tons of tin (in all forms), or roughly one-third of Bloc requirements.

* This report contains information available as of 30 June 1952.

The tin requirements of the Soviet Bloc at the present time have been estimated to be from 22,000 to 24,000 metric tons annually, of which about 75 percent is required by the USSR. It is possible that these requirements may increase as the industrialization of the Bloc countries proceeds.

The consumption pattern of the Soviet Bloc countries is different from that of the US in that the percentage of the total tin consumption which is used in the manufacture of alloys, such as bronze and babbitt, for essential industrial equipment and military end items is substantially higher than in the US, whereas the amounts directed to the production of tin plate and nonessential products are substantially lower. It is estimated that in 1951 possibly 65 to 67 percent of the total consumption was being used in the production of bronze and babbitt, 15 to 16 percent in tin plate, 12 to 13 percent in solder, and 6 to 7 percent in other uses. It is apparent that in the event of full-scale war, the amount of nonessential tin production which could be diverted to additional military use is limited.

Any estimate of the size of stockpiles of tin in the Soviet Bloc is difficult. It is believed, however, that the USSR has accumulated limited stocks of tin and that sufficient tin may be stored to enable Bloc war industries to operate for a period of 1 to 2 years if imports from outside the Bloc were eliminated.

Domestic production and imports of tin are adequate to meet the minimum requirements in the Soviet Bloc under present conditions, and the supply situation within the Bloc should improve. Communist China is capable of considerably increasing its output of tin over an extended period, and Soviet production probably will continue to rise. The tin requirements of the Bloc probably will also rise, however, and it is not believed that self-sufficiency in tin will be achieved in the near future.

I. Resources and Production.

Of the total area within the Soviet Bloc, only three countries produce primary tin -- the USSR, Communist China, and East Germany. The present Bloc output is estimated at about 15,000 to 16,000 metric tons annually, produced approximately as follows: the USSR, about 60 percent; Communist China, about 40 percent; and East Germany, less than 1 percent.

A. USSR.

1. Resources.

For many years the USSR was considered to be deficient in tin resources. The Soviet government, however, has made a determined effort to locate domestic sources of supply. In 1940, of the total funds for prospecting available to the People's Commissariat of Nonferrous Metals, 11.5 percent was allocated to the search for tin resources, a percentage exceeded only by the amount devoted to the search for gold. 1/* Substantial tin reserves are believed to have been developed as a result of the extensive prospecting program.

In 1933 the known tin reserves of the USSR were confined to Chita Oblast and were estimated at 8,300 to 13,000 metric tons of contained tin. In the period before the outbreak of World War II, known reserves in Chita Oblast were expanded, and important new tin deposits were located in the following general areas: the Tetyukhe area in Primorskiy Kray, the Verkhoyansk area in Yakutsk ASSR, 2/ and the Kolyma area in Khabarovsk Kray. 3/ Less important occurrences were located in Vostochno-Kazakhstan, 4/ Tadzhik SSR, and Kirgiz SSR. During World War II the Khingan deposits in the Evreyskaya Autonomous Oblast were discovered. Important reserves may also exist in the Chukchi National Okrug of Khabarovsk Kray. 5/

In 1944, Soviet officials made the claim that the tin reserves of the USSR were exceeded only by those of Southeast Asia (presumably including South China) and of Bolivia. 6/ Even if this statement is exaggerated, it indicates substantial ore reserves. In evaluating Soviet claims for tin resources, however, it should be noted that many of the tin occurrences of the USSR are located in inaccessible areas and that the grade, or tin content, of the ores has never been disclosed. It is believed that many of the deposits may be of low grade. Although geological data may, therefore, indicate large tin reserves, commercially exploitable reserves may at present be much less.

2. Mining, Milling, and Smelting.

a. Mining.

The first important tin deposit to be developed in the USSR was the Onon Mine, which began production about 1933. Shortly thereafter, the Khapcheranga Mine -- long considered to be the most important mine in the USSR -- and the Sherlovaya Gora Mine were opened. All three mines are in Chita Oblast, which produced practically all of the Soviet output of tin before World War II and which may still be the most important of the Soviet tin-producing areas.

* Footnote references in arabic numerals are to sources listed in Appendix D.

By 1940 the Bol'shaya Sinancha and Stalinsk deposits in the Tetyukhe area of Primorskiy Kray had been located and probably were in production. 7/ Two other mines in this area, the Khrustal'noye and the Lifudze, have been reported to be major deposits with excellent ores. 8/ The Mikoyan Mine, located in the Khingan area of the Evreyskaya Autonomous Oblast, was discovered about 1942 and has been developed since the war. 9/

In the Verkhoyansk, Kolyma, and Chukchi areas, all mining activities are controlled by the Dal'stroy organization, created in 1932 as the State Trust for Construction of the Far North for the purpose of exploiting the mineral resources of the area by the use of cheap slave labor. The Dal'stroy organization, since its establishment, has been under the jurisdiction of the State Security Police (originally the OGPU, later the NKVD, and at present the MVD). It is therefore difficult to obtain accurate information about the organization. As early as 1940, tin mining was reported in the Seymchan River Basin in the Kolyma area 10/ and shortly thereafter at Ege-Khay'a in the Verkhoyansk area. As to the deposits reported in the Chukchi area, little is known of the size or quality of the deposits or of the extent of exploitation. A major deposit at Pyrkakai has been reported, 11/ and another source reported the movement of some 15,000 penal workers to the Chukchi area in 1940 for the purpose of exploiting tin deposits. 12/ A number of small scattered deposits are being worked in Vostochno-Kazakhstan, Tadzhik SSR, and Kirgiz SSR.

b. Milling.

