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Dissemination Authorized
Assistant Director
Office of Current Intelligence

17 October 1956

[Redacted]
No. Pages - 43
Copy No. - 60

NEW CONSTRUCTION IN THE CHEMICAL INDUSTRY
OF THE USSR

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Office of Research and Reports

CENTRAL INTELLIGENCE AGENCY

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FOREWORD

This report on new construction in the chemical industry of the USSR was undertaken for the primary purpose of providing a basic inventory of the various projects currently in progress or projected by the Sixth Five Year Plan (1956-60). With the use of plant information in combination with announced increases in production, locational trends can be discerned in production of basic chemicals and can be correlated with fragmentary information about the less publicized sectors of the chemical industry and with trends in industry as a whole. Surveys of new plants are made in connection with commodity studies, but this piecemeal approach does not provide the over-all view which was the purpose of this report. In addition, a close monitoring of construction activities -- for which this report will provide the basis -- will be extremely useful in checking on the progress during the Sixth Five Year Plan.

This report also had several subsidiary purposes -- to provide capital coefficient data (specifically, cost per annual ton of capacity by product); to investigate time periods of construction; and to reveal, for possible future use in connection with economic vulnerability studies, bottlenecks in construction.

In general, this report covers only those sectors of the chemical industry engaged in the production of basic chemicals. This limitation was imposed by the fact that reasonably good information is obtainable only for these sectors.

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(ORR Project Z2.861)

NEW CONSTRUCTION IN THE CHEMICAL INDUSTRY
OF THE USSR*

Summary

The USSR has launched a vast construction program for expansion of production of chemicals during the Sixth Five Year Plan (1956-60). Planned capital investment in the chemical industry in the new plan is 150 percent greater than in the Fifth Five Year Plan (1951-55), while investment in industry as a whole is only 70 percent greater. An estimated 50 billion rubles will be invested for the expansion of production facilities of the chemical industry from 1956 through 1960 -- an amount approaching that invested in the chemical industry in the US during the 1950-55 period.

In the postwar period a major part of the Soviet construction effort in the chemical industry has been directed to facilities for the production of mineral fertilizers, and secondary emphasis has been placed on facilities for the production of synthetic rubber and alkalis. In addition to the rebuilding of plants damaged during World War II, three new nitrogen fertilizer plants, many superphosphate plants, a new potassium combine, and several new phosphorite mines were constructed during the Fourth (1946-50) and Fifth Five Year Plans. The Sixth Five Year Plan emphasizes, in general, the same sectors of the chemical industry as did the Fourth and Fifth Five Year Plans. Five superphosphate plants, 2 ammonium nitrate plants, 2 potassium combines, and 3 phosphorite mines are planned or are under construction. In addition, new facilities are planned for increased production of soda ash.

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 July 1956.

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caustic soda, sulfuric acid, synthetic rubber, and synthetic alcohol. Almost one-third of the total planned investment in the chemical industry is for facilities for the production of mineral fertilizers, synthetic rubber, sulfuric acid, and soda ash.

The Sixth Five Year Plan calls for a marked expansion of the chemical industry in Kazakhstan, Central Asia, and East Siberia, based on the developing electric power industry in these areas. This program has the dual purpose of exploiting an abundant supply of raw materials and of locating production facilities in proximity to markets. In the southeast the USSR will construct its first ammonia plant using natural gas as the source of hydrogen, and in the Baltic Republics new fertilizer plants will be built.

The construction program in the Soviet chemical industry has met with some difficulties. One of them has been the long time periods of construction, averaging at least three times those in the US. An analysis of Soviet construction costs indicates, however, that this slow pace has not resulted in inordinately high costs. A comparison of the estimated construction costs of chemical plants in the USSR with comparable costs in the US shows a ruble/dollar construction cost ratio of between 9 and 15 to 1, more or less normal for relative industrial prices in general. The prolonged construction periods have been caused primarily by a diffusion of the available resources over too many building projects. As a partial result of the heavy Soviet commitment in construction, certain materials have appeared to be in short supply at construction sites. The most chronic shortages include those of copper wire, armored cable, cement, and lumber. Striking deficiencies in the organization of labor also have been noted.

The USSR has demonstrated the capability for designing and constructing operational chemical plants of most types, but some weaknesses have been observed -- the inability to design and construct plants that use technologically advanced processes, such as plants for the production of some new types of plastics and petrochemicals; and the general inability to complete construction projects within prescribed time limits. Successful fulfillment of the directives on

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capital construction in the Sixth Five Year Plan should result in shortened construction periods and in the completion of building projects on schedule. According to the Plan, the dispersal of capital investments over a wide range of construction projects is to be eliminated, building operations are to be further mechanized, and other measures are to be taken to accelerate construction. It appears that during the next few years the Soviet capability for the construction of conventional chemical plants will be significantly improved and that the capability for the construction of new types of chemical plants probably will be only moderately improved.

Although the construction of chemical plants could not be completely disrupted by economic sanctions, a denial of materials in short supply, especially copper wire, probably would delay the construction program.

Long-term trends in the construction program of the Soviet chemical industry do not provide a good indication of intentions; the plants that produce materials needed in peacetime also produce essential materials in wartime. Short-term trends, however, could provide indications of Soviet intentions. Such moves as an intensive effort to complete construction projects in progress and to halt the initiation of new projects, or shifts to favor more essential projects over projects with purely peacetime implications, could be indications of Soviet preparations for hostilities. In the Soviet chemical construction program currently in progress or planned, there are no clear indications of preparations for hostilities.

I. Introduction.

A. Significance.

The chemical industry of the USSR is one of the most important branches of Soviet heavy industry. It supplies products to

all branches of industry, to agriculture, to transport, and to the household consumer. Increased production of agricultural crops depends to a large extent upon the ability of the chemical industry to provide larger quantities of fertilizers and pesticides. Similarly, growth of the petroleum, metallurgical, and almost all other industries demands increased amounts of the acids, alkalies, plastics, dyes, and other products of the chemical industry. The importance attached by the USSR to the expansion of the chemical industry was revealed in the Sixth Five Year Plan (1956-60). Capital investment in the chemical industry is to be increased by 150 percent over the investment during the Fifth Five Year Plan (1951-55) 1/*; the corresponding increase planned for industry as a whole is only 70 percent. 2/

B. Organization.

Construction and associated planning for the Ministry of the Chemical Industry are carried out by a number of organizations, some of which are not subordinate to the ministry itself.

1. Planning.

The planning which precedes the construction of chemical plants is carried out by the Directorate of Planning of the Ministry of the Chemical Industry and by a number of planning institutes, such as Giprokhim** and GIAP,*** which are subordinate to the various production Chief Directorates of the Ministry. 3/ The Directorate of Planning prepares, for the approval of the Council of Ministers, the perspective, or long-range, plan for the development of the chemical industry. 4/ In conformance to the perspective plan, the Ministry of the Chemical Industry (probably through either the Directorate of Planning or Glavkhimproyekt****) prepares the

* For serially numbered source references, see Appendix D.

** Gosudarstvennyy Institut po Proyektirovaniyu Predpriyatiy Osnovnoy Khimicheskoy Promyshlennosti (State Institute for the Planning of Establishments of the Basic Chemical Industry).

*** Gosudarstvennyy Institut Azotnoy Promyshlennosti (State Institute of the Nitrogen Industry).

**** The functions of Glavkhimproyekt (Chief Directorate of Chemical Designing) are not known.

planning assignment (zadaniye na proyektirovaniye) for the construction of a specific project. The planning institutes, using the planning assignments submitted by the Ministry, then prepare the working plans and drawings which immediately precede construction. 5/

2. Construction.

Major construction projects of the Ministry of the Chemical Industry are generally carried out on a contract basis by the Ministry of Construction of Metallurgical and Chemical Industry Enterprises, which has a net of construction enterprises in many regions of the country. 6/ In a few cases it appears that the Ministry of Construction is engaged as the general contractor, 7/ probably because it is active in the area of the construction project.

Chemical construction projects (ob''yekts) which are intermediate in size are carried out by the Ministry of the Chemical Industry through its Chief Directorate for Chemical Industry Construction (Glavkhimpromstroy) and the Construction-Installation Trust, which is a part of the Chief Directorate. 8/

Minor construction jobs at operating plants are conducted by the construction departments of the plants. 9/

II. Construction from 1946 to 1955.^a

A. Fourth Five Year Plan (1946-50).

Reconstruction of the many war-damaged plants and construction of new plants for the production of fertilizers, dyes, soda products, and plastics were planned during the Fourth Five Year Plan (1946-50). The extent of the construction planned was revealed by the statement that the planned capital investment in the chemical industry during this period would be equal to the total amount invested in this industry during all three of the previous Five Year Plans* 11/

* The capital investment in the chemical industry during the Fourth Five Year Plan has been estimated at 17.5 billion rubles. 10/ The actual amount of capital investment planned is not known.

Strong emphasis was to be placed on the construction of facilities for the production of mineral fertilizers and pesticides, 50 percent of the total investment in the chemical industry being allocated for this purpose. 12/

Considerable success was achieved in the reconstruction of the war-damaged plants during this period, but the construction plan probably was not fulfilled, because few new chemical plants were put into operation. The following chemical plants, some of which were planned for completion during this period, were still under construction at the end of 1950: the ammonia plants at Kirovakan, Lisichansk, and Rustavi; the superphosphate plants at Samarkand, Chardzhou, Krasnoural'sk, and Maardu; the potassium combine at Berezniki; the synthetic rubber plants at Sumgait, Usol'ye-Sibirskoye, Krasnoyarsk, Kadiyevka, and Temir-Tau; and the soda plants at Sterlitamak and possibly Berezniki.

B. Fifth Five Year Plan (1951-55).

During the Fifth Five Year Plan (1951-55), construction activity was increased; capital investment in the chemical industry was 1.8 times that of the Fourth Five Year Plan. * 14/ The Fifth Five Year Plan called for expansion of the production capacities for mineral fertilizers, ammonia, sulfuric acid, synthetic alcohol, soda, and chemicals for combating agricultural pests. Few new major construction projects were started during the period of the Plan. Construction was continued on the projects that had been started during the years of the previous plan, and many of these plants were completed. Before the end of 1955 the following plants were put into operation: the three ammonia plants at Kirovakan, Lisichansk, and Rustavi; the superphosphate plants at Samarkand, Krasnoural'sk, and Sumy; the first section of the potassium combine at Berezniki; the synthetic rubber plants at Sumgait, Temir-Tau, Kadiyevka, and Krasnoyarsk; and the soda plant at Sterlitamak. Construction continued at the Chardzhou and Maardu superphosphate plants, at the synthetic rubber plant at Usol'ye-Sibirskoye, and probably at the potassium combine in Berezniki. Construction of a new ammonia

* The capital investment in the chemical industry during the Fifth Five Year Plan has been estimated at about 31.5 billion (July 1950) rubles. 13/

plant at Nevinnomyssk, in Stavropol'skiy Kray, RSFSR, was begun. The construction plan for the 1951-55 period probably was not fulfilled, however, because the chemical industry was scored in 1955 for underfulfillment of the plan for putting new capacity into operation. 15/

III. Sixth Five Year Plan Goals and New Construction.

A. Mineral Fertilizers.

The goal for production of mineral fertilizers in 1960 has been announced as 19.6 million metric tons, * an increase of 10 million tons over 1955. 16/ It is estimated that the increase in annual production will consist of the following: superphosphate, 5 million tons; nitrogen, 2.7 million tons; phosphorite, 1.3 million tons; and potassium, 1 million tons. ** A comparison of these totals with known construction activity*** furnishes some idea of the extent of information on current construction in this sector of the chemical industry.

1. Superphosphate.

Sources of planned increase in production of superphosphate in the USSR in 1956-60 are shown in Table 1. ****

* Tonnages are given in metric tons throughout this report.

