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Economic Intelligence Memorandum

PURCHASES BY THE SOVIET BLOC OF CHEMICAL EQUIPMENT AND TECHNOLOGY FROM THE FREE WORLD 1958–60

CIA/RR EM 61-7

19 May 1961

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

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FOREWORD

This memorandum surveys the major purchases of chemical equipment and technology by countries of the Soviet Bloc from the Free World during 1958-60 and discusses the contributions that these and other purchases will make toward the fulfillment of plans for chemical production in the Bloc through 1965. The survey is restricted to the activities of the USSR and the European Satellites because no significant increases in purchases by Communist China or the Asian Satellites have been noted.

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PURCHASES BY THE SOVIET BLOC OF CHEMICAL EQUIPMENT AND TECHNOLOGY FROM THE FREE WORLD* 1958-60

Summary

As a part of the general plan to accelerate the growth of chemical production in the Soviet Bloc, the USSR and the European Satellites have been importing increasing quantities of chemical equipment and technology from the Free World. During 1958-60 the USSR concluded about 45 major contracts for the delivery of chemical equipment and technology valued well in excess of $350 million. During this same period the Satellites negotiated about the same number of contracts. Prominent among Bloc purchases to date are equipment and technology for producing synthetic materials (notably fibers and plastics) and facilities for making the required basic and intermediate chemicals from petroleum and natural gas. These are the areas in which the chemical technology of the Bloc lags behind the technology of the Free World by the widest margin. A number of contracts, however, have involved equipment and technology for other chemical products, including conventional processes already in use in the Bloc. This feature of the purchasing program is indicative of the general strain placed on existing chemical engineering and equipment facilities by the ambitious plans for expanding production of chemicals.

There is little question that the equipment and technology already ordered from the Free World will make a significant contribution to the implementation of Bloc plans for chemicals and in turn to the fulfillment of plans for increasing output in other sectors of the economy. A substantial share of the planned new capacity for production of such products as polyethylene plastic, viscose rayon, synthetic fibers, motor vehicle tires, urea, ethylene, and acetylene is being purchased in the Free World. In many cases the purchased facilities will be highly automated and mechanized to provide for increased labor productivity and an improved quality of product. Moreover, additional contracts are under negotiation. The available information indicates that, all told, about 7.5 to 15 percent (by value) of the equipment installed in Bloc chemical industries during 1959-65 will be purchased in the Free World. For the USSR alone, imports valued at $0.75 billion to $1.5 billion are expected.

* The estimates and conclusions in this memorandum represent the best judgment of this Office as of 15 April 1961. The sources cited in this memorandum represent only a small part of those used. A complete list of sources is available in the files of this Office.

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I. Introduction

Soviet imports of chemical equipment* and technology from the Free World have been increasing rapidly in recent years and are now making a substantial contribution to the growth of the Soviet chemical industry. The value of imports rose successively from practically zero in 1956 to approximately 30 million rubles in 1957, 78 million rubles in 1958, and 311 million rubles in 1959.** As an indication of the contribution of imports from the Free World in 1959, the total value of equipment delivered to the chemical industry of the USSR in that year is reported to have been 1.9 billion rubles. 2/ Imports of chemical equipment from the Free World by the European Satellites also increased during this period. No significant increase has been noted, however, in imports of chemical equipment by Communist China or the Asian Satellites, although the Chinese expressed interest in buying substantial amounts of equipment in Western Europe in 1958 and in 1959.

The sharp increase in Soviet imports of chemical equipment from the Free World probably is associated in part with the decision made in late 1956 to realign investment priorities in favor of the materials industries, including the chemical industry. In implementing the plans for accelerated expansion of the chemical industry, the regime decided to buy some of the required equipment and technology from the Free World, a decision that became evident in May 1958 when Khrushchev announced the 1965 goals for chemicals:

> We will soon need a large amount of equipment which must be designed and produced anew. It would also be expedient to order a part of this equipment in capitalist countries, primarily the US, West Germany, and Britain. 3/

In the following months the European Satellites adopted plans for production of chemicals patterned after that of the USSR, and their

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* As listed in Soviet foreign trade statistics under the category "equipment for the chemical industry." 1/ (For serially numbered source references, see Appendix C.) This category probably does not include pumps, compressors, and other types of general industrial equipment for use in chemical plants.