In general, milling facilities are located at or near the mines. It is believed that the milling procedure generally consists of gravity concentration by washing. A flotation process may be used when treating complex ores where sulfides are present.

c. Smelting.

Two tin smelters are known to be operating in the USSR at this time: one located at Podol'sk, near Moscow, and the other near Novosibirsk in West Siberia.

The plant at Podol'sk, the first Soviet tin smelter, began operations about 1934, treating principally the complex concentrates from Khapcherangà. 13/ The prewar capacity of the Podol'sk smelter was estimated at about 5,000 metric tons. 14/

In 1940, construction was begun on a tin smelter at Krivoshchakova, across the Ob' River from Novosibirsk. By the summer of 1942, this smelter was largely completed and was in partial operation. 15/ Its capacity is unknown.

Before World War II the Krasnin Vyborskez Armament Works operated a small tin smelter in Leningrad which supplied only the needs of the plant, 16/ but it is not believed that this smelter has produced t'

since the war. Although reports have been received of the construction, or of planned construction, of tin-smelting facilities at Tetyukhe in the Far East, at Ege-Khay'a in Yakutsk ASSR, and at the Khapcheranga and Sherlovaya Gora properties in Chita Oblast, 17/ the existence of these installations has not been confirmed.

3. Output.

Since the limited beginnings of the Soviet tin industry in 1933-34, the output of tin has increased steadily to the present, and, on the basis of potential tin resources and the apparent determination of the Soviet government to increase domestic supplies, it is probable that the rate of tin production will continue to increase. It is not believed, however, that the domestic tin industry has ever met the requirements of the Soviet industry, and it is not considered probable that self-sufficiency in tin will be achieved in the near future. Although the USSR may have substantial tin reserves, the exploitation of some deposits is extremely difficult because of climatic conditions or inaccessibility, or may be uneconomical because of low tin content.

The Soviet government does not release figures on tin production and has made every effort to conceal its tin production and resources. Evidence of Soviet reluctance to divulge information on the tin situation in the USSR is the Soviet attitude toward the Combined Tin Committee, which was formed in 1946 as an instrument of international allocation to distribute the world tin supply in relation to the consumption requirements of the various nations. Despite an inadequate domestic tin supply, the USSR refused to participate in the program, inasmuch as membership would have required the USSR to reveal domestic production and requirements of tin. 18/

Some limited information is available on trends in Soviet tin production. The only direct evidence of Soviet output has been a statement made early in 1942 by I.M. Mayskiy, Soviet Ambassador to the UK, in connection with Lend-Lease negotiations, that Soviet production of tin was 170 to 180 metric tons per month, 19/ which would amount to 2,040 to 2,160 metric tons per year. It has been reported that in the period 1940-43 the output of tin increased by 68 percent 20/ and that the 1945 production exceeded the 1940 output by 2.22 times. 21/ On the basis of this information, if it is assumed that the 1941 production was about 2,100 metric tons, as Mayskiy's statement implies, and that the rate of increase was relatively constant, a production of about 3,800 metric tons in 1945 would be probable.

Production increases of 19.1 percent in 1946 over 1945 and of 17.1 percent in the first 9 months of 1947 over the output of the same period in 1946 have been reported. 22/ The Fourth Five Year Plan (1946-50) required an increase by 1950 of 2.7 times the 1945 output, 23/ which, on

the basis of the above figures, would indicate a 1950 goal of about 10,300 metric tons. It is not believed that this goal was achieved. The Fifth Five Year Plan (1951-55) calls for an increase of 80 percent.

On the basis of the limited information above, the reported increases in reserves, the difficulties of bringing some deposits into production, and the probability of low-grade ores in some cases, the output of Soviet tin during 1940-51 is estimated in Table 1, subject to a margin of error ranging from 10 to 20 percent.

Table 1

Estimated Output of Tin in the USSR
1940-51

Metric Tons

Year	Output	Year	Output
1940	1,700	1946	4,500
1941	2,100	1947	5,300
1942	2,400	1948	6,300
1943	2,800	1949	7,300
1944	3,200	1950	8,300
1945	3,800	1951	9,300

B. Communist China.

1. Resources.

The tin reserves of Communist China generally have been estimated at about 1.5 million metric tons of contained tin -- the magnitude of the reserves of the Federation of Malaya, which are the largest known reserves in the world.

Of the total tin resources of Communist China, it is estimated that more than 80 percent is located in Yunnan Province in an area surrounding the town of Ko-Chiu. 24/ Ko-Chiu is located at 23°32' N - 103°05' E and is about 80 kilometers from Lao Kai on the French Indochina border. 25/ The Ko-Chiu tin-bearing area is about 30 kilometers long and 20 kilometers wide. 26/ The tin ore consists of finely disseminated cassiterite. It contains relatively soft, clayey limonite and hematite and frequently carries small amounts of copper and zinc oxides and carbonates, galena, and, on occasion, some silver. 27/ In general, the ore occurs in crevices and pipes following twisting courses and in the overburden on hillsides and in valleys. 28/ Any accurate estimate of the reserves of the Ko-Chiu area

is difficult because of the erratic distribution of the deposits and of the tin content within the various deposits; the lack of development work; and the primitive mining methods, especially on the part of the native operators.*

A second important tin area occurs in Kwangsi Province and consists of deposits occurring over a wide area including the following districts: Fu-Ch'uan, Ho, Ch'uan-Shan, Ch'ing-Ch'eng, Nan'tan, Ho'ch'ih, and Ch'uan. 29/ The best known properties are the Tsapayyven Mine in the P'ing-lo District and the Fu-Ho-Ch'uan deposits located in the Fu-Ch'uan, Ho, and Ch'uan-Shan districts -- the latter covering an area 42 kilometers long with an average width of 1 kilometer. 30/

Tin occurs in well-scattered tungsten deposits in Kiangsi Province. The tin content is usually less than 10 percent of the tungsten content of the ore. 31/ The principal areas of tin occurrence are said to be Shang-lung, Hsia-lung, Hsi-hua-shan, Kong-shui, Ta-yu, Tsungyi, and Piao-tang. Tin deposits also occur in Hunan Province, north of the Hunan-Kwangsi border, and are known in Kwangtung Province. 32/

2. Mining, Milling, and Smelting.

a. Yunnan Province.