** Based on an estimated product mix for 1954 as follows: superphosphate, 50 percent; nitrogen, 27 percent; potassium, 10 percent; and phosphorite, 13 percent. 17/ At present there is no evidence that the mix will change significantly during the Sixth Five Year Plan.

*** It is probable that not all new fertilizer construction projects have been announced and that capacities for some of the projected plants may have been higher than estimated in Tables 1 and 2 (pp. 8 and 10, respectively, below). Actually, then, the "new facilities" may represent a substantially greater portion of the total than is shown in Tables 1 and 2.

**** Table 1 follows on p. 8.

Table 1

Sources of Planned Increase in Production of Superphosphate
in the USSR
1956-60

| <u>Source</u> | <u>Million Metric Tons</u> <u>Amount of Increase</u> |
|--|---|
| New facilities | |
| Maardu Chemical Combine | 0.25 <u>a/</u> |
| Bobruysk Superphosphate Plant | 0.25 <u>a/</u> |
| Sumgait Superphosphate Plant | 0.25 <u>a/</u> |
| Chardzhou Superphosphate Plant | 0.25 <u>a/</u> |
| Plant in Lithuania | 0.32 <u>b/</u> |
| Total | <u>1.3</u> |
| Expansion of existing facilities, increased efficiency, and other new facilities <u>c/</u> | 3.7 <u>d/</u> |
| Total increase | <u>5.0</u> <u>e/</u> |

a. Capacity was estimated on the basis of recently built plants in Central Asia.

b. 18/

c. Increased efficiency includes use of new technology, automation, and mechanization of production at existing facilities. 19/

d. The announced plan 20/ provides that a production increase resulting from increased efficiency (through better organization of production and use of existing facilities) will amount to 34 percent for ammonia plants, 53 percent for caustic soda plants, and 30 percent for soda plants. There have been no similar announcements for superphosphate plants, but by assuming that 40 percent of the production increase planned will come from increased efficiency, this remaining figure of 3.7 million tons may be further allocated to 2 million tons from increased efficiency and 1.7 million tons from expansion of existing facilities and other new facilities.

e. See A, p. 7, above.

Very little information is available on the substantial expansion which is evidently planned at existing plants, but it is known that 150 million rubles have been allocated for capital investment at Dzhambul Superphosphate Plant No. 193. 21/ On the basis of estimated costs per annual ton, this investment should provide an increase of 300,000 to 400,000 tons of superphosphate.*

2. Nitrogen Fertilizers.

The planned increase in production of nitrogen fertilizers during the Sixth Five Year Plan is estimated at about 2.7 million tons of annual capacity,** of which approximately 300,000 tons should be ammonium sulfate from coke-chemical plants.*** The remaining 2.4 million tons will be principally in the form of ammonium nitrate. Sources of planned increase in production of ammonium nitrate in the USSR in 1956-60 are shown in Table 2.**** Ammonium nitrate is produced from synthetic ammonia at integrated chemical plants. At present, an ammonia plant is under construction at Nevinnomyssk, in Stavropol'skiy Kray, RSFSR, 24/ and construction of another plant is planned at Angren, in Uzbek SSR. 25/ It is probable, however, that this latter plant will not be in production before 1961. The plant at Nevinnomyssk is estimated to be at least the size of the Rustavi plant, which went into partial operation in 1955 with an estimated annual capacity of 30,000 tons of ammonia and 110,000 tons of ammonium nitrate (20.5-percent nitrogen basis). 26/ Thus new facilities, including the Rustavi plant, will account for about 200,000 tons of ammonium nitrate by 1960.

The Sixth Five Year Plan 27/ calls for a 34-percent increase in production of ammonia through better organization of

* For a discussion of capital investment, see p. 35, below.

** See A, p. 7, above.

*** Estimated on the basis of coke production estimates of 43.3 million and 64.1 million tons in 1955 and 1960, respectively, 22/ and an ammonium sulfate factor of 0.013. 23/

**** Table 2 follows on p. 10.

Table 2

Sources of Planned Increase in Production of Ammonium Nitrate
in the USSR
1956-60

Million Metric Tons ^{a/}

| Source | Amount of Increase |
|---|--------------------|
| New facilities | |
| Rustavi Nitrogen Fertilizer Plant | 0.1 |
| Nevinnomyssk | 0.1 |
| Angren | 0.0 |
| Total | 0.2 |
| Expansion of existing facilities | |
| Chirchik Electrochemical Combine | 0.8 (maximum) |
| Unallocated | 0.6 (minimum) |
| Total | 1.4 |
| Increased efficiency | 0.8 |
| Total increase | 2.4 |

a. In terms of 20.5 percent nitrogen content.

production and more efficient use of existing production facilities, and it can be assumed that an increase in ammonium nitrate from this source will be of about the same magnitude, 800,000 tons. The remaining 1.4 million tons probably will be obtained through expansion of existing facilities. The only available report of plans for substantial expansion at the ammonium nitrate plants now operating

appeared in a Soviet press reference to the Chirchik Electrochemical Combine (1955 estimated production: 540,000 tons of ammonium nitrate), where a 153-percent increase in production of mineral fertilizers has been planned for the current Five Year Plan. 28/ Although this planned increase has been completely allocated in Table 2* to "Expansion of existing facilities," it is probable that a substantial portion of it will be accomplished by increased efficiency. To the extent that this is true, planned expansion at plants other than Chirchik will be larger than the 600,000 tons shown.

3. Potassium.

An increase of 1 million tons of annual capacity for production of potassium fertilizer** will require the construction of new facilities. The first of the two planned sections of the Berezniki Potassium Combine was commissioned in 1954. 29/ The construction of the second section probably will be completed during the Sixth Five Year Plan. In addition, construction of a potassium combine at Starobinsk, in the Belorussian SSR, is planned. 30/ A large part of the planned expansion of production could be achieved by this construction program, and the rest could be achieved by production increases from increased efficiency and expansion of existing facilities.

4. Phosphorite-Apatite.

An increase of 5 million tons of superphosphate** will require an increase of 2.6 million to 3 million tons of phosphorite ore and apatite concentrate.*** It is estimated that in addition to the concentrate, 1.3 million tons of phosphorite ore** is included in the mix of the planned fertilizer increase. The total increase in phosphorite ores and apatite concentrates, therefore, is estimated to be about 4 million tons of annual capacity. Construction of new facilities is in progress or is planned at the following locations: Tallinn, Estonian SSR; Marusinsk, Tambovskaya Oblast, RSFSR; and Polpino, Bryanskaya Oblast, RSFSR.**** The production increase

* P. 10, above.

** See A, p. 7, above.

*** The consumption of phosphate ores per ton of superphosphate is 0.588 ton of phosphorite ore or 0.515 ton of apatite concentrate. 31/

**** For plant studies, see Appendix B.

planned from these workings and the production increase planned from increased efficiency and expansion of existing facilities are not known, but it is likely that the planned expansion can be easily achieved.

B. Synthetic Ammonia.

According to the Sixth Five Year Plan, production of synthetic ammonia, which has military and industrial applications in addition to its use in fertilizer manufacture, will increase 87 percent by 1960. 32/ Sources of planned increase in production of synthetic ammonia in the USSR in 1956-60 are shown in Table 3.*

C. Sulfuric Acid.

The Sixth Five Year Plan calls for an increase of 91 percent, 33/ about 3.3 million tons, ** in the production of sulfuric acid. Superphosphate plants are constructed with facilities for the production of sulfuric acid, and it may be estimated that 1.8 million tons of sulfuric acid will be produced at the plants providing the 5-million-ton increase in superphosphate. Sources of planned increase in production of sulfuric acid in the USSR in 1956-60 are shown in Table 4.***

D. Soda Ash and Caustic Soda.

Because construction of new soda ash and caustic soda plants has not been reported, it is probable that the increase in production capacity for these chemicals is planned at existing plants. Sources of planned increase in production of soda ash in the USSR in 1956-60 are shown in Table 5.**** Sources of planned increase in production of caustic soda in the USSR in 1956-60 are shown in Table 6.†

* Table 3 follows on p. 13.

** Estimated production of sulfuric acid in 1955 was 3.62 million tons. 34/

*** Table 4 follows on p. 14.

**** Table 5 follows on p. 15.

† Table 6 follows on p. 16. (Text continued on p. 16)

Table 3

Sources of Planned Increase in Production of Synthetic Ammonia
in the USSR
1956-60

| Source | Amount of Increase |
|--|-------------------------|
| Thousand Metric Tons | |
| New facilities | |
| Rustavi Nitrogen Fertilizer Plant | 30 <u>a/</u> |
| Nevinnomyssk | 30 <u>b/</u> |
| Angren | 0 |
| Total | <u>60</u> |
| Expansion of existing facilities and other new facilities | |
| Chirchik Electrochemical Combine | 220 (maximum) <u>c/</u> |
| Unallocated | 152 (minimum) |
| Total | <u>372</u> |
| Increased efficiency | 223 <u>d/</u> |
| Total increase | <u>655</u> <u>e/</u> |

a. This figure is the estimated planned annual production rate. 35/

b. The planned production capacity at this plant is not known but is estimated to be at least equal to the capacity of the recently built plant at Rustavi.

c. This figure is based on a production estimate of 145,000 tons annually 36/ and a planned increase of 153 percent. 37/

d. This estimate is based on the plan that 34 percent of planned increase in production of ammonia would result from better organization of production and more efficient use of existing production facilities. 38/

e. 1955 production is estimated at 753,000 tons. 39/

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Table 4

Sources of Planned Increase in Production of Sulfuric Acid
in the USSR
1956-60

| Million Metric Tons | |
|---|--------------------|
| Source <u>a/</u> | Amount of Increase |
| New facilities | |
| Maardu Chemical Combine | 0.1 <u>b/</u> |
| Bobruysk Superphosphate Plant | 0.1 <u>b/</u> |
| Sungait Superphosphate Plant | 0.1 <u>b/</u> |
| Chardzhou Superphosphate Plant | 0.1 <u>b/</u> |
| Plant in Lithuania | 0.1 <u>b/</u> |
| Total | <u>0.5</u> |
| Expansion of existing facilities, increased efficiency, and other new facilities <u>c/</u> | |
| | 2.8 |
| Total increase | <u>3.3</u> |

a. For plant studies, see Appendix B.

b. The estimated capacity is based on an approximate requirement of 0.36 tons of sulfuric acid required per ton of superphosphate produced, 40/ and the estimated superphosphate capacity at these plants as derived in A, 1, p. 7, above.

c. This figure includes a 100,000-ton increase at the Dzhabul Superphosphate Plant. The production capacity of sulfuric acid at nonferrous metals industry enterprises is planned to increase 5.2 times during the Sixth Five Year Plan. 41/ A considerable part of the unlocated increase probably will be contributed by this industry.

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Table 5

Sources of Planned Increase in Production of Soda Ash
in the USSR
1956-60

| Thousand Metric Tons | |
|----------------------------------|----------------------|
| Source | Amount of Increase |
| New facilities | 0 |
| Expansion of existing facilities | 686 |
| Increased efficiency | 294 <u>a/</u> |
| Total increase | <u>980</u> <u>b/</u> |

a. The plan 42/ stated that 30 percent of the planned increase in production would result from better organization of production and more efficient use of existing production facilities.

b. The production goal for soda ash in 1960 of 2.42 million tons will require an increase of 980,000 tons, 68 percent above the 1955 production. 43/

Table 6

Sources of Planned Increase in Production of Caustic Soda
in the USSR
1956-60

| Source | Amount of Increase Thousand Metric Tons |
|----------------------------------|--|
| New facilities | 0 |
| Expansion of existing facilities | 205 |
| Increased efficiency | 230 <u>a/</u> |
| Total increase | <u>435 b/</u> |

a. The plan 44/ stated that 53 percent of the planned increase in production would result from better organization of production and more efficient use of existing production facilities.

b. The production goal for caustic soda in 1960 of 1 million tons will require an increase of 435,000 tons, 77 percent above the 1955 production. 45/

E. Synthetic Rubber.

The goal for production of synthetic rubber under the Sixth Five Year Plan is 2.2 times the 1955 production, 46/ an estimated increase of 286,000 tons. 47/ Sources of planned increase in production of synthetic rubber in the USSR in 1956-60 are shown in Table 7.*

F. Artificial Fibers.

The Sixth Five Year Plan sets a production goal of 330,000 tons of artificial fiber in 1960, an increase of 220,000 tons above the indicated 1955 production of 110,000 tons. 48/

* Table 7 follows on p. 17.