** Values computed on the basis of ruble prices used in foreign trade accounting are not as a rule comparable with values based on domestic ruble prices. Available information suggests, however, that in the case of chemical equipment the two sets of ruble prices are, on the average, about the same. Ruble values in this memorandum are given in pre-1961 rubles. An approximate rate of exchange is 4 rubles to US $1.

spokesmen likewise indicated that reliance is to be placed on Western equipment and engineering firms, particularly for equipment and technology for production of synthetics from petroleum and natural gas. For example, a recent Polish press article included the following statement:

> The domestic machine-building industry now basically produces only traditional chemical equipment and does not fully cover the needs of the chemical industry. Therefore, in the period 1961-65 it will be necessary to purchase abroad about 50 percent of the apparatuses and equipment which will then be installed.
>
> This presents foreign trade with great problems both in finances and in finding the best sources of purchases. Socialist nations will cover a great part of the requirements for the chemical apparatuses. However, some of the apparatuses, particularly those for the production of synthetic fiber ("terylene" type), plastics (polyethylene, polypropylene, and others) and petrochemical products will probably be purchased, together with licenses, in capitalist countries. 4/

Although the need for equipment from the Free World is evident from these statements, [redacted], has been specific about the quantity of equipment required.

[redacted] that preliminary estimates indicated a 10-percent shortage, by weight, of chemical equipment for all branches of industry in the Soviet Bloc during 1959-65. [redacted] t "part" of the shortage would be covered by imports from the Free World but that ways proposed to cover remaining shortages were "not adequate." The estimates [redacted] i showed shortages of 10 percent in 1959 and 17 percent in 1960, with a gradual decline thereafter to 5 percent in 1965. 5/

Countries of the Soviet Bloc have placed themselves clearly in a position of dependence on imports from the Free World during the current plan period, but it is uncertain as yet whether or not substantial imports will be incorporated into plans for future periods. The USSR has hinted that such dependence may be considerable, Mikoyan having stated in mid-1960 that "under normal conditions of trade" the Soviet policy of purchasing chemical and other installations would not end with the completion of the "plan"* but would be maintained for "many years." 6/

* Presumably the Seven Year Plan (1959-65).

II. Highlights of Negotiations, 1958-60

Interest of the Soviet Bloc in purchasing chemical equipment and technology has centered on plants that produce synthetic materials (plastics, fibers, and rubber) and on facilities that produce the required basic and intermediate chemicals from petroleum and natural gas. Negotiations have not been restricted to these areas, however, and a number of contracts and inquiries have involved other products, including conventional processes already in use in the Bloc. Where standard processes are involved, the latest design features, including larger scale units with automatic controls, usually have been incorporated. This pattern reflects both the very marked lags in domestic research and development of new products and the inability of the local engineering and machine-building facilities to provide equipment and technology for efficient production of the older, conventional chemicals on the scale required by the plans.

The following sections survey major contracts (generally for complete plants) in relation to plans by the Soviet Bloc for increasing production of individual chemicals or groups of chemicals.*

A. Plastics

Materials included in the general category of plastics constitute perhaps the single most important group of chemical products in the eyes of Soviet Bloc planners at this time. During the period of the Seven Year Plan (1959-65), investment in Soviet facilities for production of plastics is scheduled to take about 20 percent of the investment funds allocated for the chemical industry.** The production goal for 1965 appears to be about 2 million metric tons,*** or more than seven times the estimated production in 1958. A major objective of the drive to boost production of plastics is the substitution of these synthetics for metals (both nonferrous and ferrous) and other materials. In addition, plastics are required for a number of military and industrial purposes where their unique heat resistance and electrical properties, light weight, and other characteristics can be used to good advantage. A similar drive to increase production of plastics is underway in the European Satellites.

Interest of the Soviet Bloc in purchases from Western firms in the field of plastics has centered on equipment and technology for

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* The contracts are listed by recipient country in Appendix A, p. 15, below.

** This figure probably includes investments in production of some of the required basic and intermediate chemicals.

*** Tonnages are given in metric tons throughout this memorandum.

producing polyethylene, one of the newer types. Of the Soviet goal of approximately 300,000 tons of polyethylene planned for 1965 (production in 1958 was negligible), 7/ two plants with a combined capacity of 48,000 tons have already been contracted for, and negotiations for the purchase of additional plants appear to be underway.

The USSR apparently is conducting considerable research and development work in the field of polyethylene but with indifferent results to date. In 1960 a Soviet publication revealed that a high-pressure process under development at the Okhta Chemical Plant in Leningrad had not yet been mastered, although data for the process were supposed to have been obtained in 1958. Delays caused by lack of equipment or technology have been encountered in construction of polyethylene installations at Sverdlovsk, Dzerzhinsk, Ufa, and Groznyy.