There are hundreds of pits, caves, and underground workings in the Ko-Chiu area, which have been exploited for several hundred years. 33/ At the time of the Communist occupation of Yunnan Province, two groups were operating in the Ko-Chiu area: the Yunnan Consolidated Tin Corporation, a company owned and operated by the government, and a large number of native properties, consisting mainly of primitive underground workings, some extending in depth to 1,000 feet. 34/ In general, the ore-dressing practices of the native operators consisted of puddling and washing in sluices, 35/ with recoveries averaging only 45 to 50 percent. 36/ Because of the primitive mining methods and the low recoveries, ore averaging less than 2.5 percent tin could not be worked profitably by the native operators. 37/ In 1948 there were over 150 native properties operating in the Laochang District, and others working in the Hsin-Ch'ang, K'ai-Feng, and Hiushihpo districts. 38/

In 1948 the Yunnan Consolidated Tin Corporation was operating two major underground mines: the Laochang Mine in the Laochang District and the Malako** Mine in the Hsin-Ch'ang District. By Chinese standards,

* The small private operators are generally referred to as native operators as distinct from government-owned and operated properties.
** Also spelled Malake and Malaka.

these mines were relatively efficient mining enterprises. The ore produced at the Laochang Mine was milled locally in a native type of mill, achieving a recovery of about 60 percent. The ore produced at the Malako Mine was moved by a two-stage aerial tramway to a more modern ore-dressing plant at Ko-Chiu, 39/ which consisted of a jaw crusher, a rod mill, a Dorr classifier, cone classifiers, and Wilfley tables. 40/ This mill was reported to achieve a recovery of 75 percent 41/ and to have a capacity of 220 metric tons of ore per day. This corporation also operated placer mines at Chiu-ts'ai-ch'ung and at Yiuchiatung. These mines are operated by hydraulicking.*

In the town of Ko-Chiu there were about 15 native smelters, each with an average capacity of 1 metric ton per day, giving a combined output of about 15 metric tons of crude tin, 93- to 99-percent pure, per day. 42/ The Yunnan Consolidated Tin Corporation also operated a smelter in Ko-Chiu, treating concentrates from Laochang and Ko-Chiu mills and producing a crude tin averaging about 96-percent purity. 43/ Smelting losses ran over 10 percent. 44/ The crude tin was refined by liquating** and by agitation by poling*** or compressed air. The National Resources Commission reported in 1948 that the refining capacity was 700 metric tons per month. 45/

b. Kwangsi Province.

As in Yunnan Province, two groups were operating in the Kwangsi tin fields in 1948: the Ping Kwei Mining Administration, a company owned and operated by the government, and a number of native operators. Mining was usually done hydraulically with monitors, and the cassiterite was recovered by sluicing. 46/ The Kwangsi ores are free of the copper and arsenic impurities usually associated with Yunnan tin ores and are thus more amenable to concentration by washing. The concentrates obtained averaged about 75 percent tin. 47/

The larger native operators had their own smelters, producing a crude tin of 97-percent purity. 48/ The Ping Kwei Mining Administration operated a smelter at Pa-pu with a capacity of 150 metric tons of tin per month averaging about 99.5-percent purity. The Administration also operated a refinery, using reverberatory furnaces and poling and liquating kettles. The capacity of this refinery was 300 metric tons of refined tin per month. 49/

* Hydraulicking is washing down a bank of earth or gravel by playing on it a stream of water under high pressure.

** The process of separating a fusible substance from one less fusible, by means of heat.

*** A process consisting of the introduction of poles of green wood into the molten metal. Gases are generated which have a reducing action on oxides.

3. Output.

Before World War II, China was one of the major producers of tin, reaching a high of about 14,200 metric tons in 1939. 50/ Tin production declined sharply in 1942 and fell to an estimated 1,500 metric tons by 1945. 51/ This decline in output was largely the result of uncontrolled inflation in China, making operations by the native operators unprofitable. 52/ For 1948, the last full year of operations under the Nationalist government, production has been estimated at 4,900 metric tons; for 1949, at about 4,300 metric tons. 53/

Although the Chinese Communist government has published no statistics on tin production, it is known that considerable effort has been made to expand tin production. The quota established for the Ko-Chiu area in Yunnan Province for the year 1951 has been reported to be 5,000 metric tons, and it was also reported that in the early part of the year the "Yunnan Tin Company" (which may or not be the same as the Yunnan Consolidated Tin Corporation) had exceeded its quota. 54/ In view of the extensive reserves of the Ko-Chiu area, the output achieved in the past, and the smelting capacity available in the area, the reported achievement of an output of 5,000 metric tons of tin in Yunnan Province in 1951 is considered probable.

The second major producing area, in Kwangsi Province, reached a peak of about 3,500 metric tons in 1938 and averaged about 2,000 metric tons annually from 1935 to 1942. By 1945, production was halted in Kwangsi Province 55/ because of the war with Japan. The 1948 output has been estimated at about 455 metric tons, 56/ and it is believed that the rate of production in 1951 was probably about 750 to 1,000 metric tons.