Table 7

Sources of Planned Increase in Production of Synthetic Rubber
in the USSR
1956-60

| Thousand Metric Tons | |
|--|--------------------|
| Source | Amount of Increase |
| New facilities | |
| Usol'ye-Sibirskoye | N. A. |
| Chkalov | N. A. |
| Expansion of existing facilities, increased efficiency, and other new facilities | |
| | N. A. |
| Voronezh (expansion) | 26 |
| Total increase <u>a/</u> | <u>286</u> |

a. The part that oil-extended rubber will play in this expansion is not known. Production increases of up to 20 percent could be obtained by the addition of mineral oil to the current production of synthetic rubber, judging from recent successes of the USSR in the preparation of experimental quantities of oil-extended rubber at Voronezh. 49/

Of the 11 artificial fiber plants planned for construction, 7 are planned in the eastern USSR. The production from these 7 plants will permit the manufacture of as much silk fabric as was produced in the entire USSR in 1955. 50/

Artificial fiber plants are planned for construction in the Ukraine at Cherkassy and Chernigov. An artificial silk plant is

planned for construction at Kirovakan, in the Armenian SSR. Neither the size nor ministerial subordination of these plants is known.

G. Others.*

Other construction projects of the Ministry of the Chemical Industry that are in progress or are planned are the following:

| | |
|---|---------------------------|
| Tiflis Plastics Plant, Georgian SSR | -- Polystyrene shop |
| Yerevan Polyvinyl Acetate Plant, Armenian SSR | -- Expansion |
| Chemical Factory, Sumgait, Azerbaijan SSR | -- Expansion |
| Kara Bogas Sulfate Combine, Turkmen SSR | -- Expansion |
| Chemical Works, Dzhambul, Kazakh SSR | -- New plant |
| Plant No. 39, Komsomol'sk, Khabarovskiy Kray, Far East | -- Boric acid shop |
| Chemical Plant, Groznyy, Groznyy Oblast, RSFSR | -- Synthetic alcohol shop |

IV. Cost of New Construction.

An important objective of this report was to derive cost data for new Soviet chemical plants, specifically the cost per annual ton of production. These data have several uses: they provide a means of breaking out the share of investment for the sectors for which planned increases are available, thus giving some measure

* For plant studies, see Appendix B.

of activity in less publicized sectors; in instances where capital investment figures for individual plants are announced in the Soviet press, unit costs are useful in estimating plant capacities; and with the increased pace of the Soviet economic offensive, unit costs are useful in arriving at value aggregates of economic aid to underdeveloped countries.

It was possible to make independent estimates of unit costs for an integrated ammonia plant (which includes facilities for the production of nitric acid and ammonium nitrate), an integrated superphosphate plant (which includes facilities for the production of sulfuric acid), a synthetic rubber plant which uses petroleum gases as the raw material, and a synthetic rubber plant which uses alcohol as the raw material. These plant costs in the USSR, when compared with the estimated costs of comparable plants in the US, indicate a ruble/dollar construction cost ratio of between 9 and 15 to 1. A comparison of costs of construction of selected chemical plants in the USSR and in the US is shown in Table 8.* Also shown in Table 8 are the estimated costs of the component plants of the integrated ammonia plant and the integrated superphosphate plant, based on the distribution of total plant costs estimated for the US.

To obtain some measure of the intelligence coverage of construction activity planned for the Soviet chemical industry during the Sixth Five Year Plan, the unit-cost data were multiplied by planned tonnage increases and compared with an independent estimate of capital investment in the chemical industry. Because the capital cost coefficients were derived from data on new plant construction, this method provides a maximum estimate of capital investment for the sectors covered. The capital cost coefficients will be higher than the coefficients for the expansion of existing facilities or for increased efficiency because of the use of new techniques, automation, and mechanization of processes. A recent US study 51/ on capital coefficients for the chemical industry points out:

* Table 8 follows on p. 20.

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Table 8

**Comparison of Costs of Construction of Selected Chemical Plants
in the USSR and in the US a/**

| <u>Type of Plant</u> | <u>Estimated Soviet Cost b/ (July 1950 Rubles per Ton of Annual Capacity)</u> | <u>Estimated US Cost (1950 Dollars per Ton of Annual Capacity)</u> | <u>Ruble/Dollar Ratio</u> |
|--|---|--|-------------------------------|
| Integrated ammonia | 6,000 | 528 | 11/1 |
| Ammonia | 2,500 | 220 | |
| Nitric acid | 1,700 | 150 | |
| Ammonium nitrate | 148 | 13 | |
| Integrated superphosphate | 400 | 28 | 14/1 |
| Superphosphate | 200 | 14 | |
| Sulfuric acid | 525 | 36 | |
| Synthetic rubber (from petroleum gases) | 10,000 | 1,100 | 9/1 |
| Synthetic rubber (from alcohol) | 7,300 | 500 | 15/1 |

a. For methodology, see Appendix A.

b. The figures include the cost of housing, educational, and other facilities not normally included in the construction costs of plants in the US, but they do not include the interest charge on capital tied up during construction, which is included in the US figures. The cost of housing and other nonproductive facilities included in the Soviet figures probably more than offset the interest charge included in the US figures. The actual ruble/dollar ratio for construction, therefore, may be somewhat lower than indicated.

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Capital requirements will not vary substantially with the proportion of new plants and balanced additions (expansion of existing facilities) in a given expansion. In general, balanced additions may be expected to require approximately the same equipment but slightly smaller construction inputs than new plants Unbalanced additions (increased efficiency) usually involve relatively small equipment purchases for a given addition to capacity since such expansions serve primarily to remove specific bottlenecks. The capital coefficients based on new plants and balanced additions overstate capital requirements for unbalanced additions to an unknown extent.

Insufficient data preclude estimates of capital investment that would reflect the lower capital investment required for production increases planned from increased efficiency.

Estimated planned capital investment in selected sectors of the chemical industry of the USSR in 1956-60 is shown in Table 9.* As shown in Table 9, the planned investment in facilities producing mineral fertilizers, sulfuric acid, ammonia, synthetic rubber, and soda ash is estimated at about one-fourth to one-third of the total planned investment (net) in the chemical industry in the Sixth Five Year Plan. Considering the vast array of chemicals not included in this analysis, the emphasis currently being given by the USSR to these important chemicals becomes clear.

In the US in the past 5 years, at least US \$1 billion** has been estimated as the annual investment for the expansion of plants and facilities in the chemical industry. 52/ Assuming a ruble/dollar construction cost ratio of 12 to 1, the planned net investment in the chemical industry of the USSR in the Sixth Five Year Plan (40 billion to 59 billion rubles) approaches the amount invested in the chemical industry of the US from 1951 to 1955.

* Table 9 follows on p. 22.

** Dollar values are given in 1950 US dollars throughout this report.

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Table 9

Estimated Planned Capital Investment in Selected Sectors
of the Chemical Industry of the USSR a/
1956-60

| Type of Plant | Planned Increase in Production (Million Metric Tons) | Investment (July 1950 Rubles per Ton of Annual Capacity) | Total Invest- ment (Billion July 1950 Rubles) |
|--|---|--|--|
| Mineral fertilizers | | | |
| Superphosphate (integrated) | 5 | 400 | 2.0 <u>b/</u> |
| Ammonium nitrate <u>c/</u> (integrated) | 2.4 | 1,500 | 3.6 <u>b/</u> |
| Ammonium sulfate | 0.3 | N.A. | N.A. |
| Phosphorite <u>d/</u> | 1.3 | N.A. | N.A. |
| Potassium | 1.0 | N.A. | N.A. |
| Total | <u>10.0</u> | | <u>10.0</u> |
| Sulfuric acid | 3.3 | 525 | 1.7 <u>b/ e/</u> |
| Ammonia | 0.655 | 2,500 | 1.6 <u>b/ f/</u> |
| Synthetic rubber | 0.286 | 10,000 | 2.9 <u>b/</u> |
| Soda ash | 0.98 | 756 | 0.7 <u>b/</u> |
| Other <u>g/</u> | | | 26 to 45 |
| Total investment | | | 40 to 59 |

- a. For methodology, see Appendix A.
b. The maximum estimate does not allow for (1) a probable lower investment coefficient for expansion of existing facilities or (2) the part of the production increase planned to come from increased efficiency.
c. 20.5 percent nitrogen content.
d. In addition, 2.6 million to 3 million tons of phosphorite ore and apatite concentrate will be required for the planned increase in production of superphosphate.

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Table 9

Estimated Planned Capital Investment in Selected Sectors
of the Chemical Industry of the USSR
1956-60
(Continued)

-
- e. Approximately 0.9 billion rubles of this total is included in the estimate of 2 billion rubles for the integrated superphosphate plant. It is probable that a part of this investment (1.7 billion rubles) will be made in the nonferrous metallurgy industry, where increases in production of sulfuric acid are planned.
 - f. This investment estimate is included in the estimate of 3.6 billion rubles for the ammonium nitrate plant (integrated).
 - g. This category includes all other chemical products.

V. Location of New Construction.

The policy governing the location of industry in the USSR, as recently indicated by a Soviet authority, 53/ is as follows:

The establishment and development of a rational system of territorial division of labor by means of correct specialization and the comprehensive development of the economies of areas and republics with the object of bringing industry closer to sources of raw material and fuel and to consumer areas, thus effecting the abolition of excessive transportation.

This policy was not rigidly adhered to in the years immediately following World War II. There was a tendency to locate new industrial enterprises in the European part of the USSR, which is rich in manpower but relatively poor in fuel and raw materials. As a result, according to the Soviet authority quoted, industrial production has been somewhat retarded. 54/

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In the Sixth Five Year Plan, however, much attention is devoted to economic factors in locating new industrial enterprises. In the fertilizer industry, particular emphasis is being placed on economic considerations in the location of new plants. The abundant supplies of phosphorite ore, coal, sulfur, and electric power in Kazakhstan and Central Asia will be used further in producing greater quantities of nitrogen and phosphate fertilizers, which -- in turn -- will be applied principally to the nearby cottonfields of Central Asia. Local deposits of phosphorite ore and potassium salts in the Baltic and Belorussian Republics, and in the Central Region, will be used to increase the supplies of mineral fertilizers for consumption in these areas. Construction of a new superphosphate plant is planned at Sumgait, in Azerbaydzhan SSR. 55/ This plant probably will operate, at least partially, on the waste sulfuric acid from the nearby synthetic rubber plant and will deliver its product to local agricultural organs. In the northern Caucasus in Stavropol'skiy Kray a nitrogen fertilizer plant is being built which will use the newly discovered gas deposits in that area. This plant will be the first in the USSR to use natural gas as a source of hydrogen for the production of ammonia. 56/

In the new Plan, almost one-half of all capital investment in new construction is directed to the "eastern areas" of the USSR. 57/ In addition to the construction of chemical plants, principally for the manufacture of fertilizers, in Kazakhstan and Central Asia, expansion of the chemical industry in Irkutskaya Oblast of East Siberia is planned. The reserves of coal and salt in the area will provide the basic raw materials, and the expanding hydroelectric power industry will provide the necessary power. In this area, particularly in the towns of Angarsk and Usol'ye-Sibirskoye, it is planned to construct plants producing synthetic rubber, mineral fertilizers, and salt 58/ and probably to expand facilities for the manufacture of chlorine and caustic soda and other products derived from salt. These products will be consumed by the expanding economy in the area. A new boric acid shop is being constructed at Plant No. 39 in Komsomol'sk, in Khabarovskiy Kray. This shop will process local boron raw materials, which previously were shipped all the way to Latvia for processing. 59/ Current and planned construction projects in the chemical industry of the USSR are shown in Table 10.*

* Table 10 follows on p. 25.