In the European Satellites the situation with respect to polyethylene is similar, although few contracts have as yet been signed. Of the roughly 600,000 tons of new capacity for plastics scheduled for 1965, approximately 100,000 tons will be for polyethylene. A consortium composed of the trading organizations of East Germany, Poland, Czechoslovakia, and Rumania has been negotiating with a UK firm for the purchase of polyethylene facilities, and it is probable that contracts will soon be signed covering most of the planned capacity. East Germany has already purchased one 5,000-ton plant from a West German firm. Both Hungary and Bulgaria plan to be in production by 1965, and Hungary is to receive help from the USSR in building a 10,000-ton plant. 8/

A number of other significant purchases in the field of plastics have been made. These include purchases of polystyrene plants by the USSR and Poland and a polyvinyl chloride plant by Hungary. Much interest also has been shown in equipment for the processing of plastics, as is evidenced by the Soviet purchase of two plants capable of turning out a total of 22,000 tons of plastic pipe. These two plants will have the capacity to satisfy about one-third of the requirements in 1965 for plastic pipe in agriculture and construction. Equipment for processing plastics also has been purchased by some of the Satellites.

B. Chemical Fibers*

The plan to increase production of chemical fibers in the Soviet Bloc appears to have almost equal priority with the effort to increase

* Including, in accordance with Soviet terminology, so-called artificial fibers (largely rayon, which is [footnote continued on p. 7]

production of plastics. The motivation for the ambitious plan is the desire to provide a broader and more economical base for production of consumer goods and industrial items, particularly tire cord.* In the USSR the planned investment in production of chemical fibers in the Seven Year Plan is 18 percent of the total for the chemical industry, and output is scheduled to increase from 166,000 tons in 1958 to about 665,000 tons in 1965. Of the 500,000 tons of new production, about 350,000 will consist of cellulosics (viscose and acetate rayon), with the remainder consisting of newer synthetic fibers. In the European Satellites, production is scheduled to increase by about 200,000 tons between 1958 and 1965, with the increase about evenly divided between artificial and synthetic types. The emphasis on synthetic fibers is relatively greater in the Satellites, for production of rayon in East Germany, Poland, and Czechoslovakia is already greater on a per capita basis than in the USSR, and these countries therefore plan relatively minor increases in production of rayon.

The Soviet Seven Year Plan calls for the building of 27 new chemical fiber plants. The USSR has sought to obtain in the Free World a substantial part of the new facilities and has already contracted for the purchase of at least 10 plants in 1958-60. Two of the viscose rayon plants that were purchased reportedly will have a combined annual capacity of about 40,000 tons (more than 10 percent of the planned increase in production of cellulosics), and a third plant of unknown capacity also is under contract. In the sphere of purely synthetic fibers, two of the plants under contract have a combined capacity of 14,000 tons per year and account for about 10 percent of the planned increase of 155,000 tons. Contracts have been concluded for several other synthetic fiber plants, the capacities of which are not known.

In implementing its expansion program for viscose rayon, a large part of which is to be used as tire cord, the USSR has contracted for three plants to produce high-grade cellulose, a material required for production of viscose cellulose. The combined annual capacity of the three plants is reported to be 600,000 tons, which is

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composed of regenerated cellulose) and fibers that are actually synthesized (marketed in the US under such trade names as nylon, dacron, and orlon).

* The low quality of tire cord presently produced in the USSR has been an important factor in the limited road life of Soviet tires. About 50 percent of the cord now used is made of cotton, with the remainder derived from chemical fibers (viscose rayon and nylon) of indifferent quality. By 1965, chemical fibers of improved quality are scheduled to comprise about 88 percent of the total cord used in Soviet tires.

more than sufficient to take care of the increase in production of viscose cellulose originally scheduled for 1959-65.