Yunnan Province normally produces about 80 percent of the total Chinese Communist production of tin, and Kwangsi Province, from 15 to 18 percent. On this basis, it is probable that the Chinese Communist output for 1951 was about 6,000 metric tons. One source has reported that statistics compiled on 15 February 1952 by the Committee of Finance and Economics of the Chinese Communist government indicated a tin production of 6,143 metric tons for the year 1951. 57/ A tabulation of the estimated output of tin in Communist China from 1939 through 1951 is given in Table 2.*

C. Czechoslovakia.

Some tin production has been reported from a mine located at Zinnwald, on the German-Czechoslovak border, with one shaft on each side of the border. 58/ Any production would be processed in East Germany and would be included in East German records. Also, a tin deposit has been reported at Cinobana. 59/ It should be noted that the 1949 Plan for the production and allocation of metallurgical products in Czechoslovakia made

* Table 2 follows on p. 10.

Table 2

Estimated Output of Tin in Communist China 60/
1939-51

Metric Tons

Year	Output	Year	Output
1939	14,200	1946	2,500
1940	10,700	1947	4,400
1941	11,400	1948	4,900
1942	7,900	1949	4,300
1943	7,200	1950	5,000 61/
1944	3,000	1951	6,000 62/
1945	1,500		

no reference to any domestic production of primary tin, although imports of tin and the recovery of secondary metal were indicated. 63/

D. East Germany.

Germany has had a long history of tin production from low-grade deposits, with exploitation dating back to the Middle Ages. Before World War II the output averaged about 150 metric tons per year and was increased during the war, but production came to a complete halt by 1945. 64/ In 1948 the output of refined tin was reported to be less than 50 metric tons. 65/

The tin ore production of East Germany is largely from four mines located, in order of importance, at Altenberg, Ehrenfriedersdorf, Sadisdorf, and Gottesberg. All of the concentrates produced are treated at the tin smelter (Zinnhuette) at Freiberg, where a metal of 99.6- to 99.8-percent purity is produced.

The 1950 tin production of East Germany was reported to be 80 metri tons of refined tin, with an output of 110 metric tons planned for 1951. The capacity of the tin smelter at Freiberg is reported to be 140 metric tons of electrolytic tin per year, and it is planned to increase the capacity to 200 metric tons per year by 1955. 66/

II. Imports.

Traditionally the USSR and the European Satellites have depended on imports for all or a large part of their tin supplies. Although the output of tin in the USSR and Communist China has expanded, the Soviet Bloc is not presently self-sufficient in tin supplies, and the net deficit is

met through imports. It is estimated that 7,000 to 8,000 metric tons of tin in all forms were obtained by the Bloc through imports in 1951. Evidence is available accounting for exports to the Bloc of 6,538 metric tons of tin metal in 1951, and it is considered possible that 500 to 1,500 metric tons were obtained through imports of the various alloys containing tin, of tin plate, and of manufactures and through other shipments of tin metal not recorded. It is believed, however, that the amount of imports in excess of recorded shipments is nearer the 500-metric-ton figure than the 1,500-metric-ton figure. Table 3* gives known imports of tin by the Soviet Bloc in 1951.

III. Consumption.

No attempt is made to determine the demand requirements of the various tin-consuming industries, inasmuch as such requirements must be established by ascertaining the demand for end products by the Soviet Bloc economy and the productive capacity of the various industries. Insofar as is possible, however, the pattern of tin consumption by use is indicated.

The major part of tin consumption by the Soviet Bloc is in the form of various alloys of bronze, babbitt, and solder, and in tin plate. In addition, there is a wide range of miscellaneous uses, including collapsible tubes, foil, tinning, and type metal, which are treated hereafter as other uses.

The chief consuming industries for bronze, a copper-tin alloy with the proportions of tin running from 1 to 28 percent, are general engineering, shipbuilding, and electrical equipment. The addition of tin to copper increases the hardness, strength, and the resistance to corrosion and provides better casting qualitites. Bronze is effective in bearings when used where speeds are relatively low and load pressures are high. The resistance to corrosion makes bronze especially suitable for marine engineering.

Bearing metal alloys generally contain from 10 to 90 percent tin. The properties of tin bearing metal include the ability to withstand galling the shaft, the capacity to retain an oil film, a high resistance to corrosion, a low resistance to shearing, and a relatively longer life. Since bearing metals are relatively weak metals, they are bonded to some stronger backing metal, and tin-base alloys are good in this respect. In all of the properties indicated above, an increase in the tin percentage of the alloy will improve the physical properties. A general rule of thumb is that the faster the rotation of the shaft, the higher should be the tin content of the bearing. Lead-base alloys can be substituted for tin-base alloys and require a minimum of lubrication, but they are not so malleable, and they tend to crack and break up when the load imposed becomes excessive. The tin-base alloys are tough and malleable and also more fluid, thus permitting the casting of a much thinner bearing of greater strength. Tin-base

* Table 3 follows on p. 12.

Table 3

Known Imports of Tin by the Soviet Bloc 67/
1951

Metric Tons

Exporting Country	USSR	Communist China	Czecho-slovakia	East Germany	Hungary	Poland	Rumania	Bulgaria	Total Soviet Bloc
Belgium	200 68/	0	0	0	0	472 68/	0	0	672
Nether-lands	0	26 68/	309	41 71/	111	0	0	0	487
Malaya	0	0	2,510	0	0	1,870	406	0	4,786
UK	102	0	0	0		116 72/	0	97 72/	315 72/
West Germany	0	0	0	210 68/	0	0	0	0	210
Denmark	0	0	6 72/	0	0	0	0	0	6 72/
Other	50 69/	0	0	12 70/	0	0	0	0	62
Total	352	26	2,825	263	111	2,458	406	97	6,538

alloys do require more lubrication and attention in service, however, and the substitution of lead-base bearings amounts to a sacrifice of possible longer service. Among the uses of bearing metals are high-speed dynamos, motors, lathes, cranes, rolling mills, and automotive main bearings.

