

~~CONFIDENTIAL~~

Release 1999/09/26 : CIA-RDP79-01093A000700020008-2

~~SECRET~~

137

US OFFICIALS ONLY

PROVISIONAL INTELLIGENCE REPORT

THE ANTIBIOTICS INDUSTRY IN THE SOVIET BLOC



CIA/RR PR-80

15 November 1954

DOCUMENT NO. 1
NO CHANGE IN CLASS.
 DECLASSIFIED
CLASS. CHANGED TO: TS S (C)
NEXT REVIEW DATE: 1989
AUTH: HR 70-2
DATE: 5 Oct 79 REVIEWER: 000514

CENTRAL INTELLIGENCE AGENCY

OFFICE OF RESEARCH AND REPORTS

US OFFICIALS ONLY

~~SECRET~~

Approved For Release 1999/09/26 : CIA-RDP79-01093A000700020008-2

~~CONFIDENTIAL~~

W A R N I N G

This material contains information affecting the National Defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law

~~CONFIDENTIAL~~

~~SECRET~~

US OFFICIALS ONLY

PROVISIONAL INTELLIGENCE REPORT

THE ANTIBIOTICS INDUSTRY IN THE SOVIET BLOC

CIA/RR PR-80

(ORR Project 22.288)

NOTICE

The data and conclusions contained in this report do not necessarily represent the final position of ORR and should be regarded as provisional only and subject to revision. Comments and data which may be available to the user are solicited.

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

US OFFICIALS ONLY

~~SECRET~~

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

~~SECRET~~

FOREWORD

This report, prepared jointly by the CIA Office of Research and Reports and the Office of Scientific Intelligence, presents an analysis of the production capabilities of the antibiotics industry in the Soviet Bloc. Included as essential factors in that analysis are trade data on the flow of antibiotics from the West to Soviet Bloc countries and to points of possible transshipment to those countries.

- iii -

~~SECRET~~

~~CONFIDENTIAL~~

CONFIDENTIAL

~~SECRET~~

CONTENTS

	<u>Page</u>
Summary	1
I. General	3
A. Definition and Occurrence	3
B. Raw Material Requirements	4
II. Production and Quality	4
A. Production	4
1. Penicillin	4
2. Other Antibiotics	7
B. Quality	7
III. Trade	7
A. General	7
B. US Exports to the East	9
C. Western European Exports to the East	9
IV. Requirements	14
V. Capabilities, Vulnerabilities, and Intentions	14
A. Capabilities	14
B. Vulnerabilities	14
C. Intentions	15

~~SECRET~~

CONFIDENTIAL

CONFIDENTIAL

~~SECRET~~

Page

Appendixes

Appendix A. Possible and Known Antibiotics Plants in the USSR	17
Appendix B. Possible and Known Antibiotics Plants in the European Satellites	21
Appendix C. Known Antibiotics Plants in Communist China and North Korea	29
Appendix D. Methods of Production	31
Appendix E. Methodology	33
Appendix F. Gaps in Intelligence	35
Appendix G. Sources and Evaluation of Sources	37

Tables

1. Estimated Production of Penicillin in the Soviet Bloc, 1953	5
2. Plants for the Production of Antibiotics Other Than Penicillin in the Soviet Bloc, 1949-54	8
3. US Exports of Antibiotics to Communist China, Hong Kong, and Macao, 1950-53	10
4. Hong Kong Imports and Exports of Antibiotics, 1952-53	11
5. Exports of Antibiotics by Non-Soviet Bloc Countries to the World and to the Soviet Bloc, 1952	12
6. Exports of Antibiotics by Non-Soviet Bloc Countries to the World and to the Soviet Bloc, 1953	13

~~SECRET~~

CONFIDENTIAL

~~CONFIDENTIAL~~CIA/RR PR-80
(ORR Project 22.288)~~S-E-C-R-E-T~~THE ANTIBIOTICS INDUSTRY IN THE SOVIET BLOC*Summary

Antibiotics are sometimes referred to as the "Wonder Drugs of World War II," in recognition of their value in the treatment of disease and infection. With the aid of these drugs, the number of fatalities caused by infectious wounds was greatly reduced, and casualties were returned to the battle front in much less time than in previous conflicts with older methods of treatment. The possibility of mass bombings and the threat of biological warfare make a supply of these drugs a necessity in any nation that might become involved in war.

The USSR began to produce antibiotics** as early as 1945. It was not until 1948, however, that the mass production of solid penicillin, the first of this family of antibiotics, was begun. It is estimated that 1953 production of penicillin in the Soviet Bloc was 113,100 billion units (BU***), as shown in the following tabulation:

USSR	92,200 BU
European Satellites	19,700 BU
Communist China	1,200 BU
Total	<u>113,100 BU</u>

* The estimates and conclusions contained in this report represent the best judgment of the responsible analyst as of 1 July 1954.

** The antibiotics discussed in this report are penicillin, streptomycin, dihydrostrymycin, terramycin, chloramphenicol (chloromycetin), aureomycin, and bacitracin.

*** One billion units (BU) -- one billion international units of penicillin -- weighs approximately one and one-third pounds, is valued at approximately \$400.00, and is sufficient for 5,000 average doses of 200,000 units each.

CONFIDENTIAL

~~S-E-C-R-E-T~~

S-E-C-R-E-T

US production of penicillin, approximately 370,000 BU in 1953, was more than 3 times that of the Soviet Bloc. Assuming an average annual dose of 200,000 units per individual, US production is sufficient to provide more than 10 such doses, whereas the Bloc production is insufficient for even 1 such annual dose per individual. Production of penicillin in the Bloc, however, appears to have made marked progress in the 5-year period from 1949 to 1953 and within the next 5 years is expected to meet all requirements for penicillin.

The Soviet Bloc appears to be producing some streptomycin and chloramphenicol* on a plant scale, but there is no available data on the productive capacity. Efforts to develop production methods for terramycin and aureomycin have been reported, but no actual production can be confirmed. It is believed that by 1955 the Bloc should be producing substantial quantities of streptomycin and chloramphenicol, and should be ready to produce terramycin and aureomycin on a plant scale by the end of that year.

Despite US efforts to impose restrictions, there has been a brisk trade in antibiotics from the West to the East. Because a small quantity of antibiotics sells for a high price (penicillin is \$300.00 per pound, as compared with ammonium nitrate at \$0.035 a pound or soda ash at 2 cents a pound), the drugs are very adaptable to smuggling. Many instances of smuggling have been reported, and the quantities involved are believed to be large -- particularly the quantities which go to the Chinese Communists. The known and reported trade in antibiotics from non-Soviet Bloc countries to the Soviet Bloc is shown in the following tabulation in terms of US \$**:

* Chloramphenicol produced synthetically is called chloromycetin.
** Trade in antibiotics is reported in money value only rather than in weight or other units; penicillin is measured by international units (see definition in Appendix D), and the other antibiotics in kilograms. Money value is the only common measure in trade, where antibiotics are lumped together, in contradistinction to production, where the commodities are treated individually.