In addition to the expansion of chemical fiber capacity, an extensive modernization of existing plants is planned. All told, some 20 chemical fiber plants are to be modernized. There have been several recent reports in the Soviet press describing the obsolescent status of the chemical fibers industry, one indication of which is the fact that labor productivity appears to be only one-third of that in the US. 9/ In making arrangements to carry out this program the USSR reportedly has approached a Western firm with a proposal that the latter modernize existing viscose rayon plants in the USSR, a task that apparently would embrace a large number of Soviet enterprises. 10/

The European Satellites likewise have been negotiating for imports of chemical fiber plants and technology. The exception is East Germany, which already produces adequate quantities of rayon and which appears to be well along with its own development program in the field of synthetic fibers. Poland has purchased a synthetic fiber plant with a capacity of 7,000 tons, about one-fourth of the planned increase by 1965. Czechoslovakia has contracted for at least one plant of unspecified capacity. Rumania has contracted for synthetic fiber plants with capacities totaling 8,000 tons per year, about 60 percent of the production goal for 1965. In addition, Rumania has purchased a large amount of equipment and technology for production of rayon and cellulose. Hungary's purchases in this area have been confined to a cellulose plant.

C. Rubber and Rubber Products

Rubber and rubber products comprise the third of the four groups of chemical products receiving major emphasis in the Soviet Bloc during 1959-65. Soviet plans apparently call for an increase of 170 percent in production of rubber and a doubling of production of motor vehicle tires. The relatively greater increase for synthetic rubber reflects in part the Soviet intention to reduce imports of natural rubber. Satellite production of synthetic rubber during the plan period is to be three to four times as large as the output in 1958 of 85,000 tons, most of which was produced in East Germany. Poland now is in limited production, and Czechoslovakia, Rumania, and Bulgaria are scheduled to have plants in operation by 1965. Similarly large increases in production of tires are planned.

In the sphere of rubber and rubber products the most significant Soviet purchase to date from the Free World has been that of a highly automated British-designed tire plant costing $39 million with an annual production capacity of 2 million tires. The plant,

reported to be the largest such enterprise in Europe, probably can be classed as one of the most modern tire plants in the world. The plant capacity will provide about 14 percent of the planned increase in production between 1959 and 1965. In addition to its quantitative impact on the goals of the Seven Year Plan, the imported tire plant, which is to be a model for future Soviet tire plants, provides a means of raising labor productivity in the industry. According to Soviet press reports the productivity of the new plant will be 22.3 kilograms of finished product per man-hour, 11/ a level that probably is more than 50 percent higher than the current average in the Soviet tire industry.

The USSR reportedly also is purchasing a synthetic rubber plant in the Free World, but few details are as yet available. The report that the contract involves only $2.4 million suggests that only part of the necessary equipment and technical data for such a plant is being purchased under this contract.

In the European Satellites, both Rumania and Poland have contracted to purchase tire plants from the UK. The Rumanian plant can provide practically all (1 million of 1.1 million tires) of the new production planned by 1965. The Polish plant, which will be built in two sections, reportedly will have an eventual capacity of 3.5 million tires compared with the goal for 1965 of 2.5 million tires.

D. Agricultural Chemicals

Compared with the purchases of plants for production of synthetic materials, the efforts of the Soviet Bloc to obtain plants for production of agricultural chemicals have been relatively less intensive. A few significant purchases, nevertheless, have been made, including plants for production of ammonia* and urea, the latter product being useful for production of feed supplements and plastics as well as of fertilizers.

The USSR contracted in 1960 for the purchase of three urea plants, which, when completed, will be the three largest such installations in the world. These plants, valued at $19.6 million, reportedly have a combined capacity of 540,000 tons of urea, about one-third of the 1.6 million tons** planned for production in 1965. The USSR, which produces only negligible quantities of urea at present, is placing heavy emphasis on the use of urea in feed supplements for livestock, and some 700,000 tons are planned for use in animal husbandry in 1965. The European Satellites also have expressed interest in urea

* Ammonia is discussed in E, p. 10, below.

** The present world capacity is only about 1.6 million tons. 12/

plants, but Rumania is the only Satellite country known to have placed an order for one so far.

E. Petrochemicals*

In order to provide a more efficient raw material base for production of plastics, fibers, rubber, and other synthetic organic products, as well as certain inorganic products (notably nitrogen fertilizers), countries of the Soviet Bloc are planning greater utilization of petroleum and natural gas and correspondingly less dependence on coal and agricultural products. Production of petrochemicals is, however, one of the areas of chemical processing with which Bloc technicians have had only limited experience and success. The USSR has an active program of research and development in this field, but, aside from developing petrochemical processes for producing ethyl alcohol and phenol, its achievements have been limited. Progress in deriving acetylene from petroleum hydrocarbons or natural gas has lagged considerably, and experimental units at Saratov and Lisichansk did not go into operation until 1959. Soviet efforts to produce the pure ethylene required for the manufacture of polyethylene have met with numerous difficulties. According to information received in 1958, delays in construction of the polyethylene plant at Ufa were caused, at least in part, by the failure to solve the problem of purifying ethylene. Construction of Soviet-designed ammonia plants utilizing natural gas have lagged considerably, and one such plant, in Nevinnomyssk, was not scheduled for operation until 1961, although construction began in 1954. This construction time is more than four times as long as that required for similar installations in the US.