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Table 10

Current and Planned Construction Projects in the Chemical Industry of the USSR
1956

| Location | Name of Plant | Type of Plant |
|-----------------------------------|-------------------------------|--------------------------------|
| West (Economic Region II) | | |
| Tallinn, Estonian SSR | Maardu Chemical Combine | Superphosphate, sulfuric acid |
| Lithuanian SSR | Maardu Phosphorite Plant | Phosphorite |
| Bobruysk, Belorussian SSR | (Unknown) | Superphosphate (320, 000 tons) |
| | Bobruysk Superphosphate Plant | Superphosphate |
| Starobinsk, Belorussian SSR | Starobinsk Potassium Combine | Potassium fertilizer |
| South (Economic Region III) | | |
| Cherkassy, Ukrainian SSR | (Unknown) | Artificial fiber plant |
| Chernigov, Ukrainian SSR | (Unknown) | Artificial fiber plant |
| Southeast (Economic Region IV) | | |
| Nevinnomyssk, Stavropol'skiy Kray | Nitrogen Fertilizer Plant | Ammonia, ammonium nitrate |
| Groznyy, Groznskaya Oblast | Groznyy Chemical Plant | Synthetic alcohol shop |
| Transcaucasus (Economic Region V) | | |
| Sumgait, Azerbaydzhan SSR | Superphosphate Plant | Superphosphate |
| Kirovakan, Armenian SSR | Chemical Factory | (Enlarge) |
| Yerevan, Armenian SSR | Artificial Silk Factory | Acetate silk |
| Tiflis, Georgian SSR | Polyvinyl Acetate Plant | (Enlarge) |
| | Tiflis Plastics Plant | Polystyrene |

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Table 10

Current and Planned Construction Projects in the Chemical Industry of the USSR
1956
(Continued)

| Location | Name of Plant | Type of Plant |
|---|--|---------------------------------------|
| Central Industrial (Economic Region VII) | | |
| Polpino, Bryanskaya Oblast | Polpinskiy Phosphorite Plant | Phosphorite |
| Marusinsk, Tambovskaya Oblast | Marusinsk Phosphorite Mine | Phosphorite |
| Voronezh, Voronezhskaya Oblast | Kirov Synthetic Rubber Plant | Synthetic rubber (expansion) |
| Urals (Economic Region VIII) | | |
| Berezniki, Molotovskaya Oblast | Berezniki Potassium Combine (second section) (Unknown) | Potassium fertilizer |
| Chkalov, Chkalovskaya Oblast | | Synthetic rubber |
| Kazakhstan and Central Asia (Economic Region X) | | |
| Dzhambul, Kazakh SSR | Dzhambul Superphosphate Plant | New fertilizer shop |
| Kara Bogaz Gol, Turkmen SSR | Chemical Works Kara Bogaz Sulfate Combine | (Unknown) Sodium sulfate |
| Chardzhou, Turkmen SSR | Chardzhou Superphosphate Plant | Superphosphate |
| Angren, Uzbek SSR | Nitrate Fertilizer Plant | Ammonia, ammonium nitrate |
| Chirchik, Uzbek SSR | Chirchik Electrochemical Combine | Ammonia, ammonium nitrate (expansion) |

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Table 10

Current and Planned Construction Projects in the Chemical Industry of the USSR
1956
(Continued)

| Location | Name of Plant | Type of Plant |
|--|------------------------|-----------------------------------|
| East Siberia (Economic Region XI) | Chemical Combine No. 1 | Synthetic rubber |
| Usol'ye-Sibirskoye, Irkutskaya Oblast, RSFSR | (Unknown) | Mineral fertilizer |
| Irkutskaya Oblast, RSFSR | Plant No. 97 | Caustic soda-chlorine (expansion) |
| Usol'ye-Sibirskoye, Irkutskaya Oblast, RSFSR | | |
| Far East (Economic Region XII) | | |
| Komsomol'sk, Khabarovskiy Kray | Plant No. 39 | Boric acid shop |

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VI. Construction Problems.

Probably the most striking feature of the postwar construction program in the Soviet chemical industry has been the exceedingly long periods of time required for the construction of chemical plants. Judging from the available data, construction periods in the USSR are at least triple those in the US. Prolonged construction periods have resulted from a dispersal of available material and financial resources simultaneously among many building sites instead of concentrating the available resources on a few projects at a time. The construction program has been too ambitious for the resources available. The construction time required for selected superphosphate plants in the USSR in selected years, 1947-57, is shown in Table 11.

Table 11

Construction Time Required for Selected Superphosphate Plants
in the USSR a/
Selected Years, 1947-57

| <u>Location</u> | <u>Capacity (Thousand Metric Tons)</u> | <u>Year of Completion</u> | <u>Period of Construction (Years)</u> |
|------------------------|--|-------------------------------|---|
| Alaverdi, Armenian SSR | 15 | 1947 | 3 |
| Dzhambul, Kazakh SSR | 200 to 250 | 1950 | 3 |
| Chardzhou, Turkmen SSR | 200 to 250 | 1957 (Plan) | 6 |
| Samarkand, Uzbek SSR | 200 to 250 | 1955 | 8 |
| Maardu, Estonian SSR | N.A. | 1956 | 8 |

a. For plant studies, see Appendix B.

In the US a superphosphate plant with an annual capacity of 200,000 tons is currently planned for completion in 18 months. 60/

Other examples of prolonged construction periods are evident in the Soviet nitrogen industry. The integrated ammonia - nitric acid - ammonium nitrate plants built since World War II at Kirovakan and Rustavi -- both relatively small -- required approximately 6 years for construction. Likewise, the time required to construct the plant at Lisichansk -- estimated to be about triple the size of the other new nitrogen plants -- probably was about 6 or 7 years. By comparison, the time required in the US for construction of integrated ammonia plants is generally about 18 months or less. In one recent US project, construction time of an integrated plant with an annual capacity of 70,000 tons of ammonia was cut to 8 months. 61/

Similarly, in the construction of Soviet synthetic rubber plants such as those at Sumgait, Krasnoyarsk, and Temir-Tau, the time required has been about 5 or 6 years.

Conclusions on the relative efficiency of the Soviet construction industry cannot be based directly, however, on the obvious disparity in construction periods between the USSR and the US. The ruble/dollar ratios (1950) for cost per ton of annual capacity appear to range from about 9 to 15,* more or less normal for relative industrial prices in general. This would indicate that the slow pace of Soviet construction work in the chemical industry has not resulted in inordinately high costs.**

Long periods of construction have not been unique to chemical plants; Soviet industry in general has required prolonged periods for the construction of new facilities. A recent announcement 62/ of the establishment of time norms for various types of construction indicates a Soviet effort to cope with this problem.

* For methodology, see Appendix A.
** Other factors that affect the real cost of construction and relative plant costs include (1) relative quality of construction, (2) relative type of construction as dictated by extremes of climate, (3) inclusion of housing and other nonproductive facilities in the Soviet plant costs, and (4) the exclusion of interest charges on capital tied up during the construction period in the USSR.

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Shortages of materials, manpower, and financial resources, stemming partially from the diffusion of resources, have been apparent in construction projects of the chemical industry. Materials used in the construction projects that have appeared to be in short supply in the postwar period have included cement, lumber, round timber, stainless steel welding rods, rolled lead, lead pipe, high-pressure fittings (ammonia), electrical equipment and cable products, and compensating wire and control cable for control and measuring instruments. Armored cable and wire for electric power lines have been reported in short supply at several of the construction projects, and these reports may indicate a general shortage of copper products available for construction in the USSR.*

During the postwar period, poor organization of labor has delayed construction work in the Soviet chemical industry. Efforts to cope with this problem are indicated by the many reorganizations in governmental administration of construction in recent years.

The shortage of manpower has also been a factor in prolonging periods of construction in the eastern USSR. In the Irkutsk area of East Siberia, there were manpower shortages in 1953, 1954, and 1955. 65/

VII. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

The USSR has demonstrated that it is capable of designing and constructing operational chemical plants of most types, but certain weaknesses have been observed. The first of these weaknesses appears to be an inability to design and construct certain

* The Fifth Five Year Plan announced a 53-percent increase 63/ in the production of refined copper, which reflects a marked under-fulfillment of the planned goal of 90 percent. 64/ Evidence of a shortage of copper is indicated by large imports of copper from non-Bloc sources in recent years.

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plants employing technologically advanced processes -- plants, for example, to produce some new types of plastics and petrochemicals. Another outstanding weakness has been the inability to complete construction of chemical projects within prescribed time limits. The first of these weaknesses probably is the result of insufficient research and development work in the subject fields, and the second has been the result primarily of a diffusion of the available resources over too many building sites. It is probable that in the next few years this latter weakness will be largely overcome. If the directives on capital construction in the Sixth Five Year Plan are carried out, capital investments will no longer be dispersed over a wide range of construction projects, building operations will be further mechanized, and other measures will be taken to accelerate construction. 66/ Continued efforts on the part of the USSR to obtain information on the latest chemical developments in foreign countries will lead to an improved capability for the design and construction of new types of chemical plants, but the Soviet weakness in such design and construction will not be eliminated until a more extensive practical research and development program is undertaken. In summation, it appears that over the next few years Soviet capability for the construction of conventional chemical plants will be significantly improved, whereas the capability for construction of new types of chemical plants probably will be only moderately improved.

B. Vulnerabilities.

One of the purposes of this report was to obtain, insofar as possible, information about recurring shortages of materials and equipment in the construction program for the Soviet chemical industry so that such information might be collated with evidences of bottlenecks in construction in other industries, with production data for the items in short supply, and with the foreign trade situation. The items observed to be in short supply are copper wire, armored cable, and construction materials.* A denial of these materials -- especially copper wire, for which demand apparently exceeds current supply -- probably would interfere with the construction effort.

* For plant studies, see Appendix B.

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C. Intentions.

The construction program in the Soviet chemical industry, from an over-all, long-term point of view, is not a good general indicator of intentions. In general the plants that produce materials in peacetime turn out essential materials in wartime. During the postwar period, great emphasis has been placed on the construction of plants for the production of mineral fertilizers. These are the same plants that produce ammonia, nitric acid, ammonium nitrate, and sulfuric acid -- basic requirements for a war effort. Besides providing materials used in uranium processing, the peacetime consumer-oriented program also provides for exploitation of phosphorite ore deposits, a possible future source of uranium.

It is in an analysis of short-term trends, however, that real indicators of intentions might be forthcoming from an analysis of the Soviet construction program. The preparations for an all-out war effort probably would result in an intensive effort to complete projects which are under way and to stop the initiation of new projects.* In addition, there might be subtle shifts in the construction program such as increased emphasis on the completion of essential projects (for example, nitrogen plants) and a curtailment, or abandonment, of those projects considered to be less essential (for example, superphosphate and potassium fertilizer plants). There are no indicators of preparations for hostilities in the Soviet chemical construction program which is currently in progress or planned.