S-E-C-R-E-T

	US \$	
	<u>1952</u>	<u>1953</u>
US	None	8,000
Western Europe	1,032,000*	306,000*
Hong Kong	12,064,000	14,271,000
Japan	None	596,000
Total	<u>13,096,000</u>	<u>15,181,000</u>

Unusual efforts to increase the supply of antibiotics in the Soviet Bloc by means of imports might be an indicator of military intentions -- allowances being made, of course, for naturally occurring epidemics.

I. General.

A. Definition and Occurrence. 1/**

An antibiotic is a chemical substance produced or derived from living organisms which, in small concentrations, is capable of inhibiting the life processes of microorganisms.

Microbes are living organisms, occurring by the millions in the soil. Some of them exist only because of their capability of forming antibiotics, which protect them from disease-producing microorganisms also found in the soil in the form of bacteria, fungi, and viruses. The discovery that these antibiotic substances would control certain disease-producing microorganisms in the living body led to the development of numerous antibiotics. The better

* These are minimum figures. Many countries lump antibiotics with other drugs and commodities, and the antibiotics so included are not reported as antibiotics.

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

S-E-C-R-E-T

known of these are penicillin, streptomycin, dihydrostreptomycin, terramycin, chloramphenicol (chloromycetin), aureomycin, and bacitracin.

B. Raw Material Requirements.

With the exception of chloramphenicol, which may be prepared synthetically, antibiotics are produced by fermentation. The principal raw materials are corn-steep liquor, casein, cottonseed meal, or sunflower seed oil as a source of nitrogen; and lactose, glucose, dextrin, starch, or maltose as a source of carbon. Inorganic ions, such as the salts of sodium, potassium, and calcium, and sulfuric and phosphoric acids are required. Organic solvents, antifoam agents, filter aids, and sterile air are some of the other materials needed in the process. More than 150 metric tons of raw materials are required to produce approximately 0.5 metric ton of penicillin. There appears to be no shortage of these raw materials in the Soviet Bloc.

II. Production and Quality.

A. Production.

1. Penicillin.

There are numerous reports of antibiotic plants, principally for the production of penicillin, being installed throughout the Soviet Bloc. Plants located in the USSR are listed in Appendix A, and the Satellite plants are listed in Appendix B.

At the close of World War II, the United Nations Relief and Rehabilitation Administration (UNRRA) ^{2/} furnished to Poland, China, Czechoslovakia, and the Ukrainian and Belorussian Republics of the USSR penicillin plants having a total capacity of 600 billion units per year. It was not until about 1948 that any substantial quantity of solid (amorphous or crystalline) penicillin was reported as being produced by the Soviet Bloc. It is believed that prior to that time reports of production of penicillin referred to the form produced by surface fermentation. This product was impure and deteriorated rapidly and was not considered satisfactory. It is believed that the Russians initially may have copied the UNRRA plant designs and duplicated them in the instances where new installations for the production of penicillin have been reported.

- 4 -

S-E-C-R-E-T

S-E-C-R-E-T

Reports from prisoners of war indicate that the original capacity of some of these plants has been greatly expanded, an indication which is consistent with the following statement quoted from a leading Soviet medical periodical 3/:

"During the current Five Year Plan (1951-55), the production of antibiotics is to be particularly increased. In 1955, antibiotics will amount to 30 percent of all drugs manufactured in the USSR. Production of penicillin and streptomycin in 1955 will be high enough to insure not only the needs of the population but will also permit a wide use of penicillin for veterinary purposes"

Total 1953 production of penicillin in the European Satellites and Communist China is estimated at about 21,000 BU. Hungary is the largest producer with a total of 8,000 BU, and Czechoslovakia is second with a total of 7,000 BU.

Table 1 gives estimated production of penicillin in the Soviet Bloc for 1953.

Table 1

Estimated Production of Penicillin in the Soviet Bloc
1953

		Billion Units (BU)
<u>Country</u>	<u>Plant Location or Name</u>	<u>Amount</u>
USSR	Kiev	11,700
	Minsk	7,600
	Moscow (Karpova)	23,300
	Moscow (Plant No. 7)	6,000
	Moscow (Plant No. 40)	20,000
	Riga	9,000
	Sverdlovsk	14,600
Total		<u>92,200</u>

S-E-C-R-E-T

Table 1

Estimated Production of Penicillin in the Soviet Bloc
1953
(Continued)

<u>Country</u>	<u>Plant Location or Name</u>	<u>Billion Units, (BU)</u> <u>Amount</u>
Albania	None	
Bulgaria	Razgrad (under construction)	
Czechoslovakia	Roztoky	7,000
Hungary	Chinoi	2,000
	Debrecen	6,200
Poland	Tarchomin	600
Rumania	Chitila	600
East Germany	Jena	3,000
	Dresden (VEB	
	Arzneimittelwerk)	300
Total European Satellites		<u>19,700</u>
Communist China	Shenyang (Mukden)	600
	Shanghai	600
Total Communist China		<u>1,200</u>
North Korea	None	
Grand Total Soviet Bloc		<u><u>113,100</u></u>

- 6 -

S-E-C-R-E-T

S-E-C-R-E-T

During 1953, the production of penicillin in the US was 370,000 billion units, about three times the quantity estimated for the Soviet Bloc. Thus, the Soviet Bloc, with almost 5 times the population of the US (750 million to 160 million), produces less than one-third of the amount of penicillin produced in the US.

2. Other Antibiotics.

Available information on the production of antibiotics other than penicillin in the Soviet Bloc is scattered and inconclusive. It is known, however, that plants in the USSR, Czechoslovakia, Hungary, Poland, and East Germany are producing, or can be expected to produce, these antibiotics. In the USSR, production of syntomycin* (an antibiotic used for bacillary dysentery and trachoma of the eye), as well as other antibiotics such as gramycin, albomycin and levomycetin, is growing rapidly. 4/ Table 2** shows plants for the production of antibiotics other than penicillin in the Soviet Bloc, 1949-54.

B. Quality.

Two samples of antibiotics produced in the USSR were obtained recently (April 1954). One sample was penicillin and the other was streptomycin. 5/ Reports on laboratory analyses of these samples indicated that both were crystalline in nature, pale yellow in color, and adequate to meet US standards. The penicillin sample assayed by the microbial method gave a result of 1,610 units per milligram, equivalent to 97 percent purity. The streptomycin sample assayed 610 micrograms per milligram by the maltol assay and 620 micrograms per milligram by the turbidimetric microbial assay, corresponding to 77 percent purity. Packages for both materials appeared technically adequate, although they lacked the workmanship and elegance to which the US market is accustomed.

III. Trade. 6/

A. General.

The value of antibiotics in the treatment of disease and infection has been reflected by the enormous demand for these

* The Russian term for chloromycetin (synthetic chloramphenicol).
** Table 2 follows on p. 8.