In view of the difficulties in developing commercial production of petrochemicals, the USSR and the European Satellites have been negotiating with firms in the Free World for many types of petrochemical facilities, including those for producing ethylene, acetylene, butadiene, and ammonia. The USSR has purchased at least one ethylene plant and currently is interested in purchasing a larger facility for production of 150,000 to 160,000 tons of ethylene per year. 13/ As an indication of the importance of such a plant, 150,000 tons of ethylene per year would be sufficient to supply almost one-half of the amount required to meet the goal for production of polyethylene plastics, one of the major uses of ethylene. In the field of acetylene the USSR has contracted to purchase three plants based on processes using natural gas. The capacity of one of these plants reportedly is 35,000 tons, and if it is assumed that the other two are of similar size, the combined capacity

* Basic and intermediate chemicals produced from petroleum and natural gas.

will be about one-fifth of the increase of 500,000 tons planned during 1959-65. The USSR also has contracted to purchase an ammonia plant to operate on natural gas.

Of the European Satellites, East Germany has contracted to buy ethylene capacity equal to the entire increment in capacity planned for 1959-65. Additional contracts have been negotiated for the technology involved in making ethylene oxide from ethylene. Poland and Czechoslovakia have bought acetylene plants.

F. Other Chemicals

The above categories do not exhaust the range of chemical equipment and technology that countries of the Soviet Bloc have imported or are interested in importing from the Free World. Other purchases, a partial list of which is given in Appendix A,* include plants for the manufacture of acids, alkalies, chlorine, and coal tar products. These other transactions are by no means inconsequential. For example, the USSR has purchased from the Free World a large plant for the joint production of caustic soda and chlorine that is to have a capacity of 100,000 tons of caustic soda per year, or about 14 percent of the estimated increase in production scheduled during 1959-65.

III. Conclusions

A review of the major contracts concluded by the Soviet Bloc since 1958 with chemical equipment and engineering firms of the Free World**

* P. 15, below.

** Most of the contracts are with British and Western European firms. The fact that only a few such contracts have been made with US firms can be attributed, at least in part, to the more restrictive US controls on exports of this type to the Soviet Bloc. Licenses have been denied by the US Department of Commerce for the export of equipment or technology relating to production of a number of items not under multilateral (COCOM) embargo, including petrochemicals, plastics, and intermediates for the production of plastics. In a number of cases, equipment or technology relating to similar but not necessarily identical or equally efficient processes is being obtained elsewhere by countries of the Bloc. These purchases include processes for manufacturing acetylene, ethylene, ethylene oxide, maleic anhydride, polyvinyl pyrrolidone, polyethylene, and polyurethane. Significant among the processes that the countries of the Bloc apparently have not yet been able to obtain elsewhere are those for producing butadiene directly from petroleum-derived butane, carbon blacks from oil by a continuous furnace process, cold S-type synthetic rubber, nylon-66, and polystyrene film.

reveals a large number of transactions that become highly significant when they are related to plans for the expansion of chemical production in the Bloc through 1965. The USSR is believed to have concluded about 45 major contracts, and the European Satellites together have signed about the same number. The value of 35 of the major contracts signed by the USSR alone since the beginning of 1958 is estimated to be approximately $350 million. There is little question that the equipment and technology being purchased under these contracts will contribute significantly in both quantitative and qualitative terms to the implementation of Bloc plans for the chemical industry -- particularly those for production of synthetic materials -- and in turn to plans for increased quantities and improved qualities of consumer goods, construction materials, industrial equipment, and in some cases products with military end-use. In addition to the direct effect on the fulfillment of Bloc chemical plans by 1965, the purchases of equipment and technology obviously permit the Bloc to concentrate its resources available for chemical research and development in selected areas of high priority.

Although the flow of orders from the Bloc may slacken at any time, there are no indications of such a development as yet. Evidence that the USSR intends to continue importing chemical equipment, at least for the immediate future, is buttressed by the continued displays of Western chemical equipment and products in the USSR. In 1961 the US is to present a plastics fair in the USSR, 14/ and a UK firm is to have a display relating to the field of agricultural chemicals. Development in both of these fields is heavily stressed in the Soviet Seven Year Plan, and progress in domestic production in 1959 and 1960 was quite modest compared with the 7-year goals.