Solder is a tin-lead alloy used for joining metals. The higher the tin content of the alloy, the lower will be the melting temperature, the greater the adherence to other metals, and the greater the ability to flow into joints. Among the many uses of solder are electrical connections, manufacture of automobile radiators, automobile body seams, joint wiping in plumbing, and the manufacture of tin cans and tin boxes.*

The primary use of tin plate and terneplate (metal coated with an alloy of tin and lead) is in the manufacture of containers. Tin plate is particularly suitable for packaging because of its resistance to corrosion, cheapness, ease of assembly, ease of handling (not subject to breakage), and the long "shelf-life" of the packaged product. In general, tin plate is used in the manufacture of consumer goods. It also is used for the packaging of field rations for military use.

A. USSR.

With the expansion of industry in the USSR, the requirements for tin have been increased. With the exception of the war years, however, the pattern of tin consumption has remained fairly constant.

For the prewar period, 1934-41, Soviet consumption has been estimated as having risen from about 5,000 metric tons to about 12,000 metric tons. 73/ During this period the planned development of Soviet industrial and military equipment directed the consumption of tin supplies largely to those alloys required for the manufacture of industrial equipment and military end items. In contrast to the US, the USSR had a relatively small food-canning industry, and the consumption of tin plate was low. Table 4** shows a reported distribution of the consumption of primary tin in the USSR in 1937. 74/ Captured German and Soviet documents have indicated that, in 1940, the USSR used 34.7 percent of its tin supply in bronze and about 32 percent in babbitt. 75/

During World War II the USSR, unlike the US, was unable to cut total tin consumption by the reduction of nonessential needs, inasmuch as such uses were already largely curtailed under the so-called peacetime economy. In the US the pattern of tin consumption of all tin supplies, including secondary tin, shifted. The percentage used in tin plate and terneplate declined from 45.1 percent in 1937 to 28.6 percent in 1944, and the percentage used in bronze and babbitt rose from 14.7 percent in 1937 to 46.5

* During World War II, solders with less than 3 percent tin were successfully used in the manufacture of tin cans in the US.

** Table 4 follows on p. 14.

Table 4

Consumption of Tin in the USSR
1937

Use	Percent of Total Consumption
Plate	12.4
Bronze and Babbitt	67.5
Solder	11.6
Other	8.5

percent in 1944. It also is very probable that the pattern of tin consumption in the USSR shifted, with most of the tin being consumed in bearings and other items for essential industrial machinery and in production directly for military use. 76/

In the postwar period the USSR resumed the planned development of its industrial and military potential. Emphasis also has been placed on military equipment, although the consumption pattern, as given in percentage of total consumption, may not have changed much. It is estimated that in 1951 possibly 65 to 67 percent of total Soviet tin consumption was used in the manufacture of bronze and babbitt, 15 to 16 percent in tin plate, 12 to 13 percent in solder, and 6 to 7 percent in other uses. It is possible that Soviet minimum requirements for 1951 rose to approximately 17,000 to 18,000 metric tons. Any estimate, however, is highly conjectural.

B. Communist China.

Although a major tin-producing country, China has never consumed tin in important amounts. The International Tin Study Group has estimated Chinese consumption from 1937 to 1948 at an average of about 400 metric tons per year. 77/ In pre-Communist China, the primary uses of tin were for pewter, tin plate, tin foil, and simulated silver bullion (used in religious worship). In view of Communist attempts to industrialize China, however, the requirements for tin may be rising slowly, and it is believed that in 1951 Chinese Communist requirements were about 500 to 700 metric tons, the balance of Chinese Communist output being exported to the USSR.

C. Czechoslovakia.

The International Tin Study Group has reported that the apparent consumption of tin in Czechoslovakia in the period 1936-38 averaged 1,685 metric tons per year. Since about 115 metric tons were re-exported, 78/ the net annual apparent consumption in Czechoslovakia was about 1,570

metric tons per year. In comparison with this prewar figure, the 1949 Plan for the allocation of tin provided for the consumption of 1,737 metric tons. The First Five Year Plan in Czechoslovakia (1949-53) calls for an annual tin consumption of 2,800 metric tons by 1953, 79/ a figure believed to be high. The planned consumption in the year 1949 is shown in Table 5. Although

Table 5

Planned Consumption of Tin in Czechoslovakia 80/
1949

Use	Percent of Total Consumption	Amount (Metric Tons)
Tin Metal a/	29.8	517.4
Bronze and Babbitt	52.9	919.1
Solder	16.2	281.5
Other	1.1	19.1
Total	100.0	1,737.1

a. Mostly tin plate.

the total consumption may increase under the present Five Year Plan, it is believed that the consumption pattern, as shown in the percentage column of Table 5, will remain more or less constant.

D. East Germany.

Data on prewar imports are of little use in determining so-called normal peacetime requirements of or consumption in East Germany, because of the present political division of Germany. Although limited amounts of primary tin have been produced in the Erzgebirge, now a part of East Germany, domestic production is insufficient to meet the requirements of East Germany and must be supplemented by imports of tin or tin products. The 1951 Plan of the East German government provided for the production of 110 metric tons of refined tin and imports of 330 metric tons, 81/ plus imports of substantial amounts of tin products.