S-E-C-R-E-T

Table 2

Plants for the Production of Antibiotics Other Than Penicillin
in the Soviet Bloc
1949-54

<u>Country</u>	<u>Plant Name</u>	<u>Location</u>	<u>Antibiotics</u>	<u>Year</u>	<u>Production</u>
USSR	Karpov	Moscow	Streptomycin Syntomycin	1949 1952 <u>a/</u>	N.A. N.A.
Czechoslovakia		Roztoky	Streptomycin Chloromycetin	1949-50 1953	N.A. N.A.
Hungary	Chinoin	Ujpest near Budapest	Streptomycin	1954 <u>a/</u>	N.A.
Poland		Kracow	Streptomycin Chloramphenicol Aureomycin	(Under Development) (Under Development) (Under Development)	
East Germany		Jena	Streptomycin Chloromycetin	1952 1952	780 BU <u>b/</u> 500 Kg <u>b/</u>

- a. Initial Plan goal.
b. 1952 production plan.

products by the Chinese Communists immediately preceding and during the recent war in Korea. Efforts by the US after 1950 to restrict trade in antibiotics with the Communists under COCOM agreements were delayed by debate over methods of control. Some delegates representing COCOM member countries objected, for purely humanitarian reasons, to curtailment of trade with the Soviet Bloc. In the mean time, a brisk trade ensued, with Hong Kong as the principal port of transshipments to Communist China. Other important gateways were Macao, Singapore, and Bangkok. Antibiotics are suited ideally for smuggling because of their relatively high value for a small quantity. It is believed that large quantities were made available to the Communists in this manner. Shipments by parcel post from individuals in Western

S-E-C-R-E-T

countries to friends and relatives behind the Iron Curtain account for an unknown quantity of these drugs reaching the Communists. The volume of trade in antibiotics is obscured further when shipments to Communist countries are reported by general categories, such as drugs, medicinals, pharmaceuticals, and diverse chemicals.

B. US Exports to the East.

US exports of antibiotics to the Soviet Bloc dwindled from a substantial \$12,388,000 in 1950 to a mere \$4,000 in 1952. There were no US exports directly to China in 1951, 1952, and 1953. US exports of antibiotics to Communist China, Hong Kong, and Macao for 1950 through 1953 are given in Table 3.*

C. Western European Exports to the East.

Reported exports of antibiotics by Western European countries to Hong Kong and destinations of transshipment by Hong Kong during 1952 and 1953 are given in Table 4.**

Trade in antibiotics to the Soviet Bloc was substantial during 1952-53, with Communist China receiving the major portion. In spite of efforts by the European Satellites to produce antibiotics, most of these countries continue to import the drugs from the West. In 1953, reported shipments of antibiotics to the Satellites were slightly more than that reported for 1952. There is some evidence that the European Satellites shipped most of their own production of antibiotics to the USSR, which may indicate that imports from the West were necessary to provide for internal requirements. (See Appendix B.)

There is some evidence of a slackening of the flow of trade through Hong Kong; shipments to Hong Kong for the first 6 months of 1953 nearly equaled the shipments for the entire year of 1953, thus indicating a substantial decrease in the volume of shipments for the last half. It is quite likely that the cessation of hostilities in Korea resulted in a sharp decline in the demand for antibiotics by the Chinese Communists. Reports advising of Communist China's large-scale rejection of Hong Kong pharmaceuticals, including antibiotics, because the quality was allegedly substandard, may have reflected Soviet intentions to negotiate cease-fire in Korea.

* Table 3 follows on p. 10.

** Table 4 follows on p. 11.

S-E-C-R-E-T

Table 3

US Exports of Antibiotics to Communist China,
Hong Kong, and Macao a/
1950-53

	Thousand US \$			
	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>
Communist China				
Penicillin	423	0	0	0
Streptomycin	159	0	0	0
Antibiotics (Not Elsewhere Classified)	115	0	0	0
Total	<u>697</u>	<u>0</u>	<u>0</u>	<u>0</u>
Hong Kong				
Penicillin	7,258	8	1	1
Streptomycin	3,736	3	2	2
Antibiotics (Not Elsewhere Classified)	684	8	0	5
Total	<u>11,678</u>	<u>19</u>	<u>3</u>	<u>8</u>
Macao				
Penicillin	7	2	0	0
Streptomycin	2	7	0	0
Antibiotics (Not Elsewhere Classified)	4	5	1	0
Total	<u>13</u>	<u>14</u>	<u>1</u>	<u>0</u>
Grand Total	<u>12,388</u>	<u>33</u>	<u>4</u>	<u>8</u>

a. All figures compiled by the US Department of Commerce.

S-E-C-R-E-T

Table 4

Hong Kong Imports and Exports of Antibiotics
1952-53

	Thousand US \$ a/	
<u>Exporting Country</u>	<u>1952</u>	<u>1953</u>
France	3,676	3,257
UK	1,366	3,470
Netherlands	1,313	1,986
Italy	1,182	1,683
Denmark	912	679
Germany	772	1,915
Total	<u>9,221</u>	<u>12,990</u>
 <u>Importing Country</u>		
Communist China	12,064	14,271
Macao	357	1,156
Taiwan	141	159
South Korea	35	78
Thailand	33	177
Indonesia	13	52
Total	<u>12,653</u>	<u>15,893</u>

a. Converted from Hong Kong dollars to US dollars at the rate of 0.1750 HK dollar to 1.0 US dollar, as published by the US Department of Commerce for June 1953.

Exports of antibiotics by non-Soviet Bloc countries to the entire world is compared to their trade with Soviet Bloc countries for 1952 in Table 5,* and for 1953 in Table 6.**

* Table 5 follows on p. 12.
** Table 6 follows on p. 13.

S-E-C-R-E-T

Table 5

Exports of Antibiotics by Non-Soviet Bloc Countries to the World and to the Soviet Bloc a/
1952

Exporting Country	Total Exports to World	Total Exports to Bloc	Soviet Bloc Importing Countries b/							Communist China
			Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Rumania	USSR	
Austria	(299)	(16)		(9)	(7)					
Belgium-Luxembourg	983	63		15	48					
Canada	24	1								
Denmark		446		267		32	60		1	
France	3,216	503		242		18	232		87	11
West Germany	330	19			(177)	19				
Hong Kong	12,701	12,064								12,064
Italy	(13,446)	(13)				(6)	(7)			
Netherlands	(8,096)	(1,055)	(9)	(342)	(176)	(77)	(13)	(129)	(295)	
Norway		(25)					(25)			
Sweden	(2,341)	(48) c/								
Switzerland	(21,746)	(453)	(14)	(105)		(37)	(110)	(38)	(1)	(149)
UK	(88,625)	(241)								(241)
Total d/	17,254	13,096		524	48	69	292	88		12,075

a. Figures shown in parentheses indicate exporting country makes no distinction between exports of antibiotics and exports of miscellaneous drugs, pharmaceuticals, and medicinal chemicals.

b. No data reported for Albania and North Korea.

c. No breakdown by countries is available.

d. Total includes only exports of antibiotics identified as such.