* For a discussion of the intelligence significance of capital investment and construction, see the account of the shifts in the Soviet construction program in the years immediately before World War II. 67/

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APPENDIX A

METHODOLOGY

A. Estimate of Total Capital Investment in the Soviet Chemical Industry During the Sixth Five Year Plan.

Capital investment in the Soviet chemical industry during the Fifth Five Year Plan has been estimated at 31.5 billion (July 1950) rubles. 68/ Pervukhin, First Deputy Premier of the USSR, stated that investment in the chemical industry in the Sixth Five Year Plan would be two and one-half times that in the Fifth Five Year Plan, 69/ thus giving an estimate of 79 billion rubles. This total includes a share for the replacement of wornout and obsolete equipment. On the basis of available data, 70/ replacement is estimated to represent 25 to 50 percent of the total, giving a figure of 40 billion to 59 billion rubles for net (new) investment.

B. Estimate of Investment Required.

1. Mineral Fertilizers.

Tikhomirov, the Soviet Minister of the Chemical Industry, has stated that in order to fulfill the expansion planned for production of mineral fertilizers (20 million to 22 million tons more in 1964 than in 1954) an investment of not less than 20 billion rubles would be required for the construction of enterprises. 71/ This statement indicates that an investment of about 1,000 rubles per annual ton of mineral fertilizer (in the mix planned) is required.

2. Ammonia, Nitric Acid, and Ammonium Nitrate.

The investment required for an ammonia plant, with facilities for the production of nitric acid and ammonium nitrate and using coke oven gas as a source of hydrogen, has been estimated at 6,000 (July 1950) rubles per annual ton of ammonia for

the plant at Ristavi, which has an annual production of 30,000 tons of ammonia.* The estimate of 6,000 rubles is equivalent to 1,500 rubles per annual ton of nitrogen fertilizer (20.5 percent nitrogen content).

In the US in 1950, costs of chemical plants were estimated as follows 72/: synthetic ammonia, \$220 per annual ton; synthetic nitric acid, \$150 per annual ton; and ammonium nitrate, \$13 per annual ton. These costs were used to estimate the cost of an integrated ammonia plant in the US producing 30,000 tons of ammonia, 55,600 tons of nitric acid,** and 70,000 tons of ammonium nitrate** annually:

| | | |
|-------------------------|------------------------|-------------|
| Synthetic ammonia plant | 30,000 tons at \$220 = | \$6,600,000 |
| Nitric acid plant | 55,600 tons at \$150 = | \$8,340,000 |
| Ammonium nitrate plant | 70,000 tons at \$13 = | \$910,000 |

The total cost is estimated at \$15,850,000, about \$528 per annual ton of ammonia. The ruble/dollar construction cost ratio is, therefore, about 11 to 1.

By assuming that the distribution of the total plant costs of an integrated ammonia plant in the USSR among the component plants (for the production of ammonia, nitric acid, and ammonium nitrate) is the same as that derived for the US, the construction costs per annual ton for an ammonia plant is estimated to be 2,500 rubles; for a nitric acid plant (synthetic), 1,700 rubles; and for an ammonium nitrate plant, 148 rubles.

C. Synthetic Rubber.

The capital investment required for a synthetic rubber plant using petroleum gas as the raw material has been estimated at 10,000 (July 1950) rubles per annual ton for the plant at Sumgait.*

* For the plant study, see Appendix B.

** These tonnages are the theoretical amounts that would be produced in an integrated ammonia plant producing 30,000 tons of ammonia annually.

In the US in 1950 the cost of a plant producing synthetic rubber varied from \$500 per annual ton when alcohol was the raw material to \$1,100 per annual ton when butane was the raw material. 73/ Because the plant at Sumgait uses petroleum gases as a raw material, the greater US cost is used for comparison and indicates a ruble/dollar construction cost ratio of about 9 to 1.

A very rough estimate of the plant costs of a synthetic rubber plant using alcohol as the raw material may be made as follows: the 2 synthetic rubber plants at Yaroslavl' and Kazan, which use alcohol as the raw material, were planned to produce 10,000 tons annually and to cost 62,780,000 rubles and 56,140,000 rubles, respectively. 74/ Converting these costs, presumably of 1935, to July 1950 investment rubles by means of the unit-cost index 75/ provides an estimated cost of 76,800,000 rubles for the Yaroslavl' plant and 68,700,000 rubles for the Kazan plants. These estimates provide a construction cost estimate of 6,900 to 7,700 rubles per annual ton of synthetic rubber produced from alcohol. When this cost is compared with the corresponding US cost of \$500 per annual ton, the ruble/dollar construction cost ratio is about 15 to 1.

D. Superphosphate and Sulfuric Acid.

An estimate of 400 (July 1950) rubles per annual ton of superphosphate has been made for the plant at Dzhambul.* This estimate includes the cost of facilities for the annual production of about 75,000 tons of sulfuric acid.

In the US in 1950 the plant cost of a sulfuric acid plant using pyrites as a raw material was \$36 per annual ton, and the cost of a superphosphate plant was \$14 per annual ton. 76/ To obtain US plant costs comparable to the Soviet plant cost, these factors were used as follows:

| | | |
|----------------------|------------------------|-------------|
| Sulfuric acid plant | 75,000 tons at \$36 = | \$2,700,000 |
| Superphosphate plant | 200,000 tons at \$14 = | \$2,800,000 |

* For the plant study, see Appendix B.

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The total cost of a comparable plant in the US is, therefore, estimated to be \$5,500,000, indicating a cost of \$27.50 per annual ton and a ruble/dollar construction cost ratio of about 14 to 1. By assuming that the component plant costs in the USSR are similar to those in the US, an estimate of sulfuric acid plant costs of 525 rubles per annual ton and for superphosphate of 200 rubles per annual ton is made.

E. Soda Ash.

The reported US plant cost of \$63 per annual ton of soda ash 77/ was used together with a ruble/dollar construction cost ratio of 12 to 1* to provide the estimated plant cost of 756 rubles per annual ton of soda ash.

* The ruble/dollar ratios used in the preceding sections have varied from 9 to 1 to 15 to 1.

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APPENDIX B

PLANT STUDIES

1. Plant Name: Maardu Chemical Combine.
 - a. Location: Tallian, Estonian SSR, Economic Region* Ila (Baltic) (59°26' N - 24°44' E)
 - b. Construction: Phosphorite is produced at the mines of the Maardu Chemical Combine. Construction of the superphosphate plant began in 1948, 78/ and a sulfuric acid plant probably was planned for construction along with the superphosphate plant. The sulfuric acid plant started operations in October 1955, 79/ and the superphosphate plant is now planned to be commissioned in 1956. 80/ In addition, construction of a new phosphorite plant was planned to be started in the latter part of 1955 to be one and one-half times larger than the existing phosphorite plant. 81/ Construction at this combine has included the superphosphate shop, housing for workers, communications, and auxiliary service. 82/
 - c. Construction Difficulties: In November 1955 a newspaper report in Sovetskaya Estoniya stated that construction was being carried out unsatisfactorily and that organization of labor at the construction site had been poor. 83/ The "Punane Kunda" Cement Plant was supplying cement to the combine irregularly, another cause of the delay in the completion of the superphosphate section. 84/
2. Plant Name: Unknown.
 - a. Location: Lithuanian SSR, Economic Region Ila (Baltic)

* The term economic region refers to the economic regions defined and numbered on CIA Map 13702 (4-55), USSR: Administrative Divisions and Economic Regions, January 1955.

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- b. Construction: The construction of a second superphosphate plant in the Lithuanian SSR was planned as early as 1951, and again in 1954 a statement was made that a superphosphate plant was to be constructed with an annual capacity of 320,000 tons of superphosphate. Recently it has been proposed that construction of this plant would start in 1956. 86/
3. Plant Name: Bobruysk Superphosphate Plant.
- a. Location: Bobruysk, Belorussian SSR, Economic Region IIb (Belorussia) (53°08' N - 29°13' E)
- b. Construction: Construction of a superphosphate plant at Bobruysk was planned, and the Minister of the Chemical Industry was instructed to speed up the implementation of the government decree for the construction in the early part of 1955. 87/ There is no further information on the status of this new construction.
4. Plant Name: Starobinsk Potassium Combine.
- a. Location: Starobinsk, Belorussian SSR, Economic Region IIb (Belorussia) (52°44' N - 27°27' E)
- b. Construction: In 1955 a request was made to the Minister of the Chemical Industry to speed up implementation of the government decree for the construction of the Starobinsk Potassium Combine. 88/ One report 89/ states that construction of "the potassium combine in Belorussia" -- possibly the one at Starobinsk -- was not provided for in the Sixth Five Year Plan. There has been no further information on the status of this project.

5. Plant Name: Cherkassy Artificial Fiber Plant.
- a. Location: Cherkassy, Ukrainian SSR, Economic Region III (South) (49°26' N - 32°06' E)
- b. Construction: Kirchenko, the first secretary of the Central Committee of the Ukrainian Communist Party, stated that it was necessary to construct artificial fiber plants in Cherkassy during the Sixth Five Year Plan. 90/
6. Plant Name: Synthetic Alcohol and Rubber Plant.
- a. Location: Kadiyevka, Voroshilovgradskaya Oblast, Ukrainian SSR, Economic Region III (South)(48°33' N - 38°38' E)
- b. Construction: This plant was reported to be under construction in 1947, 91/ and the synthetic alcohol and rubber plant was reported in operation in 1955. 92/
7. Plant Name: Chernigov Artificial Fiber Plant.
- a. Location: Chernigov, Ukrainian SSR, Economic Region III (South) (51°29' N - 31°18' E)
- b. Construction: An artificial fiber plant is planned to be constructed at Chernigov during the Sixth Five Year Plan. 93/
8. Plant Name: Lisichansk Chemical Combine.
- a. Location: Severo Donetsk, Voroshilovgradskaya Oblast, Ukrainian SSR, Economic Region III (South) (48°56'30" N - 38°28' E)
- b. Construction: The Lisichansk Chemical Construction Organization* was concerned with construction of the

* This organization probably is subordinate to the Ministry of the Chemical Industry.

nitrogen plant at Severo Donetsk in 1947 and 1948. 94/ Equipment for this plant was taken from the Leuna works in East Germany after World War II and re-assembled with an estimated annual production capacity of 127,000 tons of synthetic ammonia. 95/ The first evidence of a shipment of ammonium nitrate from this plant was in May 1951. 96/

- c. Construction-Planning Organizations: The Lisichansk Chemical Construction Organization, subordinate to the Ministry of the Chemical Industry.

9. Plant Name: Sumy Superphosphate Plant.

- a. Location: Sumy, Sumskaya Oblast, Ukrainian SSR, Economic Region III (South) (50°55' N - 34°47' E)
- b. Construction: Little is known of the construction activity at this plant, but the production of sulfuric acid is known to have begun in 1954, 97/ and a report of 1956 98/ stated that the superphosphate plant had been commissioned.

10. Plant Name: Groznyy Chemical Plant.

- a. Location: Groznyy, Groznen'skaya Oblast, Economic Region IV (Southeast) (43°20' N - 45°42' E)
- b. Construction: The State All-Union Planning Institute No. 3 (GSPI-3) has been active at this location since 1948. 99/ A statement in March 1956 that the first section of this plant was completed 2 years ago 100/ indicates that construction of the first section was completed sometime in 1954. This plant uses petroleum refinery waste gases and produces phenol and acetone and will soon produce ethyl alcohol. 101/ The planned increase in production

at this plant in the Sixth Five Year Plan is 8.5 times the present production. This article also states that when the plant is completely built it will be able to free 40 million poods* of grain per year. This amount of grain could produce about 28 million decaliters, 74 million gallons, of alcohol per year.