Although no precise information is available as to the percentages or amounts of tin distributed for the various uses, plans for importing relatively large amounts of babbitt and bronze indicate that a relatively large proportion of tin consumption is in the form of these alloys. The planned domestic production in 1951 provided for 3,000 metric tons of bronze, 82/ 240 metric tons of babbitt, and 120 metric tons of solder. 83/ No indication is given of the tin content of these alloys.

E. Hungary.

Hungary is dependent upon imports for its tin supplies. In the period 1935-39, imports, including scrap, averaged annually 635 metric tons. Little current information is available on tin consumption in Hungary. The planned production for 1947, however, amounted to a total of 315 metric tons, of which 77 metric tons, or 24.4 percent of the total, were to be exported. The planned percentages of total consumption for 1947 are shown in Table 6.

Table 6

Planned Consumption of Tin in Hungary 84/
1947

Use	Amount (Metric Tons)	Percent of Total Consumption	
		Including Exports	Excluding Exports
Tin Alloys (Bronze, Babbitt, Solder, etc.)	142	45.0	59.7
Tin Plate	76	24.1	32.0
Exports	77	24.4	
Other	20	6.5	8.3
Total	315	100.0	100.0

In view of the apparent tin consumption of Hungary in the prewar period, it is probable that 1951 requirements were about 500 to 600 metric tons per year.

It has been reported that bearing metal has been produced for export to the USSR at the Csepel Works (formerly the Manfred Weiss Works) near Budapest. 85/

F. Other Satellites.

The other Satellites are dependent upon foreign sources of supply to meet their tin requirements, and the imports of tin may be used to determine the apparent consumption. No information has been received as to the proportions of tin supplies being distributed for the various uses, but it is probable that the trends follow the general pattern for Soviet-dominated European countries, with the bulk of the tin going to alloys for essential industrial or military consumption.

1. Albania.

Albania, being primarily an agricultural country, has a negligible need for tin. It has not been the practice in Albania to use tin plate to any extent in the packaging of food.

2. Bulgaria.

During the period 1936-39, tin imports by Bulgaria ranged from 159 to 270 metric tons, the average rate being 197 metric tons per year. 86/ It is believed that the 1951 consumption of tin was about 200 metric tons per year.

3. Poland.

During the prewar years, Poland imported an average of about 1,300 metric tons of tin annually. Based on apparent consumption figures of the International Tin Study Group, in part supplied by Poland to the Combined Tin Committee and in part estimated by the International Tin Study Group, the apparent consumption for the period 1947-51 averaged 1,500 to 1,600 metric tons per year.

4. Rumania.

In the period 1936-39, Rumanian imports averaged about 325 metric tons of tin per year. In the postwar period the International Tin Study Group has estimated apparent consumption to be about 250 metric tons per year.

IV. Requirements.

The minimum tin requirements of the Soviet Bloc are estimated at 22,000 to 24,000 metric tons annually. This estimate is in part based on the estimate that available supply in 1951 from mine production was 15,000 to 16,000 metric tons and that 7,000 to 8,000 metric tons were obtained in all forms through imports. The estimated requirements by country are roughly apportioned as shown in Table 7.*

A trend has been established in Soviet Bloc countries of consuming a relatively high percentage of the total tin supply in the manufacture of alloys for essential industrial equipment and military items and of consuming a relatively low percentage in the manufacture of tin plate, largely used for containers and nonessential items.

V. Stockpile.

Over and above working inventories, the USSR, despite supply shortages, is believed to have accumulated a limited tin stockpile. In a large metal

* Table 7 follows on P. 18.

Table 7

Estimated Requirements for Tin in the Soviet Bloc
1951

Country	Requirements (Thousand Metric Tons) Minimum	Maximum	Approximate Percentage of Total Bloc Requirements
USSR	17.0	18.0	75
Czechoslovakia	1.8	1.9	8
Poland	1.6	1.7	7
Communist China	0.5	0.7	3
East Germany	0.5	0.7	3
Hungary	0.5	0.6	2
Rumania	0.25	0.3	1
Bulgaria	0.2	0.2	1
Total	22.35	24.1	100

depot at Kirov (58°35' N - 49°40' E), a returning prisoner of war has reported the storage of tin for use only for war purposes. 87/ Other returning prisoners of war have reported the existence of tin in the Kirov depot. Also several references have been made to tin stocks in the Moscow area. Tin may also be stored in other parts of the USSR, although no evidence has been received to substantiate this.

In view of the sketchy evidence available, it is extremely difficult to estimate the extent of the Soviet stockpile of tin, but it is possible that sufficient amounts have been accumulated to enable the Soviet Bloc to operate, under present conditions, for 1 to 2 years without serious difficulties if all imports from outside of the Soviet-dominated countries were eliminated.

APPENDIX A

LIST OF TIN DEPOSITS IN THE USSR

Name	Location	Area	Remarks
Chapcheranga	49°42' N - 112°10' E	Chita Oblast	A major mine.
Onon	50°36' N - 115°35' E	Chita Oblast	A major mine.
Sherlovaya Gora	50°36' N - 116°21' E	Chita Oblast	A major mine.
Ege-Khay'a	67°24' N - 134°15' E	Verkhoyansk	Reported as a major mine.
Ulys-Khay'a	65°50' N - 134°50' E a/	Verkhoyansk	Probably being exploited.
Kosterskoe	Unknown	Verkhoyansk	Possibly being exploited.
Burgavli	66°30' N - 137°00' E a/	Verkhoyansk	Possibly being exploited.
Imtandzha	66°04' N - 128°21' E	Verkhoyansk	Possibly being exploited.
Bochy	Near Imtandzha	Verkhoyansk	Possibly being exploited.
Bol'shaya Sinancha	45°10' N - 136°40' E	Tetyukhe	A major mine.
Stalinsk	45°10' N - 136°40' E	Tetyukhe	A major mine.
Khrustal'noye	44°15' N - 134°30' E	Tetyukhe	Probably being exploited.
Lifudze	Near Khrustal'noye	Tetyukhe	Probably being exploited.
Mikoyan	49°10' N - 131°00' E a/	Khingan	A major mine.
Seymchan	62°23' N - 152°36' E a/	Kolyma	Reported as a major mine.
Butyguchag	61°19' N - 149°11' E a/	Kolyma	Probably being exploited.
Tayezhiny	Unknown	Kolyma	Probably being exploited.
Pyrkakai	69°18' N - 176°00' E	Chukchi Okrug	Reported as a major deposi may be exploited.

a. Approximate location.