~~S-E-C-R-E-T~~

Table 6

Exports of Antibiotics by Non-Soviet Bloc Countries to the World and to the Soviet Bloc ^{a/}
1953

Exporting Country	Total Exports to World	Total Exports to Bloc	Soviet Bloc Importing Countries ^{b/}							Communist China
			Bulgaria	Czechoslovakia	East		Poland	Rumania	USSR	
					Germany	Hungary				
Austria	(248)	(3)					(3)			
Belgium-Luxembourg		29							28	
Canada	(3,830)	(248)		1 (120)				(41)	(87)	
Denmark	5,223	176						77	29	
France	(57,366)	(750) ^{c/}						(213)		70 (360)
West Germany	409	98			(516)					98
Hong Kong	16,219	14,271								14,271 ^{d/}
Ireland	(252)	(31)								(31)
Israel	(589)	(7)	(7)							
Japan	1,441	596								596
Malaya	(7,368)	(295)								(295)
Norway	(80)	(5)								
Netherlands	(4,939)	(392)	(10)	(72)	(58)	(4)		(28)	(206)	(18)
Sweden	(2,743)	(17) ^{e/}								
Switzerland	(24,651)	(182)	(6)	(19)	(62)	(14)	(22)	(15)	(1)	(43)
Taiwan (Formosa)	(5,923)	(16)								(16)
UK (penicillin only)	12,473	3								3
UK (other drugs)	(73,519)	(543)								(543)
Total ^{f/}	35,765	15,173		1			77	57		15,038

a. Figures shown in parentheses indicate exporting country makes no distinction between exports of antibiotics and exports of miscellaneous drugs, pharmaceuticals, and medicinal chemicals.

b. No data reported for Albania and North Korea.

c. A complete breakdown by countries was not reported.

d. Amount reported for the first 6 months of 1953 was 11,491.

e. No breakdown by countries is available.

f. Total includes only exports of antibiotics identified as such.

S-E-C-R-E-T

IV. Requirements.

It is impossible, of course, to estimate the requirements for antibiotics in the Soviet Bloc. Some conclusions can be drawn, however, about the relationship of supply and requirements in the Soviet Bloc from a comparison of the availability of penicillin in the US and in the Soviet Bloc.

It is assumed that the annual requirement for penicillin in each country is one average dose (200,000 units) per individual. The US, with a population of 160 million and a total annual penicillin production of 370,000 BU, can meet the requirement and have a penicillin surplus of 338,000 BU. The Soviet Bloc, with a population of 750 million and a total annual penicillin production of 113,000 BU, falls 37,000 BU short of meeting its requirement of 150,000 BU.

A similar supply requirement situation probably exists as far as antibiotics other than penicillin are concerned.

V. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

It appears that most of the difficulties involved in the quantity production of antibiotics have been overcome by the Soviet Bloc and that the quality of the antibiotics produced is high. Although Soviet Bloc production of antibiotics in 1953-54 is far short of requirements, it is probable that by 1958 the Soviet Bloc will be producing enough antibiotics to satisfy its normal peacetime requirements.

B. Vulnerabilities.

The antibiotics supply of the Soviet Bloc is currently (1954) vulnerable only to the extent that trade restrictions are successful and smuggling can be curtailed. This vulnerability, however, is only a temporary one; supplies of raw material are adequate, equipment presents no long-range problem, and production facilities are not concentrated geographically.

S-E-C-R-E-T

C. Intentions.

Abnormal efforts to obtain antibiotics by trade and smuggling and unusual activity in the production of antibiotics might well be indicators of Soviet military intentions. Making allowances for naturally occurring epidemics, such efforts to increase supply would be significant.

- 15 -

S-E-C-R-E-T

S-E-C-R-E-T

APPENDIX A

POSSIBLE AND KNOWN ANTIBIOTICS PLANTS IN THE USSR

1. Bezlan. 7/

In 1947 the Mikoyan Corn Products Combine at Bezlan was reported producing starch from corn, crystalline glucose for medical use, and the raw material for the production of penicillin. No additional reports have been received to indicate that penicillin is actually produced here. Apparently this plant furnishes some raw materials for processing for manufacture of penicillin elsewhere.

2. Irkutsk. 8/

Production of penicillin was reported in 1952 at the Biological Warfare Experimental Station at Irkutsk. No data are available upon which to estimate production.

3. Khar'kov. 9/

In 1947 this plant was being supplied with equipment from Canada. No antibiotics production has been reported, and there are no available data upon which to estimate production.

4. Kiev. 10/

Construction of the Sverdlov Penicillin Plant at Kiev was started in 1947 and completed in February 1949. Production of penicillin began some time later. According to reports the production department was equipped with 6 fermentors, each 3 meters in diameter by 6 meters high. Production is estimated to be from 3,500 to 11,677 BU per year.

5. Kislovsk. 11/

Early in 1949 penicillin was produced by a plant in Kislovsk for supplying hospitals in the Caucasus. No details of the plant equipment are available upon which to base an estimate of production.

- 17 -

S-E-C-R-E-T

S-E-C-R-E-T

6. Leninakan. 12/

In 1948 a penicillin plant at Leninakan was completed and production was started, but no details of the plant equipment are available upon which to base an estimate of production.

7. Leningrad. 13/

In 1947 the Kirov Meat Combine in Leningrad produced the first lot of penicillin in dry form, but no plant data are available upon which to base current production.

8. Leningrad. 14/

In 1948, production of penicillin was at a monthly rate of 3.5 billion units in a former sausage factory known as the Lemmyasprom Meat Combine. The quantity reported is negligible.

9. Minsk. 15/

This plant is located in Minsk about 600 meters northeast of the freight station. The production of penicillin was started late in 1949. Some US and British equipment were reported. The production department contained 6 fermentors of stainless steel, each 3 meters in diameter by 4 meters high. Production is estimated to be from 2,300 to 7,600 BU per year.

10. Moscow. 16/

a. The Karpova Pharmaceutical Plant is located in the suburbs of Moscow, Nizhniya Kotely, and adjacent to the ZIS automobile plant, which is near the Moscow River and southeast of the center of town.

The production of penicillin began in September 1949. The plant operates three 8-hour shifts daily. The production department is equipped with 12 fermentors, each 3 meters in diameter and 6 meters high. It is estimated that annual production of penicillin is from 7,000 to 23,300 BU per year, depending upon the fermentation cycle and the number of units of penicillin produced per milliliter.

b. Penicillin Plant No. 7, located southwest of the Karpova Pharmaceutical Plant, is believed to be an annex to the older Karpova factory.