- c. Construction-Planning Organizations: GSPI -3 has been active at this plant. In the Fifth Five Year Plan the Ministry of the Chemical Industry created a special construction organization in Grozny. 102/ The Chief Directorate for Construction and Assembly of Enterprises of the Chemical Industry has been active here. 103/

- d. Construction Difficulties: The supply of industrial materials for construction was proceeding slowly, and the rate of completion of construction in 1955 was only 70 percent of that achieved in 1953. With more attention from the Ministry of the Chemical Industry, it would be possible to put into operation in 1956 several shops for the production of alcohol. 104/ A claim was made to the machine constructors to provide modern techniques to the petrochemical industry -- gas distributors of both adsorption and condensing types, refrigerators of greater productivity, more productive gas compressors, and others. 105/

11. Plant Name: Nevinomyssk Nitrogen Fertilizer Plant.

- a. Location: Nevinomyssk, Stavropol'skiy Kray, RSFSR, Economic Region IV (Southeast) (44°38' N - 41°57' E)

- b. Construction: Prospects for industrial development of Stavropol'skiy Kray are now great, a result of the discovery of gas deposits. A large nitrate fertilizer

* One pood equals 36.113 pounds.

~~TOP SECRET~~

plant which will use local natural gases is now under construction. For the first time in the USSR, natural gas will be used as the raw material for the production of fertilizers and other chemicals. 106/

Nevinnomyssk was reported to be the site for construction of this plant, 107/ and this report is confirmed

- c. Construction-Planning Organizations: Stavropol' Chemical Construction Trust, 109/ probably subordinate to the Ministry of the Chemical Industry.

12. Plant Name: Alaverdi Chemical Plant.

a. Location: Alaverdi, Armenian SSR, Economic Region V (Transcaucasus) (42°02' N - 45°23' E)

b. Construction: Sulfuric acid and copper sulfate were produced at this plant before World War II. During the Fourth Five Year Plan the plant was to be expanded and new shops constructed. The total capital investment during this period was planned to amount to 10 million to 12 million rubles. The sulfuric acid shop was planned to be increased 3 times and the copper sulfate shop 2.5 times, with stated production goals in 1950 of 15,000 tons of superphosphate, 90,000 tons of sulfuric acid, and 10,000 tons of copper sulfate. 110/ Actually, construction of the superphosphate plant was started in April 1944, and production started in May 1947. 111/ Production of sodium silicofluoride was begun in 1947.

~~TOP SECRET~~

In 1951 a granulating shop was planned for superphosphate, 112/ in 1953 the loading operations were mechanized, and the continuous production of superphosphate was planned for 1954. 113/ Ammoniated superphosphate was planned in 1953, but there is no evidence of production. 114/

c.

13. Plant Name: Kirovakan Artificial Silk Plant.

- a. Location: Kirovakan, Armenian SSR, Economic Region V (Transcaucasus) (40°48' N - 44°30' E)
- b. Construction: An artificial silk plant is planned to be commissioned in 1959 in Kirovakan. 116/ Little more is known about this plant to be constructed. The Kirovakan Chemical Combine imeni Myasnikan is in the area and probably could provide some of the required raw materials. In the Armenian Plan the construction of a shop for the production of acetate silk was probably this installation. 117/

14. Plant Name: Kirovakan Electrochemical Combine.

- a. Location: Kirovakan, Armenian SSR, Economic Region V (Transcaucasus) (40°48'56" N - 44°28'06" E)
- b. Construction: Construction of this ammonia plant based on electrolytic hydrogen began in 1946, 118/ and production of ammonium nitrate was begun in the first part of 1952. 119/

- c. Construction-Planning Organizations: GIAP and Giprokhim have been active in the design and planning activities at this plant.

The Armenian Chemical Industry Construction Trust was active in the construction of buildings and shops. 120/ Other construction organizations were Azotstroy (Nitrogen Construction) and Montshest (Assembly 6) 121/ subordinate to the Ministry of the Chemical Industry.

- d. Construction Difficulties: Construction of this plant, planned for completion in 1949, fell behind schedule because of a lack of equipment, manpower, and funds. 122/ In 1950, shortages of round timber and lumber, 123/ high pressure fittings, and overhead cranes

15. Plant Name: Kirovakan Chemical Combine imeni Myasnikyan.

- a. Location: Kirovakan, Armenian SSR, Economic Region V (Transcaucasus) (40°48' N - 44°30' E)
- b. Construction: A 50-percent increase in the capacity of the carbide furnaces was planned for 1956 by reconstructing the current transformers in the shop. 125/

16. Plant Name: Polyvinyl Acetate Plant.

- a. Location: Yerevan, Armenian SSR, Economic Region V (Transcaucasus) (40°11' N - 44°30' E)
- b. Construction: This plant was under construction during the Fourth Five Year Plan, and the planned capacities of the shop were in operation by the end of 1951. 126/

During 1952 the production capacity of the principal shops was exceeded by 50 percent, 127/ and it appears that construction was not complete until 1952.

The Polyvinyl Acetate Plant is planned to be enlarged and reconstructed during the Sixth Five Year Plan. 128/ []

[]

17. Plant Name: Sumgait Superphosphate Plant.

a. Location: Sumgait, Azerbaydzhan SSR, Economic Region V (Transcaucasus) (40°33' N - 49°37' E)

b. Construction: []

[]

It is planned to commission the Sumgait Superphosphate Plant during the Sixth Five Year Plan. 131/ There is no evidence of actual construction at this plant.

18. Plant Name: Sumgait Synthetic Rubber Plant SK-7.

a. Location: Sumgait, Azerbaydzhan SSR, Economic Region V (Transcaucasus) (40°33' N - 49°37' E)

b. Construction: []

[]
[] surveying work was in the preliminary state at Sumgait in August 1947. 132/ This plant, designed to produce synthetic rubber based on petroleum gases, started operations in July 1952. 133/

- c. Construction-Planning Organizations: Before 1953 the chief contractor for this construction was the Transcaucasus Industrial Construction Trust of the Chief Directorate of Southern Construction of the Ministry of Construction of Heavy Industry Enterprises. * 134/ Giprokauchuk has been active in the planning operations.
- d. Capital Investments: The volume of capital investment reported for 152 days of 1949 at the Sumgait Synthetic Rubber Plant was 12,336,000 rubles. 135/ This figure indicates an approximate rate of 29,600,000 rubles for 1949.

By assuming that the volume of work completed at this plant in 1949 approximated the annual average of the work completed for the 5-year period of construction, 150 million rubles were required for the construction of this plant. By using the reported butadiene capacity planned of 12,000 tons per year, an investment of 12,500 (1949) rubles or 10,000 (July 1950 rubles** per annual ton of butadiene (from petroleum sources) production capacity is obtained.

- e. Construction Difficulties: Assembly work was delayed in 1950 because of a lack of rolled lead, lead pipe, steel tubes, electrical equipment, and cable products. 137/

* In March 1953 the Ministry of Construction of Heavy Industry Enterprises and the Ministry of Construction of Machine Building Enterprises were combined into a single ministry -- the Ministry of Construction -- which was reorganized in April 1954 into two ministries -- the Ministry of Construction and the Ministry of Construction of Metallurgical and Chemical Industry Enterprises.

** Converted by using the index derived in another report. 136/

19. Plant Name: Rustavi Nitrogen Plant.

- a. Location: Rustavi, Georgian SSR, Economic Region V
(Transcaucasus) (41°33' N - 45°03' E)
- b. Construction: Construction work at Rustavi was first indicated in 1948, 138/ and production started in 1955. 139/ Construction of this plant to produce 70,000 tons of fertilizer annually and to cost about 150 million rubles was proposed at a meeting of the Supreme Soviet in 1946. 140/ The production of this plant is estimated to be about 30,000 tons of ammonia yearly.
- c. Construction-Planning Organizations: GIAP was active in the planning. Construction operations were conducted by the Ministry of Construction of Heavy Industry Enterprises in 1950 and recently by the Ministry of Construction of Metallurgical and Chemical Industry Enterprises.*
- d. Capital Investments: The construction costs of this plant designed to produce 70,000 tons of fertilizer (ammonium nitrate), equal to an annual production of 30,000 tons of ammonia, were estimated to be 150 million rubles in 1946. The planned cost per annual ton of ammonia capacity is therefore estimated to be 5,000 (1945) rubles or 6,000 (July 1950) rubles per annual ton** for this plant, which was designed to produce ammonia, ammonium nitrate, and nitric acid by using hydrogen from the waste gases of the nearby Transcaucasus Metallurgical Plant. By averaging the reported figures*** for capital construction (1949 through 1953) and by assuming that these rates continued for the unreported months of the respective years, annual capital construction costs and housing construction costs for these years may be estimated as follows:

* See the footnote on p. 46, above.

** Converted by use of an index derived in another report. 141/

| <u>Year</u> | <u>Capital Construction Cost (Thousand Rubles)</u> | <u>Housing Construction Cost (Thousand Rubles)</u> |
|-------------|--|--|
| 1949 | 9,240 | 4,872 |
| 1950 | 12,612 | 9,240 |
| 1951 | 22,212 | 9,600 |
| 1952 | 25,020 | 9,168 |
| 1953 | 32,500 | 4,200 |

Detailed information on the total capital construction costs for 1954 or 1955 are not available, but from the estimate of construction costs from 1949 through 1953, it appears that the original estimate of 150 million rubles required for the construction of this plant was realistic. Construction costs for housing amounted to an estimated 37 percent of the total capital construction costs during the years covered.

- e. Construction Difficulties: In 1954 a serious manpower shortage was reported at this plant. 142/ A shortage of stainless steel welding rods was reported in 1954, 143/ and this shortage caused delay in the installation of the absorption towers. A shortage of engineering-technical workers in the Caucasus Electrical Installation Trust working on the Rustavi Nitrogen Fertilizer Plant in 1954 led to rejection of completed work, work stoppages, and a disruption of the deadlines for putting ob'yekts into operation. 144/

20. Plant Name: Tiflis Plastics Plant.

- a. Location: Tiflis, Georgian SSR, Economic Region V (Transcaucasus) (41°42' N - 44°45' E)
- b. Construction: This plant, which started production in 1948, has remained a processing plant up to the present time and has had no chemical or raw material

shop. Molding powders have been received from other sources. During the Sixth Five Year Plan the activities of this plant will be expanded, and a chemical section will be added to the processing shop. It is planned to produce polystyrene and a high-quality plastic raw material, and with the addition of more equipment it is planned to increase production from this plant in 1960 to 6 times the 1955 level. 145/

- c. Capital Investments: Forty-three million rubles have been assigned for the installment of new machines and development of industrial space, and 8 million rubles have been assigned for workers' living quarters. 146/

21. Plant Name: Kirov Synthetic Rubber Plant SK-2.

- a. Location: Voronezh, Voronezhskaya Oblast, Economic Region VII (Central) (51°40' N - 39°12' E)
- b. Construction: The old synthetic rubber plant was reconstructed during the Fourth Five Year Plan, and the construction of a new section was started in the early part of 1948. 147/ The estimated 1955 production rate of 53,000 tons of synthetic rubber 148/ and a recent announcement 149/ by the director of the works that by the end of the Sixth Five Year Plan the production of rubber will increase to nearly 1.5 times the 1955 production provide an estimated planned increase in production at this plant of about 27,000 tons.