In view of the fragmentary nature of the information that has been received on some contracts and the uncertainty about how many more contracts will be signed, it is not possible to estimate precisely what the total value of deliveries will be during 1959-65. The information available on orders already placed, however, together with the forecast of Bloc shortages of chemical equipment during the 7-year period,* indicates that approximately 7.5 to 15 percent (by value) of the equipment installed in chemical plants of the Soviet Bloc will be purchased in the Free World. For the USSR alone, it is expected thatthe value of imports of chemical plants, equipment, and technology will be $0.75 billion to $1.5 billion.**

* See p. 4, above.

** For methodology, see Appendix B.

What the trend will be after 1965 is uncertain as yet. Mikoyan's remark that purchases will continue for "many years" suggests that sizable imports of chemical equipment by the USSR will continue after 1965. In view of the substantial chemical research and development programs underway in the USSR, however, it is probable that the regime does not intend to make large-scale imports of chemical equipment and technology a permanent feature of Soviet Bloc trade with the Free World.

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APPENDIX A

SELECTED CONTRACTS FOR THE PURCHASE OF CHEMICAL EQUIPMENT AND TECHNOLOGY BY THE SOVIET BLOC FROM THE FREE WORLD 1958-60

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Table 1

Selected Contracts for the Purchase of Chemical Equipment and Technology by the USSR from the Free World 1958-60

Type of Plant	Production Capacity (Metric Tons a/*)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Plastics, plastics processing, and intermediates						
Polyethylene	24,000 per year	15 b/	West Germany	Ufa	1960	High-pressure process
Polyethylene	24,000 per year	15 b/	West Germany	Kuybyshev	1961(?)	Low-pressure process
Polystyrene	5,000 per year	1.82	UK	Gorlovka	N.A.	Delivery to begin in 1960
Polyurethane	9 per hour	0.15	West Germany	Moscow	1959	Output as foams and solids
Polypropylene	10,000 per year	N.A.	West Germany	N.A.	N.A.	
Plastic pipe	10,000 per year	1	US	"In the Urals"	1960	Fabrication of polyethylene and polyvinyl chloride; seller supplying equipment only; also 600 tons of plastic fittings per year
Plastic pipe	12,000 per year	N.A.	Japan	N.A.	N.A.	Fabrication of polyvinyl chloride
Maleic anhydride	N.A.	N.A.	Italy	Ufa	N.A.	
Cellulose acetate molding powder	3,000 per year	0.28	UK	N.A.	1960	
Cellophane	12 per day	N.A.	Switzerland	N.A.	1959	
Chemical fibers and intermediates						
Viscose rayon	23,000 per year	5	US	Ryazan'	1960	Equipment from US, Western Europe, and Japan
Viscose rayon	50 per day	20	Italy	Saratov	1962	Plant to produce tire cord
Viscose rayon	N.A.	42	UK	N.A.	1961	Plant to produce tire cord
Acetate rayon	N.A.			N.A.	1961	
Orlon type of fiber	N.A.			N.A.	1961	Acrylic fiber
Acetate rayon	N.A.	14	UK	N.A.	N.A.	Plant to produce yarn
Acetic anhydride	20,000 per year	N.A.	France	N.A.	1960 b/	
Nylon	9,000 per year	2	West Germany	Barnaul	1960	Nylon-6
Dacron type of fiber	N.A.	5	US	N.A.	N.A.	
Dacron type of fiber	5,000 per year	6	West Germany	Kursk	1960	Dimethyl terephthalate to be supplied from Stalinogorsk
"Synthetic fiber"	N.A.	6	UK	N.A.	N.A.	Specific type of fiber not known
Cellulose	100,000 per year	N.A.	Finland	N.A.	1962	High-strength cellulose for the manufacture of rayon tire cord
Cellulose	400,000 per year	29	Sweden	Bratsk	1962-63	Viscose cellulose suitable for super-super tire cord
Cellulose c/	100,000 per year	33	US	Komsomol'sk on the Amur	N.A.	Viscose cellulose suitable for super-super tire cord
Caprolactam	10,000 per year	6.8	West Germany	Kemerovo	1962	Intermediate for production of nylon
Dimethyl terephthalate	N.A.	5	West Germany	Stalinogorsk	1960	Raw material for the fiber plant at Kursk
Paraxylol	N.A.			Novokuybyshev	1960	Raw material for the dimethyl terephthalate plant at Stalinogorsk

* Footnotes for Table 1 follow on p. 19.