S-E-C-R-E-T

Limited production of penicillin began in November 1948 when approximately 10 grams were produced daily. This plant is reported to be in excellent condition and was completely built in the period from October 1947 to April 1949. The plant employs mostly women and operates in three 8-hour shifts daily. The production department is equipped with 6 fermentors, each 2 meters in diameter by 7 meters high. Most of the machines are modern and are of US or German origin. The production of penicillin is estimated to be from 1,800 to 6,000 BU per year.

c. Penicillin Factory No. 40 is located in the northwest section of Moscow, on the site of the Butyrski Aniline Dye Factory. The production department contains 12 large steel vats fitted with beaters driven by a vertical shaft. These vats were 3 meters in diameter by 5 meters high. It is estimated that the production of penicillin is 6,000 to 20,000 BU per year.

11. Orsk. 17/

It is reported that a meat-processing plant in Orsk also produces medical preparations and penicillin. Information is indefinite, and it is not known whether this plant produces penicillin or furnishes raw materials for processing elsewhere.

12. Pobeda, Kemerova Oblast. 18/

It is reported that a penicillin plant is to be constructed at Pobeda, about 300 km south of Stalinsk. No further details are available.

13. Riga, Latvia. 19/

This plant is located 1.5 km east-southeast of the Duena railroad bridge, directly north of the Duena tributary. Plans for the penicillin plant were based upon plans used for a Moscow penicillin plant.

Based upon information from October 1947 to February 1949, solid penicillin was shipped in vials of both 100,000 and 200,000 units, packed in cartons of 1 million units each that had blue and yellow stripes and labels bearing "P. Z." in Russian. From the packing department, one source learned that 8 milliard (billion) units were manufactured daily. On the basis of 360 working days

S-E-C-R-E-T

S-E-C-R-E-T

per year this would amount to 2,880 BU. According to another informant, the production department is equipped with 8 fermentors, each 2.5 meters in diameter by 5 meters high. Based upon this information, it is estimated that the annual production of penicillin is from 2,700 to 9,000 BU.

14. Saratov. 20/

During 1946 and 1947, a plant in Saratov was reported producing penicillin by the broth method. This process was uneconomical. No further information on this plant is available.

15. Sverdlovsk. 21/

The penicillin factory at Sverdlovsk has 2 fermentors, each 5 meters in diameter by 6 meters high, and 6 fermentors, each 2 meters in diameter by 4 meters high. It is estimated that from 3,300 to 11,000 BU could be produced annually in the 2 large fermentors and 1,100 to 3,600 BU annually in the 6 smaller ones. Thus, total annual production would be from 4,400 to 14,600 BU.

16. Tallin, Estonia. 22/

This plant produces penicillin, based upon information dated 1946. No further details are available upon which to base an estimate of production.

17. Tashkent. 23/

A penicillin plant under construction in Tashkent will use byproducts of a distillery for the raw materials. No further information has been received to indicate that this plant has begun production of penicillin.

18. Tbilisi. 24/

Based upon 1946 information, a penicillin plant in Tbilisi is reported to have a capacity of 1.5 billion Oxford units. Assuming annual production (the period was not stated in the report), the amount would be negligible. No additional information is available, indicating an increase in production capacity.

S-E-C-R-E-T

APPENDIX B

POSSIBLE AND KNOWN ANTIBIOTICS PLANTS
IN THE EUROPEAN SATELLITES

1. Albania. 25/

Medicinals in Albania are reported to be in short supply. No facilities for the production of antibiotics in Albania have been reported. Most of the required medicinals are imported from Czechoslovakia and Hungary. The Albanian government is believed to supplement these supplies by confiscating drugs sent to Albanian nationals from abroad, especially from compatriots residing in Italy.

2. Bulgaria. 26/

Razgrad (43°32' N - 26°31' E).

In 1952, to avoid importing and paying a high price for their requirements, the Bulgarian government decided to build a plant at Razgrad for the manufacture of penicillin. The machines and installations for the plant were imported from the USSR. Soviet experts helped in the construction of the plant and key workers for the complicated production of penicillin were trained in the USSR. The plant was scheduled to begin production of penicillin by 5 September 1954 and is expected to fill all of the country's requirements.

3. Czechoslovakia. 27/

a. Rostoky, near Prague.

In 1946, UNRRA furnished Czechoslovakia with machinery and equipment for the production of penicillin and enough raw materials, consisting of lactose, phosphoric acid, phenylacetic acid, amylnacetate, and corn-steep liquor, to last for 1 year. The equipment was held in storage in Czechoslovakia, near the city of Hostivar, for approximately 2 years and then removed to Rostoky where production is reported to have begun in the latter part of 1949. The plant, as originally furnished by UNRRA, had 2 fermenting vats and

S-E-C-R-E-T

S-E-C-R-E-T

was planned to produce 40 BU per month of amorphous penicillin, having a purity of 650 to 800 units per milligram. Two additional fermentors, having a capacity of 40,000 liters each, were supplied locally increasing the capacity of the plant to 80 billion units of amorphous penicillin per month. This type of penicillin requires storage in a refrigerator. Efforts were made to procure US-type centrifugal extractors through the United Nations Health Organization at Geneva, to further step up production and result in a crystalline material with a higher purity, 1,600 units per milligram. The crystalline product requires a minimum of refrigeration for storage, but not to exceed a maximum temperature of 20° C. It is believed, delivery of this equipment was stopped by the US Government because it could be used in the mass production of biological warfare (BW) agents. Attempts were then made by Czechoslovakia to obtain these separators from Sweden. Although the final outcome of these negotiations is unknown, it is not believed the equipment was obtained in 1949.

Press reports indicate that 300 BU should have been produced in the last quarter of 1949 and that production capacity would be increased 89 percent in the first half of 1950, and 125 percent in the last half of that year. Based upon an initial installed capacity of 80 BU per month, a 125-percent increase would equal a productive capacity of 180 BU a month, or 2,160 BU per year by the end of 1950. It was further reported that penicillin production in 1951 was 6 times that of 1949. This would equal a production of 1,800 BU in 1951 which appears reasonable in view of the estimated annual capacity of 2,160 BU. In 1952, production of penicillin was reported to have increased by 44 percent which indicates a production of 2,592 BU in that year. It was also reported in an East German periodical, dated September 1952, that Czechoslovakia had succeeded in producing penicillin in crystalline form, as well as procaine penicillin which can be stored for a long time without deterioration in quality.

According to a release from Prague, dated 7 January 1953, the workers of the Rostoky Penicillin Factory informed the Health Workers Conference in Prague that their output plan for 1953 provides for a 170-percent increase of production, which would make Czechoslovakia independent of penicillin imports from the West. This would be approximately 7,000 BU for 1953, based upon the estimated 1952 production of 2,592 BU.

S-E-C-R-E-T

Other antibiotics -- streptomycin and chloromycetin (synthetic chloramphenicol) -- are also reported in production at the Rostoky plant. A major portion of the antibiotics produced in Czechoslovakia are shipped to the USSR.

b. Hlohovec and Chrast Penicillin Plants.