22. Plant Name: Marusinskiy Phosphorite Mine.

- a. Location: Marusinsk, Tambovskaya Oblast, Economic Region VII (Central)
- b. Construction: In 1954 the Council of Ministers, RSFSR, ordered the Ministry of Local Industry, RSFSR, to construct a mine with a grinding shop at the Marusinskiy phosphorite deposit. The Minister of Local Industry, RSFSR, issued an order for

the Industrial Administration of the Central Regions to undertake the construction during the 1955-59 period. 150/

23. Plant Name: Polpinskiy Phosphorite Plant.

- a. Location: Polpino, Bryanskaya Oblast, Economic Region VII (Central) (53°15' N - 34°20' E)
- b. Construction: A large new plant was planned to be constructed in the Bryanskaya Oblast in the Fourth Five Year Plan, 151/ but the new plant, a concentration factory, and a planned production rate five times that of the plant that was here before World War II, was not completed until the latter part of 1955. 152/ In 1956 a phosphorite flour mill is planned to be commissioned in Bryanskaya Oblast and probably is a part of this plant. 153/

24. Plant Name: Berezniki Potassium Combine.

- a. Location: Berezniki, Economic Region VIII (Urals) (59°25' N - 56°45' E)
- b. Construction: The Fourth Five Year Plan provided for the construction of a second potassium salt combine at Berezniki, 30 Kilometers (km) south of Solikamsk, with a capacity twice as large as that of Solikamsk and planned to be the largest potassium salt combine in the USSR and in the world. The new combine was planned to be built in two parts, the first section to start operations at the end of the Fourth Five Year Plan. 154/ It was not until October 1954, however, that the first section of this combine was commissioned. 155/ It is not known whether or not the second section is under construction.

25. Plant Name: Unknown.

- a. Location: Chkalov, Chkalovskaya Oblast, Economic Region VIII (Urals) (51°45' N - 55°06' E)
- b. Construction: One report has referred to the construction of a synthetic rubber plant on the outskirts of Chkalov. 156/ No further information is available on this plant.

26. Plant Name: Krasnoural'skiy Chemical Works.

- a. Location: Krasnoural'sk, Economic Region VIII (Urals) (58°20' N - 60°03' E)
- b. Construction: The first plant for the production of double superphosphate was planned for construction at this plant during the Fourth Five Year Plan. Sulfuric acid that was already produced at this plant was to be used in the process. 157/ It was not until 1954, however, that the production of superphosphate was mastered at this plant. 158/

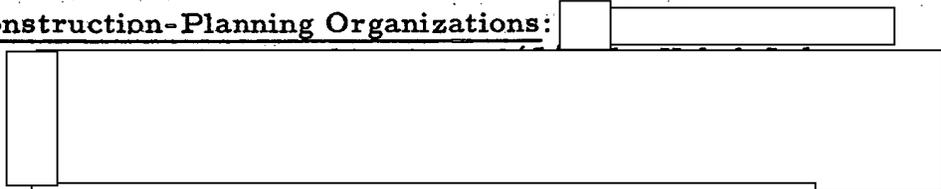
27. Plant Name: Dzhambul Superphosphate Plant No. 193.

- a. Location: Dzhambul, Kazakh SSR, Economic Region Xa (Kazakhstan) (42°55' N - 71°23' E)
- b. Construction: This plant was planned for construction during the Fourth Five Year Plan. Construction of the works started in 1947, 159/ and production began in 1950. 160/ Production may be estimated at 180,000 tons of superphosphate in 1953. 161/ In 1953 there was a report that the production of ammoniated superphosphate was mastered. 162/ This report probably referred to an experimental installation, for there has been no evidence of production of this material. In 1954 a new shop was added for the granulation of superphosphate. 163/ In 1955, reconstruction of main



production shops and construction of chambers for continuous production of superphosphate were begun. In 1956, construction of a special shop for the production of a new, highly concentrated type of fertilizer is to be started. 164/ This shop may be one for producing ammoniated superphosphate.

c. Construction-Planning Organizations:



in 1955 the second section was reported to be completed. 168/

d. Capital Investments:



the total investment required for this plant is therefore estimated to have been about 100 million (1949) rubles or 80 million (July 1950) rubles.* The planned capacity of this plant probably was about 200,000 tons of superphosphate with accompanying production of 75,000 tons of sulfuric acid required for this production,** and it therefore may be estimated that about 400 rubles of investment was required per annual ton of superphosphate. The state allocated 150 million rubles for the further expansion of the enterprise, for the purchase of modern equipment and machinery, and for cultural and communal equipment. 172/

* Conversion was based on an index derived in another report. 170/

** A ton of superphosphate requires about 0.37 ton of sulfuric acid if phosphorite ore is used. 171/



- e. Construction Difficulties: There was a shortage of round timber caused by undershipment in 1954 from Timber Procurement Trust No. 1* for construction of the central heat and power station. 173/ No further shortages or difficulties in construction have been noted.

28. Plant Name: Chemical Works.

- a. Location: Dzhambul, Kazakh SSR, Economic Region Xa, (Kazakhstan) (42°55' N - 71°23' E)
- b. Construction: The Sixth Five Year Plan states that a chemical plant will be constructed at Dzhambul. 174/ It is not known what chemicals this plant will produce.

29. Plant Name: Kirov Chemical Combine.

- a. Location: Aktyubinsk, Kazakh SSR, Economic Region Xa (Kazakhstan) (50°17' N - 57°10' E)
- b. Construction: A unit for the manufacture of superphosphate at the Aktyubinsk Chemical Combine was planned in the Fourth Five Year Plan. 175/ New mechanized chambers for the production of superphosphate were installed in 1953, 176/ and a granulating section was under construction in 1954. 177/ In 1954 the production of boric superphosphate was begun. 178/
- c. Construction-Planning Organizations:

* This trust is subordinate to the Ministry of Construction and located at Krasnoyarsk.

30. Plant Name: Nitrogen Fertilizer Works.

- a. Location: Temir Tau, Karaganda, Kazakh SSR,
Economic Region Xa (Kazakhstan)
(50°05' N - 72°58' E)
- b. Construction: During the Sixth Five Year Plan a nitrogen fertilizer plant is to be built at the Karaganda Metallurgical Works. 180/ It is not known whether this will be a plant producing byproduct ammonium sulfate fertilizer or an ammonium nitrate plant similar to the one at Rustavi, using waste gases from the coke plant.

31. Plant Name: Karaganda Synthetic Rubber Plant.

- a. Location: Temir Tau, Karaganda, Kazakh SSR,
Economic Region Xa (Kazakhstan)
(50°05' N - 72°58' E)
- b. Construction: Construction activity at Temir Tau was first observed in 1948, 181/ and plans called for completion by the end of 1950. 182/ The contractor was the Kazakh Metallurgical Construction Trust of the Ministry of Construction of Heavy Industry Enterprises, * and Giprokauchuk was active in planning operations. 183/ Production from this plant was confirmed by a report from Radio Karaganda on 19 November 1954. 184/

32. Plant Name: Nitrate Fertilizer Plant.

- a. Location: Angren, Uzbek SSR, Economic Region Xb
(Central Asia) (41°05' N - 70°08' E)

* See the footnote on p. 46, above.

- b. Construction: There has been no evidence of construction of the nitrogen plant at Angren, but the Sixth Five Year Plan directive stated that the construction of the Angren Nitrate Fertilizer Plant would be started. 185/ The source of hydrogen is not known, but there are extensive coal deposits in the Angren Valley. This plant probably will not start production until after the Sixth Five Year Plan, for the construction time required for a nitrate fertilizer plant in the past has been from 6 to 7 years.

It may be that this is the plant referred to in the Fourth Five Year Plan when it was announced that the construction of a new nitrate fertilizer plant would be started in Uzbek SSR. 186/ A large expansion was planned at Chirchik during this period, but there was never any indication that a completely new plant was started in Uzbek SSR.

33. Plant Name: Chardzhou Superphosphate Plant.

- a. Location: Chardzhou, Turkmen SSR, Economic Region Xb (Central Asia) (39°08' N - 63°36' E)
- b. Construction: Construction of a superphosphate plant in the Turkmen SSR was planned during the Fourth Five Year Plan. 187/ []
[]
[] construction probably did not start until 1951. 189/ The recently announced date for completion of construction at this plant is 1957. 190/
- c. Construction-Planning Organizations: []
[]
[] This institute conducted engineering, geological, and topographic-geodetic

work at the plant site in 1949. 192/ Construction Trust No. 93 of the Chief Directorate of Ural-Volga Construction, which was subordinate to the Ministry of Construction of Machine Building Enterprises, * probably started construction here in 1951. 193/

[]

34. Plant Name: Chirchik Electrochemical Combine.

a. Location: Chirchik, Uzbek SSR, Economic Region Xb (Central Asia) (41°31' N - 69°35' E)

b. Construction: According to the Fourth Five Year Plan the ammonia capacity of this plant was to be doubled. Construction activities have been noted since 1946, and the planned expansion probably was fulfilled. A further expansion of 153 percent is planned during the Sixth Five Year Plan. 195/

c. Construction-Planning Organizations: GIAP has been active in planning activities. GSPI-3 has provided drawings for equipment. 196/ []

[]
[]
[]

[] 198/ The All-Union Industrial Installation Trust subordinate to the Ministry of Construction of Metallurgical and Chemical Industry Enterprises continues the work at this combine. 199/

d. Construction Difficulties: In 1947 a lack of armored cable was delaying construction, 200/ and in 1948 a lack of materials was delaying construction operations. 201/

* See the footnote on p. 46, above.

- e. Capital Investments: Reports of capital investment at this plant are very incomplete, but investment may be estimated to be about 2 million rubles a month in 1946 (based on the capital investment reported for the month of October 1946 of 1.929 million rubles). 202/

35. Plant Name: Kagan Superphosphate Plant.

- a. Location: Kagan, Uzbek SSR, Economic Region Xb (Central Asia) (39°40' N - 64°35' E)
- b. Construction: In the latter part of 1955 a new superphosphate workshop was being built at this plant, and plans were made to mechanize and automatize labor processes. The batch operation of superphosphate is planned to be replaced by the continuous method. 203/

36. Plant Name: Kara Bogaz Sulfate Combine.

- a. Location: Kara Botaz Gol, Turkmen SSR, Economic Region Xb (Central Asia) (41°02' N - 52°55' E)
- b. Construction: In the past, many plans have been made by the USSR for developing this area and constructing a large chemical producing area based on the deposits of sodium sulfate found in Kara Bogaz Gol Bay. Up to the present time, however, only sodium sulfate has been extracted from the area -- in a primitive fashion, and neither the Central Committee of the Turkmen Communist Party nor the Council of Ministers of the Turkmen SSR has as yet solved the problem of the development of this enterprise. During the Sixth Five Year Plan, however, it is planned to mechanize the collection, loading, and transportation of the sulfate, and production in 1960 is to be 217 times production of sodium sulfate in 1955. * 204/

* it was necessary to speed up construction of sections for the industrial production of sulfur and sodium at the Kara Bogaz Sulfate Combine. It is probable this referred to sodium sulfate.

37. Plant Name: Kokand Superphosphate Plant.

a. Location: Kokand, Uzbek SSR, Economic Region Xb
(Central Asia) (40°32' N - 70°57' E)

b. Construction: []

[] In []
1946 the planned production from this plant was stated
to be 200,000 tons of superphosphate annually. 206/

[] in 1953 excavation work for a new
shop was undertaken by Construction Trust No. 32 of
the Ministry of Construction. 208/ []

[] in 1954
an experimental industrial installation for ammoniza-
tion of superphosphate produced from Kara Tau phos-
phorite ores was put into operation. 210/ Also in 1954
the superphosphate shop of this plant was reported to
be in continuous operation. 211/

c. Construction-Planning Organizations: []

[] the Middle Asia Electrical Installation
Trust of the Ministry of Construction 214/ have been
active at this plant.