APPENDIX B

METHODOLOGY

The estimates of tin production are based on base figures obtained for one or more years; on official percentage figures; and on extrapolation modified by various limiting factors, such as the extent and location of ore reserves.

Estimates of imports are based on export figures of the various non-Bloc exporting countries.

The estimates of the pattern of consumption are based on estimates of tin plate production, on prewar estimated figures, and on the apparent trends of development of the over-all Soviet economy. Other sources, cited in the text, were used in estimating the consumption patterns of Czechoslovakia and Hungary.

The estimates of the minimum requirements are based on apparent consumption (or available supply); on the steady growth of Soviet industry and the accompanying rise in tin requirements; on the ability of the USSR to establish stockpiles; and, in some cases, on figures reported by specific countries to the Combined Tin Committee. The estimates of requirements are highly conjectural.

APPENDIX C

GAPS IN INTELLIGENCE

The major gaps in intelligence on the tin situation in the Soviet Bloc are as follows:

1. Minimum Requirements for Tin.

Information is needed on the adequacy of the tin supply in various specific industries, the use of substitute materials and the extent of such substitution, and the degree of control over the distribution of the available tin supply.

2. Stockpiling Program.

Information is needed on the location and extent of individual depots and the amount of tin being withdrawn from available supplies for the stockpiling program.

3. Recovery of Secondary Metal.

Information is needed on the locations and capacities of plants producing secondary tin and on the amount of tin scrap available for this purpose.

4. Production of Primary Tin.

Information is needed on the extent and metal content of individual deposits; on the extent of exploitation; on milling practices; on the amount and grade of concentrates produced; and on the location, production, and capacities of smelting plants.

APPENDIX D

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

The most valuable sources for this report insofar as information on the USSR was concerned were as follows:

a. Dimitri Shimkin, Minerals, A Key to Soviet Power, Harvard University, 1947 and 1949 drafts. This book appears to be reliable insofar as source material used is extracted or abstracted, and it was of value for statements cited from various Soviet publications. It is believed, however, that the conclusions drawn from such data by the author are sometimes questionable.

b. A CIA OO source (No. 3 in sources listed in 2, below).

c. Izvestiya, cited in State Department OIR Report, No. 4611, Feb 1948. S. The statement appearing in Izvestiya concerning ore reserves in the USSR can be considered to be only an indication of potential resources.

d. The Industries of the USSR, ID WDGS, 1947. C. This report is based on captured German and Soviet documents and contains data through 1941 on the Soviet tin situation. It provides good general background information, although occasional statements including output estimates are believed to be inaccurate, in view of later information.

Other sources were used largely for single references on specific points.

Four sources were particularly valuable for information on the tin industry in pre-Communist China:

a. A CIA OO report on the Yunnan Consolidated Tin Corporation by the National Resources Commission of China, 21 Sep 1948. C.

b. Nelson Dickerman, "Mineral Resources of China," Foreign Minerals Survey, Vol. 2, No. 7, US Bureau of Mines, Washington, D.C., Jan 1948. This work provides excellent background material.

c. J. Marshall Morris, Field Report on the Chinese Tungsten and Tin Mining Industries, Chungking, China Mission, Foreign Economic Administration, Office of Economic Warfare, Washington, D.C., 1943. This work contains a detailed study of Chinese tin properties and provides excellent background material.

d. Department of State Despatch No. 835 from Manila, Oct 1949. C.

2. Sources.

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Sources of Information	Information
A - Completely reliable	1 - Confirmed by other sources
B - Usually reliable	2 - Probably true
C - Fairly reliable	3 - Possibly true
D - Not usually reliable	4 - Doubtful
E - Not reliable	5 - Probably false
F - Cannot be judged	6 - Cannot be judged

Evaluations not otherwise designated are those appearing on the cited document; those disignated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation of the cited document.

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1. Dimitri Shimkin, Minerals, A Key to Soviet Power, Harvard University, 1947 and 1949 drafts. Eval. RR 2.
2. Shimkin, ibid., 1949 draft.
3. CIA OO, 14 Nov 1951. Eval. RR 2.
4. "World's Non-Ferrous Smelters and Refineries," The Metal Bulletin, London, 1950. Eval. RR 3, insofar as the data on the USSR are concerned.
5. Shimkin, op. cit., 1947 draft.
6. Izvestiya, 2 Jul 1944, cited in State Department OIR Report, No. 4611, Feb 1948. S. Eval. RR 3.
7. The Industries of the USSR, ID WDGS, 1947. Eval. RR 2.
8. Shimkin, op. cit., 1947 draft.
9. Ibid.
10. CIA OO, 14 Nov 1951. S. Eval. RR 2.
11. Shimkin, op. cit., 1947 draft.
12. CIA OO, Sep 1948. Eval. RR 3.
13. The Tin Industry of Soviet Russia, Metalgesellschaft, A.G., Frankfurt am Main, Dec 1939. Eval. RR 2.
14. The Industries of the USSR, op. cit.
15. CIA OO-W 28 Jul 1950. C. Eval. RR 2.
16. The Tin Industry of Soviet Russia, op. cit.
17. "World's Non-Ferrous Smelters and Refineries," op. cit.
18. OIR Report, No. 4800.25, Soviet Affairs, Jan 1951. S. Eval. RR 2.
19. OIR Report, No. 4611. Eval. RR 2.
20. Bolshevik, No. 22, Nov 1944, cited in OIR Report, No. 4611, op. cit. S. Eval. RR 2.