Penicillin has also been reported in production at Hlohovec and at Chrast, near Chrudim, formerly the Dr. Heisler factory and now owned by Chemapol. The quantity of penicillin produced at these plants is unknown, and no information is currently available concerning size and type of equipment at these installations.

4. Hungary. 28/

a. Chinoin, Ujpest near Budapest.

Dr. Zoltan Földi first produced penicillin in the Chinoin laboratories using 3,000-liter tanks early in 1948. The quantity produced was small, and most of it was sent to the USSR. Hungary was forced to import its requirements. It is reported that Hungarian imports of penicillin amounted to 1,500 BU in 1951. Dr. Földi was also experimenting in the production of other antibiotics -- streptomycin, chloromycetin, aureomycin, terramycin, and bacitracin. It was reported early in 1954 that streptomycin was being produced at Chinoin and that sufficient production of this antibiotic had been included in the 1954 plan, presumably to meet the country's requirements and avoid the necessity of further imports. Based upon reported fermentation capacity of 45,000 liters, it is estimated that annual production of penicillin is 624 to 2,000 BU.

b. Debrecen.

In the spring of 1951, the construction of a new penicillin factory was started at Debrecen. The plans were based upon Czechoslovak and Polish plants. Dr. Zoltan Földi was placed in charge of the new laboratories, Hajdusagi Gyogyzergyar, at the Debrecen plant. The plant, also called the Ducios Chemical Plant, was equipped with machinery partly imported from the US and the USSR. A large part of the equipment was also furnished by L. Lang and Company of Budapest, who received considerable advice and assistance from the Czechoslovak machine factory CKD (Ceskomoravska Kolben Denek).

S-E-C-R-E-T

The factory was completed by 20 August 1952. Production was stepped up in the summer of 1952 with the arrival of new machines from East Germany. The quality of the penicillin produced at this factory is believed to be improving. The quantity produced is supposed to be sufficient to take care of Hungarian needs. It is reported, however, that the entire production of this plant is shipped to the USSR, packed 12 vials to a box and 10 boxes to a larger box, with all labels and instructions printed in Russian. Based upon reported fermentation capacity, which is 3 times that of the Chinoin plant, or 135,000 liters, the annual production of penicillin is estimated to be 1,872 to 6,200 BU.

5. Poland.

Tarchomin Chemical Pharmaceutical Factory Ludwig Spies. 29/

A complete penicillin plant capable of producing 50 BU of amorphous, or crystalline, penicillin per month supplied to Poland by UNRRA was installed at Tarchomin, a suburb of Warsaw. Essential parts of the plant were missing, and it took several years to obtain them from Czechoslovakia.

In 1948, part of the culture needed for full-scale production was obtained from Czechoslovakia. Polish maize extract proved unsuitable for the production of penicillin. Rumanian, Hungarian, Bulgarian, and Russian maize proved unsatisfactory. Maize extract from Yugoslavia was eminently suitable, but, because Yugoslavia withdrew from the Cominform, trade between Poland and Yugoslavia was blocked at this time. Therefore, it was reported that the factory was at a standstill and that no penicillin was produced during 1948.

The production of penicillin was first started in Tarchomin on 22 July 1949 with the aid of machines and advice from the USSR and Czechoslovakia. Poland is now producing great quantities of penicillin. By the third quarter of 1952, penicillin production was expected to be of such a volume that imports would no longer be necessary. Under the Six Year Plan, if the 1950 penicillin production is taken at 100, Poland was to produce 200 percent more in 1951, 800 percent more in 1952, and plans called for a 2,500-percent increase in 1955. A production of 105 BU of penicillin was planned by the Tarchomin plant for 1951. The production of crystalline penicillin was to be initiated in the first quarter of 1952.

- 24 -

S-E-C-R-E-T

S-E-C-R-E-T

According to the statement by source, penicillin production in Poland will increase to 800 BU in 1955.

Calculations based upon information contained in the same source above indicate that production of penicillin in Poland is as follows:

<u>Year</u>	<u>Percent (Six Year Plan)</u>	<u>Billion Units</u>
1950	100	35
1951	300	105
1952	900	315
1955	2,600	910

It is stated in the source that the plant shipped to Poland by UNRRA is capable of producing 50 BU per month, equivalent to 600 BU per year. This indicates that an additional 300 BU of capacity are planned by 1955. Based upon information above it is estimated that current (1953) production of penicillin in Poland is 600 BU per year.

There have been reports (1952) that Poland is developing a wider assortment of antibiotics, including chloramphenicol of a "purity and potency equaling that of foreign production" at Krakow.

6. Rumania.

Chitila, suburb of Bucharest. 30/

Rumania's first plant for the production of penicillin is being erected. All of the equipment is being supplied by the USSR, and the plant will be operated at the outset by Soviet specialists. The planned capacity of the plant has not been reported, but, because the plant is presumed to be a copy of the UNRRA plant, the capacity is estimated at 600 BU a year. It is stated by source that the Ministry of Health (Rumania) inquired in 1949 relative to the procurement of a penicillin plant capable of supplying a thermo-stable product at the rate of 50 billion units per month. It is estimated that current production (1953) of penicillin in Rumania is 600 BU per year.

S-E-C-R-E-T

S-E-C-R-E-T

7. East Germany.

a. VEB Jenapharm. 31/

The VEB Jenapharm, one of the largest pharmaceutical enterprises in East Germany, originated from the Institute of Microbiology. The plant was jointly operated by the Schott Jena Glass Works and the Carl Zeiss Optical Works until 1 January 1950, when it became an independent VEB (Volkseigener Betrieb -- People Owned Enterprise). The plant produces penicillin in every form, and streptomycin is scheduled for production in the near future.

The following production figures for June 1951 illustrate the types of penicillin produced at VEB Jenapharm:

<u>Penicillin Type Produced</u>	<u>Amount (BU)</u>
Jenapharm ointment tubes of 7-8 g (7,000 IU*)	0.242
Jenapharm ointment bottles 30 g (30,000 IU)	0.108
Jenapharm vulnerary powder tubes of 5 g (5,000 IU)	0.232
Jenapharm vulnerary powder bottles of 50 g (50,000 IU)	0.230
Jenapharm calcium salts ampoules of 500 IU	0.013
ampoules of 1,000 IU	0.005
bottles of 5,000 IU	0.044
Jenapharm calcium salts for injections	75.872
bottles of 200,000 IU	21.607
Jenacain penicillin (storage or depot penicillin)	
2,250 bottles	6.750
2,139 bottles	4.278
Total	<u>109.384</u>

Deliveries of calcium salt penicillin in June 1951 were as follows:

<u>Destination of Calcium Salt Penicillin</u>	<u>Amount (BU)</u>
Berlin (Soviet Sector)	5.000
Brandenburg Province	8.900
Mecklenburg Province	6.500
Saxony-Anhalt Province	10.900

* IU is the standard abbreviation for International Units.