Table 1

Selected Contracts for the Purchase of Chemical Equipment and Technology
by the USSR from the Free World
1958-60
(Continued)

Type of Plant	Production Capacity (Metric Tons a/)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Chemical fibers and intermediates (Continued)						
AH salt	10,000 per year	6.4	West Germany	Lisichansk	1961	Intermediate for the manufacture of nylon-66
Cellulose acetate	50 per day	N.A.	France	Tsyurupin	1961 b/	
"Synthetic fiber"	N.A.	5.6	Italy	Barnaul and Kiev	1960	Lilion type
Rubber and rubber products						
Motor vehicle tires	2 million tires per year	39	UK	Dnepropetrovsk	1960	
Rubber finishing plant	70,000 per year	1.4	UK	"Siberia"	N.A.	Drying, baling, and packaging equipment
Synthetic rubber	N.A.	2.4	West Germany	N.A.	N.A.	Butadiene-styrene type
Fertilizers						
Urea	500 per day	19.6	Netherlands	Tashkent	N.A.	Equipment to be shipped in 1962
Urea	500 per day			Ufa	N.A.	
Urea	500 per day			Tula	N.A.	
Basic petrochemicals						
Ammonia	400 per day	10.5	Belgium	Stalinogorsk	1962 b/	From natural gas
Acetylene	N.A.					
Acetylene	35,000 per year	6.2	West Germany	"Vicinity" of Stalingrad	1961	By oxidation of methane from natural gas
Acetylene and ethylene d/	N.A.	24	Italy	Ufa	N.A.	From fuel oil
Ammonia	100,000 per year	N.A.	Italy	N.A.	N.A.	Natural gas assumed to be the raw material
Other chemicals						
Sulfuric acid	24 per day	0.25	UK	N.A.	N.A.	Concentration plant
Titanium dioxide	N.A.	N.A.	Italy	Ufa	N.A.	Used chiefly as a pigment
Caustic soda	100,000 per year	N.A.	France	N.A.	N.A.	Electrolytic plant; the plant also to have the capacity to produce 90,000 tons of chlorine per year; delivery to begin in 1960

Table 1

Selected Contracts for the Purchase of Chemical Equipment and Technology
by the USSR from the Free World
1958-60
(Continued)

Type of Plant	Production Capacity (Metric Tons a/)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Other chemicals (Continued)						
Sodium sulfate	40 per day	2	West Germany	N.A.	N.A.	Vacuum crystallizer plant
Synthetic fatty acids	5,000 per year	8.4	UK	N.A.	N.A.	To be used for the manufacture of synthetic detergents
Fatty alcohols	5,000 per year					
Polyvinyl pyrrolidone	180 per year	2	West Germany	Tula	1961	Blood extender
Methyl pyrrolidone	250 per year					Solvent
Silica (aerosil)	5,000 per year	2.16	West Germany	N.A.	1961	
Silicon tetrachloride	15,000 per year	0.82	West Germany	N.A.	1961	
Gas purification	200 per day	9	France	Rastorgvyeve	N.A.	Purification of coke-oven gas for ammonia synthesis
Gas purification	200 per day	10	France	Lipetsk	N.A.	
Phosphoric acid	166 per day	N.A.	France	N.A.	1960 b/	

a. Unless otherwise indicated.
b. Estimated.
c. An application for a renewal of the license to export technical data is under review by the US Department of Commerce.
d. One of three plants purchased from Italy for $24 million. The other two manufacture titanium dioxide and maleic anhydride.

Table 2

Selected Contracts for the Purchase of Chemical Equipment and Technology by East Germany from the Free World 1958-60

Type of Plant	Production Capacity (Metric Tons)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Plastics and intermediates						
Polyethylene	5,000 per year	N.A.	West Germany	Merseburg	1962	
Polyethylene	30,000 to 40,000 per year	N.A.	UK	Merseburg	N.A.	Negotiations involving a consortium of Bloc countries including East Germany, Czechoslovakia, Poland, and Rumania
Cellulose acetate	3,000 per year	N.A.	West Germany	Finowtal	N.A.	Evidently to be used in the manufacture of photographic film;
Basic petrochemicals						
Ethylene	40,000 per year	4.2 a/	UK	Merseburg	1962	One-half of the output at VEB Leuna-Werke to be used on site for production of polyethylene; the remainder to be used at the VEB Chemische Werke Buna in Schkopau for production of styrene required in the manufacture of synthetic rubber
Ethylene	40,000 per year	N.A.	West Germany	Merseburg	1962 or 1963	
Ethylene oxide	N.A.	N.A.	UK	N.A.	N.A.	Reported to have purchased technical data for production by direct oxidation of ethylene

a. A contract for design and technical data only. The total cost of the completed plant reportedly will be $11.2 million.