21. Izvestiya, 2 Apr 1946, cited in OIR Report, No. 4611. Eval. RR 2.
22. Shimkin, op. cit., 1947 draft.
23. The Great Stalin Five Year Plan, Soviet Embassy, Washington, D.C., 1946. Eval. RR 2.
24. Vei Chow Juan, "Mineral Resources of China," Economic Geology, Vol. XLI, No. 4, 1946. Eval. RR 2.
25. CIA OO, 6 Dec 1951. C. Eval. RR 2.
26. Nelson Dickerman, "Mineral Resources of China," Foreign Minerals Survey, Vol. 2, No. 7, US Bureau of Mines, Washington, D.C., Jan 1948. Eval. RR 2.
27. J. Marshall Morris, Field Report on the Chinese Tungsten and Tin Mining Industries, Chungking, China Mission, Foreign Economic Administration, Office of Economic Warfare, Washington, D.C., 1943. Eval. RR 2.
28. Dickerman, op. cit.
29. CIA OO-W- 12 May 1949. R. Eval. RR 2.
30. Dickerman, op. cit.
31. Ibid.
32. CIA SO, 23 Nov 1949. S. Eval. RR 2, insofar as the material used in this report is concerned.
33. Morris, op. cit.
34. Department of State Despatch No. 835 from Manila, Oct 1949. C. Eval. RR 2.
35. Morris, op. cit.
36. State Despatch No. 835, op. cit.
37. CIA SO.
38. State Despatch No. 835, op. cit.
39. CIA SO.
40. Dickerman, op. cit.
41. State Despatch No. 835, op. cit.
42. CIA SO.
43. CIA OO.
44. State Despatch No. 835, op. cit.
45. CIA OO.
46. CIA SO.
47. CIA OO, Jun 1948. C. Eval. RR 2.
48. CIA SO.
49. CIA OO.
50. Minerals Yearbook, 1946, US Bureau of Mines, Washington, D.C. U.
51. Minerals Yearbook, 1949, US Bureau of Mines, Washington, D.C. U.
52. Dickerman, op. cit.
53. Minerals Yearbook, 1949, op. cit.
54. CIA OO-W /27 Jun 1950. C. Eval. RR 2.
55. China Project, WAC No. (SO-3) I, Serial No. 197, citing Ching-ping Yang, "The Tungsten, Antimony, Tin, and Mercury Industries During Eight Years War," Nanking, 1946, published in National Resources Commission Quarterly, Vol. 6, Nos. 1-2. U. Eval. RR 2, insofar as 1945 production of tin in Kwangsi Province is concerned.
56. CIA SO.

57. CIA SO, 3 May 1952. C. Eval. RR 2.
58. AA, Praha, R-305-49. Eval. RR 2.
59. CIA OO, Dec 1949. Eval. RR 2.
60. Figures from US Bureau of Mines, except where noted.
61. CIA estimate.
62. Ibid.
63. Plan for the Production and Allocation of Metallurgical Products in Czechoslovakia, 1949, FDD Special Translation, No. 10, 6 Feb 1951. Eval. RR 2.
64. Statistical Yearbook, 1949, International Tin Study Group, The Hague, 1950. U. Eval. RR 2.
65. CIA SO, 13 Apr 1949. S. Eval. RR 2.
66. CIA SO, 2 Apr 1952. S. Eval. RR 3.
67. Statistical Bulletin, International Tin Study Group, Jun 1952, Vol. V, No. 6. U.
68. Compiled from CIA International Trade Register.
69. CIA SO, 31 May 1951. S.
70. CIA SO, 10 Aug 1951. S.
71. OIT Commerce, printed sheets, Maandstatistiek Van de In-Uiten Doorvoer per land, Utrecht, Mar 1951.
72. Table 3 Q, COCOM Statistics, 1952. S.
73. OIR Report, No. 4611, op. cit.
74. Shimkin, op. cit., 1947 draft.
75. The Industries of the USSR, op. cit.
76. OIR Report, No. 4611, op. cit.
77. Statistical Yearbook, 1949, op. cit.
78. Ibid.
79. Detailed Five Year Plan for Czechoslovakian Metallurgical Industry, FDD Translation, No. 1/50, 10 Jan 1950. S. Eval. RR 3.
80. Plan for Production and Allocation of Metallurgical Products in Czechoslovakia, 1949, op. cit.
81. CIA SO, 13 Apr 1949. S. Eval. RR 2.
82. CIA SO, 10 Aug 1951. S. Eval. RR 2.
83. CIA SO, 6 Feb 1951. S. Eval. RR 2.
84. FDD Translation, No. 31, 14 Sep 1950. S. Eval. RR 2.
85. USFA No. 313/FSS/4 Det/317, 16 Feb 1950. S. Eval. RR 2.
86. "Mineral Resources of Bulgaria," Foreign Minerals Survey, Vol. 1, No. 9, US Bureau of Mines, Washington, D.C., Sep 1944. U. Eval. RR 2.
87. CIA SO, 1950. S. Eval. RR 2.