S-E-C-R-E-T

<u>Destination of Calcium Salt Penicillin</u>	<u>Amount (BU)</u>
Saxony Province	10.200
Thuringia Province	10.500
Wismut AG Chemnitz	1.100
Volks Polizei (Peoples Police), Leipzig-Wied	0.200
Volks Polizei, Berlin-Nieder-Schoeneweide	0.200
DAHA for China	40.000
Soviet FPN 61 963 (balance of order 27/28 on 13 Jan 51)	7.500
Total	<u>101.000</u>

The 1952 production plans for various antibiotics at Jenapharm are as follows:

<u>Item</u>	<u>Amount (BU)</u>
Penicillin	1,500
Streptomycin (large-scale production to commence in April 1952)	250
Chloromycetin	60

In the first half of 1952, penicillin production at Jenapharm was 265 BU of depot penicillin. During the first half of 1952, Jenapharm shipped 290 BU to Communist China and North Korea. Streptomycin production at Jenapharm was planned to begin in September 1952, and the monthly production rate was to be 65 BU. During the first half of 1952, Jenapharm produced 162 kilograms of synthetic chloromycetin. In 1952, the monthly production plans for chloromycetin were 42 kilograms. Three hundred BU of penicillin were shipped to North Korea on 24 September 1952. A streptomycin plant was finished in October 1952 and produced small quantities during December. Minor flaws developed, however, and the plant was shut down, not expecting to resume operations until early 1953. Small quantities of aureomycin were also produced in December 1952. The 1953 production of penicillin by Jenapharm is estimated as 3,000 BU. The estimate is based upon the annual production of 2,900 BU and a reported output of 1,600 BU during the first half of 1953.

S-E-C-R-E-T

b. Biopharm Plant (Langenhennersdorf). 32/

Early in 1949, mass production of 100 million units of penicillin per month was started at Biopharm Plant in Langenhennersdorf. It was planned to reach a production of 1 BU of penicillin per month early in 1950. However, no further reports of the production of penicillin at this plant have been noted.

c. VEB Madaus Pharma Plant. 33/

About 28 BU of penicillin were produced in 1949. The 1950 original penicillin production plan was 50 BU but the final production plan was approximately 90 BU. No further information concerning production of penicillin at this plant has been received.

d. VEB Schering Plant. 34/

This plant produced 1.3 BU of penicillin during the first 4 months in 1950. Production was suspended for 4 months and was resumed in September 1950. Final production figures for 1950 are not available. In 1953 it was reported that the production of penicillin had been discontinued at the Schering Plant.

e. VEB Arzneimittelwerk (Dresden). 35/

Production of penicillin was reported to be 130 BU during the first half of 1953. In 1954 it was planned to produce 150 BU of calcium salt penicillin and 150 BU of depot penicillin.

S-E-C-R-E-T

APPENDIX C

KNOWN ANTIBIOTICS PLANTS IN COMMUNIST CHINA AND NORTH KOREA

1. Communist China. 36/

a. Peiping.

Prior to 1948, small quantities of penicillin were reported produced at the Temple of Heaven Health Research Institute. Presumably these laboratories were under control of the National Epidemic Prevention Bureau and were removed to Kunming from Peiping in 1937 to avoid capture by the Japanese. Under the direction of Dr. T. H. Shen, these laboratories produced vaccine, serum, and penicillin. The quantity of penicillin reported to be produced in 1946 was small, amounting to only 3.9 million units. In 1951, Dr. Shen, who was living in Berlin as a delegate of the Academia Sinica Peiping, revealed that China was planning to build a penicillin plant, similar to the Jenapharm plant in East Germany, capable of producing 4 BU per year.

b. Chungking. 37/

According to information dated January 1952, penicillin produced at a Chungking plant under the direction of Dr. Wang (trained at Pasteur Institute) was satisfactory in quality. No additional information on the plant is available.

c. Shenyang (Mukden). 38/

The state-owned Northeast China Chemical-Pharmaceutical Factory is located at Shenyang. Penicillin is produced with equipment supplied by the World Health Organization (WHO) and UNRRA in 1946 and 1947. The UNRRA plant had a production capacity of 40 to 50 BU of penicillin per month. It is estimated that approximately 600 BU of penicillin were produced in 1953.

With Soviet assistance, the production of chloromycetin was initiated in 1953 at the Northeast Factory.

- 29 -

S-E-C-R-E-T

S-E-C-R-E-T

d. Shanghai. 39/

In 1951, production of penicillin on a large scale was begun in the state-owned factory at Shanghai. According to information dated 4 August 1953, the capacity of the Shanghai penicillin factory was to be increased by eight times. Dr. Tung Tsun, who is Assistant Director of the factory, was formerly associated with developmental work in connection with the production of penicillin at Peiping. Estimated production for 1953 is 600 BU per year.

2. North Korea.

No production of antibiotics has been reported.

S-E-C-R-E-T

APPENDIX D

METHODS OF PRODUCTION

Most antibiotics are produced commercially by a submerged-agitated-aerated fermentation process in which a carbon source, a nitrogen source, essential mineral elements, and certain growth-promoting substances are utilized by the antibiotic-producing microorganism in producing a specific antibiotic substance. Chloramphenicol has also been produced synthetically and is known under the trade name of "chloromycetin."

Nitrogen sources used in the production of penicillin have been corn-steep liquor, casein, cottonseed meal, sunflower seed oil, peanut meal, distiller's wastes, and nitrate or ammonium salts; carbon sources have consisted of lactose, starch, dextrin, glucose, maltose, and molasses. Inorganic ions used are zinc, copper, manganese, potassium, sodium, calcium, phosphate, sulfate, and nitrate. In addition, a precursor is used, a catalyst for increasing the yield of the desired type of penicillin; such precursors are phenylacetic acid, phenylacetamide, or B-phenylethylamine. The incubation temperature for penicillin is 25° C to 28° C. An incubation time of 7 days, with yields of only 200 units per milliliter, was required for old surface-fermentation methods, whereas only 2 to 3 days, with yields up to 3,000 units per milliliter, are required for newer submerged methods. Fermentation processes for the other antibiotics are similar but with some variation in raw materials and conditions of incubation. 40/

In general, the fermentation process for the production of antibiotics involves preparation of a culture of the producing organism; inoculating the mashing ingredients (corn-steep liquor, and lactose in the case of penicillin) with the culture; aeration with sterile air to accelerate the growth rate of the organism on the utilization of the raw materials; transfer to seed tank containing additional mashing ingredients and in which sterile aeration is continued; placing the material from the seed tank in the fermentor (tanks ranging up to 30,000 gallon capacity) where aeration continues and additional mash is added and the fermentation process is continued under carefully controlled conditions of temperature, pressure, and acidity. The antibiotic may be separated from the mashing ingredients

S-E-C-R-E-T

when fermentation has been completed by (1) adsorption on activated carbon, elution with water and an organic solvent such as acetone, amyl acetate, or chloroform; (2) by the solvent process whereby the acidified culture liquor is extracted using a solvent in a centrifugal-type extractor; (3) ion-exchange resin process. The production of antibiotics must be conducted under carefully controlled conditions to avoid contamination of the ingredients and loss of the entire batch. Stainless steel equipment, or equivalent non-corrosive type surface in contact with the broth, is required in the production of antibiotics.