38. Plant Name: Samarkand Superphosphate Plant.

a. Location: Samarkand, Uzbek SSR, Economic Region Xb
(Central Asia) (39°40' N - 66°58' E)

b. Construction: This plant was planned to be constructed
during the Fourth Five Year Plan. []

[]

[] Delivery of the plant was later planned for the fourth quarter of 1954. 216/ It appears, however, that only sulfuric acid production was started in 1954 and that the production of superphosphate did not start until sometime in 1955. 217/ The size of this plant is not known, but it probably is the same size as the other plants constructed in Central Asia at this time -- about 200,000 to 250,000 tons of superphosphate annually.

c. Construction-Planning Organizations: []

[]

39. Plant Name: Synthetic Rubber Plant SK-9.

a. Location: Krasnoyarsk, Economic Region XI
(East Siberia) (56°02' N - 92°48' E)

b. Construction: Construction of this synthetic rubber plant probably started in 1947, 222/ []

[]

c. Construction-Planning Organizations: []

[]

40. Plant Name: Plant No. 97.

a. Location: Usol'ye Sibirskoye, Irkutskaya Oblast,
Economic Region XI (East Siberia)
(52°45' N - 103°48' E)

- b. Construction: Construction at this plant in 1950 was concerned with an expansion of the heat and power station, construction of living quarters, and a special depot for reserves. 225/ []

[]

- c. Construction-Planning Organizations: [] The Eastern Heavy Construction Trust of the Ministry of Construction of Metallurgical and Chemical Industry Enterprises has been the general contractor. 229/

- d. Capital Investments: In 1953 the Eastern Heavy Construction Trust completed work valued at 3,453,000 rubles at the electrochemical installation which is believed to be located at this plant. 230/ The value of construction completed at the electrochemical installation from [] January 1954 to [] June 1954 was 6,099,000 rubles, 231/ and an increase in construction activity in 1954 over 1953 has been noted.

- e. Construction Shortages: In 1950 a lack of living quarters prevented the plant from requisitioning the [] new workers which it required. 232/ It appears [] that construction at this plant and in the general area has been hampered by a shortage of workers and, probably, housing facilities for new workers. In [] 1953, 1 million rubles was the [] expenditure for the organized recruitment of workers. 233/ In [] 1954, some workers were transferred [] to Irkutsk and to this plant. 234/ Again in [] 1955 a considerable lag in construction [] and to eliminate the lag, 300 additional laborers were needed. 235/

Another shortage noted was a lack of electric power for construction. The delay in work on the power line was caused by the lack of wire. 236/ []

41. Plant Name: Chemical Combine No. 1.

a. Location: Usol'ye Sibirskoye, Irkutskaya Oblast.
Economic Region XI (East Siberia)
(52°45' N - 103°48' E)

b. Construction: A recent announcement of the Irkutskaya Oblast Planning Commission stated that in the town of Angarsk and in Usol'ye Sibirskoye, it is planned to construct synthetic rubber, mineral fertilizer, salt refining, soda, and other plants. 237/ []

[]
[] Most of the construction work to date appears to be concerned with the construction of houses for workers and roads for the combine. It is probable that the synthetic rubber plant will use carbide as a raw material, and there are widespread coal deposits in the area.

c. Construction-Planning Organizations: GSPI-3 and Giprokauchuk have been active at this location. The Eastern Heavy Construction Trust of the Ministry of Construction of Metallurgical and Chemical Industry Enterprises has served as general contractor in the area from 1950 to the present, and one of the clients of this Trust has been the Chemical Combine No. 1. 239/ []

d. Construction Difficulties: In 1950, difficulty of assembling manpower for the newly created Eastern Heavy Con-

[] A shortage of workers for the Eastern Heavy Construction Trust probably has continued, []

[] material shortages reported to have caused delay in construction are the following:

- (1) A lack of armored cable has caused delay in supplying electric power for the housing and industrial area. 242/
- (2) A lack of wire PR (rubber-insulated copper wire covered with impregnated cotton braid) and cord PRD (two-conductor rubber-insulated copper wire with outer protective covering of cotton braiding) disrupted efforts to put housing and sociocultural public service projects into operation. 243/

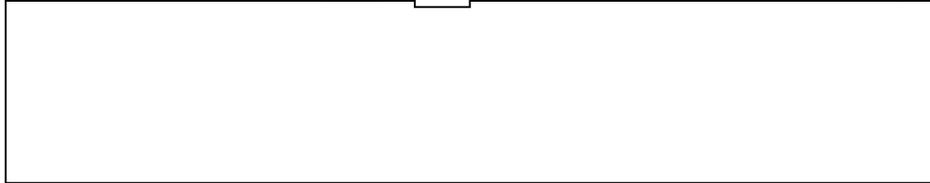
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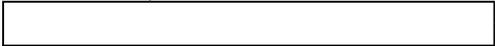
42. Plant Name: Plant No. 39.

- a. Location: Komsomol'sk, Khabarovskiy, Kray, Economic Region XII (Far East) (50°33' N - 136°59' E)
- b. Construction: This plant, subordinate to the Ministry of the Chemical Industry, produces sulfuric acid. Giprokhim was active in this location in the latter part of 1953 in early 1954. 245/ This activity may have been connected with the promise of Giprokhim to deliver the working drawings of the foundations of a boric acid shop at this enterprise in mid-1954. 246/ This shop probably is the boric acid shop recently [] being set up for processing local boron raw materials which previously were shipped to Latvia for processing. 247/



- c. Construction-Planning Organizations: Giprokhim has been active in determining the hydrology of the area and also in providing working drawings of new construction. 248/ The Amur Steel Construction Trust probably is engaged as the constructor. 249/ 



- d. Construction Difficulties:  because of a lack of compensating wire and control cable for the control and measuring instruments the new equipment could not be included in the work. 251/



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APPENDIX C

GAPS IN INTELLIGENCE

Major gaps in intelligence concerning the construction of chemical plants in the USSR are as follows:

1. Additional information is needed regarding the construction of chemical plants other than those which produce mineral fertilizers and basic chemicals. Specifically, information is lacking on the location, production capacity, and investment which is planned or actually expended on plants for the production of plastics, insecticides, synthetic alcohol, dyes, and other chemicals which are less highly publicized than mineral fertilizers and basic chemicals.

2. Information is needed on capital investment, both planned and actual, in the chemical industry of the USSR. In addition, more information is needed on the planned or actual costs of construction of plants for the production of ammonia, synthetic rubber, sulfuric acid, alkalies, and other chemicals.

3. Information of a continuing nature is required on construction projects which are known to be under way or planned. For each of the construction projects listed below, information is desired regarding planned production capacity, planned or actual costs of construction, construction difficulties or shortages, and degree of completion of construction.

a. Plant Name: Nitrate Fertilizer Plant.

Location: Nevinnomysk, Stavropol'skiy Kray,
RSFSR (44°38' N - 41°57' E, town
coordinates)

Description: This is the location of the construction site of the first synthetic ammonia plant in the USSR to use natural gas as a source of hydrogen. This plant is now under construction.

b. Plant Name: Grozny Chemical Plant.

Location: Grozny, Groznen'skaya Oblast, RSFSR
(43°20' N - 45°42' E)

Description: A synthetic alcohol plant is under construction at this location. In addition to the general requirements, given above, information on the type of process to be used is required.

c. Plant Name: Nitrate Fertilizer Plant.

Location: Angren, Uzbek SSR (41°05' N - 70°08' E)

Description: Construction of a synthetic ammonia plant is planned at this location. The starting date of construction and the process to be used are requirements, in addition to the general requirements.

d. Plant Name: Unknown.

Location: Angarsk and Usol'ye Sibirskoye, Irkutskaya Oblast, RSFSR (52°45' N - 103°48' E, coordinates of Usol'ye Sibirskoye)

Description: In these towns, plants for the production of synthetic rubber, mineral fertilizers, refined salt, and soda are planned. In addition to the above general requirements for this plant, information is required regarding the type of mineral fertilizer to be produced and the type of soda plant planned.

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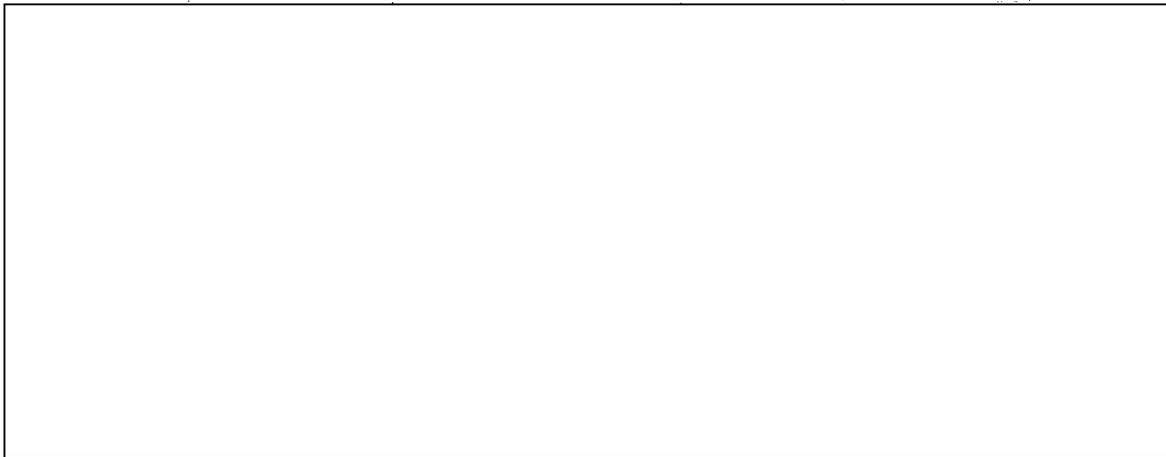
APPENDIX D

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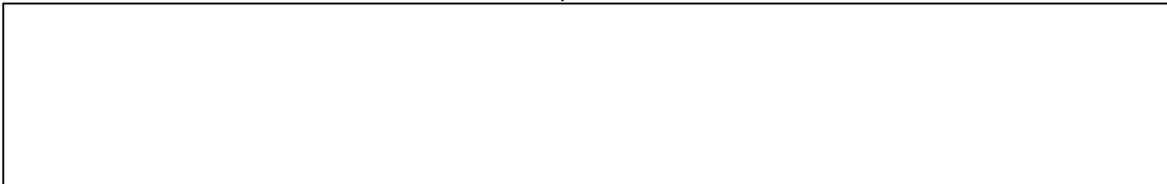
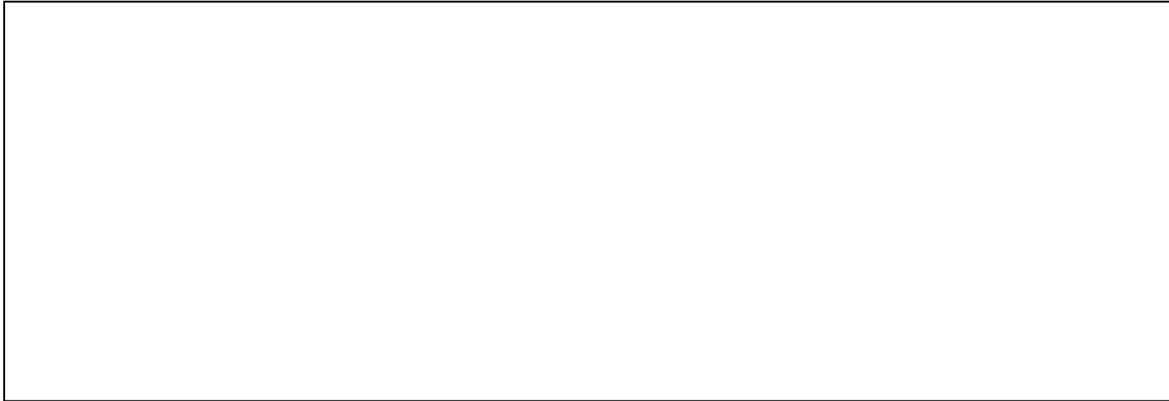
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