Forms, Units, Dosages, Package. 41/

Commercially, antibiotics are in the liquid form or as crystalline or amorphous powders. Penicillin preparations are primarily the salts of sodium, potassium, calcium, and magnesium. Type G, the sodium salt, is often used with procaine in oil. The purest form of penicillin is the white crystalline powder. With the exception of penicillin, the antibiotics are measured in terms of kilograms. The potency of penicillin is measured in terms of the Oxford (Florey) unit or international unit. The Oxford unit is the amount of penicillin which, when dissolved in 50 milliliters of meat extract broth, inhibits completely the growth of a standard test strain of *Staphylococcus aureus*. The international unit of penicillin is 0.6 microgram of the International Penicillin Standard, which is a specimen of pure crystalline sodium penicillin G. The international unit is approximately equivalent to the Oxford unit.

Antibiotics may be administered orally, by injection, or topically depending upon the type of disease being treated. Dosages are usually in terms of milligrams per kilogram of body weight. However, in the case of penicillin, dosages are in terms of units; 200,000 to 300,000 units daily are common. Penicillin is usually packed in rubber-capped vials with an aluminum seal in sizes to contain 100,000, 200,000, 300,000, 500,000, and 1,000,000 units each. Salves and ointment may be packed in tubes and jars, and the oil and wax in vials, while the crystalline variety is usually packed in air-tight bottles. One billion units of bulk penicillin weighs approximately one and one-third pounds, is valued at approximately \$400.00, and is sufficient for 5,000 individual average doses of 200,000 units each.

S-E-C-R-E-T

APPENDIX E

METHODOLOGY

It is believed that the UNRRA plants having a capacity of 600 billion units of penicillin per year were the models for many of the Soviet Bloc penicillin plants. It appears certain that the capacities of many of these plants have been increased since the late 1940's when production was first reported. This is confirmed by statements by prisoners of war, whose descriptions of the equipment at some of these plants indicate additional equipment has been installed.

A companion report describes a method for estimating the production of penicillin based upon a knowledge of the number and size of the fermentors, strain of organism used, culture medium employed, and the efficiency of the recovery method.

Assuming a yield of 800 international units per milliliter of available fermentor capacity and one recovery a week (52 times per year) with 50 percent recovery, the production of a plant reported having 6 fermentors, each 3 meters in diameter by 6 meters in height, may be estimated as follows:

$$\left(\frac{3}{2}\right)^2 \times 3.1416 \times 6 \times 6 \times 1,000,000 \text{ (converting cubic meters to milliliters) equals } 254,400,000 \text{ milliliters.}$$

Because of foaming, it is believed that only two-thirds of the total capacity, 169.2 million milliliters, would be available for fermentation.

The available capacity of the fermentors, 169.2 million milliliters, times the yield of penicillin in international units per milliliter (or 800) equals 135.36 billion units (BU) per recovery. Based upon one recovery a week or 52 recoveries a year and 50 percent recovery, the estimated annual production is 135.36 BU times 52 times 0.50 equals 3,519 BU.

It is believed that in time, as plant operators become more familiar and proficient in handling the equipment, an increase in penicillin production would result without further expanding

- 33 -

S-E-C-R-E-T

S-E-C-R-E-T

facilities and raising capacity. The production increase would occur when three-fourths, instead of only two-thirds, of the fermentation capacity was usable and fermentation yields up to 1,200 units per milliliter, rather than only 800, were obtained. Furthermore, the recovery or turnover in fermentors could increase to twice a week or 104 times a year, instead of only once a week. On this basis, a plant having 6 fermentors, each measuring 3 meters in diameter by 6 meters high, and a total capacity, as before, of 254.4 million milliliters would produce annually:

$$254,400,000 \times 3/4 \times 1,200 \times 0.5 \times 104 \text{ equals } 11,906 \text{ BU}$$

This output is 3.38 times the initially estimated production, from the same equipment.

In a similar manner, the production of penicillin was estimated for other Soviet Bloc plants, if information regarding fermentation capacity was available. In each case, the larger estimate is believed to reflect more closely current (1953) production.

The production of penicillin in East Germany is based upon reports from sources believed to be reliable, while Polish and Czechoslovakian production was calculated, as indicated under the respective plants in Appendix B, from reports cited.

The penicillin production estimate for Communist China is based upon the Mukden plant, the plant furnished by UNRRA having a reported capacity of 600 BU per year. A similar estimate of 600 BU of penicillin per year was made for the Shanghai plant, because many reports indicate that Shanghai is becoming a center of importance, and it appears reasonable that this plant may have been modeled after the UNRRA plant. The penicillin operation at Peiping appears to be more for research and development and, actual production is believed to be negligible.

S-E-C-R-E-T

APPENDIX F

GAPS IN INTELLIGENCE

For many antibiotics-producing plants in the Soviet Bloc, information on production capacities, current rates of production, and types of antibiotics produced is lacking.

Trade statistics are very incomplete on quantities of antibiotics, by type, that are shipped to the USSR by Satellite countries.

Although there are indications of general stockpiling of pharmaceuticals and drugs in the Soviet Bloc, there is no definite information on the stockpiling of various types and quantities of antibiotics.

- 35 -

S-E-C-R-E-T

S-E-C-R-E-T

APPENDIX G

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

It is believed that the sources used are reliable and furnish the best information available at this time. The mass production of antibiotics is a relatively new industry, having been stimulated by the demand created through their effectiveness in curing a variety of diseases in World War II. Production of antibiotics in the USSR lagged far behind that in the US, and it was not until 1948, about the time when reliable news from behind the Iron Curtain was difficult to obtain, that Soviet production of penicillin on plant scale was initiated. This may account for the lack of information received from the various sources on the antibiotic industry in the Soviet Bloc.

2. Sources.

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

<u>Source of Information</u>	<u>Information</u>
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

S-E-C-R-E-T

S-E-C-R-E-T

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

25X1A



- 38 -

S-E-C-R-E-T

25X1A

Approved For Release 1999/09/26 : CIA-RDP79-01093A000700020008-2

Next 2 Page(s) In Document Exempt

Approved For Release 1999/09/26 : CIA-RDP79-01093A000700020008-2

CONFIDENTIAL

Approved For Release 1999/09/26 : CIA-RDP79-01093A000700020008-2

~~SECRET~~

U. S. OFFICIALS ONLY

U. S. OFFICIALS ONLY

~~SECRET~~

Approved For Release 1999/09/26 : CIA-RDP79-01093A000700020008-2

CONFIDENTIAL