Table 3

Selected Contracts for the Purchase of Chemical Equipment and Technology by Poland from the Free World 1958-60

Type of Plant	Production Capacity (Metric Tons a/)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Plastics						
Polystyrene	5,000 per year	0.96	UK	Oswiecim	1960	Technology and nearly all equipment supplied; plant now in operation
Polyethylene	10,000 per year	N.A.	UK	Plock or Kedzierzyn	N.A.	Negotiations stage
Chemical fibers						
Dacron type	7,000 per year	1.4	UK	Torun	1963	Seller supplying license, production technology, and aid in layout of this polyester fiber plant ("Elana" -- terylene)
Cellulose	N.A.	N.A.	Italy and UK	Wloclawek	1963	Plant now located at this site to be expanded and straw to replace timber as the raw material
Rubber and rubber products						
Motor vehicle tires (plant to be in two sections)	3.5 million tires per year	N.A.	UK	Olsztyn	1965 (first section)	Seller to supply technology and 70 percent of equipment and to train operating personnel
Basic petrochemicals						
Acetylene	N.A.	N.A.	Italy	Tarnow	N.A.	Technology and equipment for producing acetylene, hydrogen, and carbon monoxide from natural gas; perhaps to include ammonia technology and equipment

a. Unless otherwise indicated.

Table 3

Selected Contracts for the Purchase of Chemical Equipment and Technology
by Poland from the Free World
1958-60
(Continued)

Type of Plant	Production Capacity (Metric Tons)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Other chemicals						
Sulfuric acid	100,000 per year	N.A.	France	Torun	1960	Seller supplied technology and a portion of equipment for this plant, which is now in operation
Butanol and octanol	2,500 per year of butanol and 4,000 per year of octanol	N.A.	France	Oswiecim	1960	Seller supplied production technology and equipment; plant now in operation
Naphthalene	N.A.	N.A.	France	N.A.	N.A.	
DDT	N.A.	N.A.	Switzerland	N.A.	N.A.	Seller supplied technology
Phenol	N.A.	N.A.	France	Oswiecim		Plant for producing synthetic phenol under French license now in operation
Gas purification	N.A.	N.A.	France	Kedzierzyn	1962	Probably for purification of coke-oven gas, which is to be used as a source of hydrogen for ammonia synthesis at this site

Table 4

Selected Contracts for the Purchase of Chemical Equipment and Technology
by Czechoslovakia from the Free World
1958-60

Type of Plant	Production Capacity (Metric Tons)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Plastics						
Polyethylene	10,000 a/	N.A.	UK	N.A.	N.A.	Negotiations stage
Chemical fibers						
Dacron type	N.A.	0.6	UK	Plana nad Luznici	N.A.	Licensed to use polyester fiber process
"Synthetic fiber"	N.A.	2.5	UK	N.A.	N.A.	All equipment for plant; this contract possibly related to the contract for the plant at Plana nad Luznici
Basic petrochemicals						
Acetylene and ammonia	N.A.	N.A.	Italy	Most	N.A.	Technology and equipment for producing acetylene, hydrogen, and carbon monoxide from natural gas; hydrogen to be used for ammonia synthesis
Other chemicals						
Benzene	N.A.	N.A.	West Germany	N.A.	N.A.	Seller to supply technology for hydrogenous refining process

a. Estimated.

Table 5

Selected Contracts for the Purchase of Chemical Equipment and Technology
by Rumania from the Free World
1958-60

Type of Plant	Production Capacity (Metric Tons a/*)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Plastics and plastics processing						
"Plastics" plant	N.A.	24	France	N.A.	N.A.	Cost of ammonia and urea facilities included in the price
Plastics processing	N.A.	N.A.	Switzerland	Bucharest	1960	For compounding polyvinyl chloride
Polyethylene	10,000 per year b/	N.A.	UK	N.A.	N.A.	Negotiations stage
Chemical fibers and intermediates						
Viscose rayon	N.A.	25	US and UK	N.A.	N.A.	Part of $75 million cellulose, rayon, and paper complex; plant to produce tire cord
Cellulose c/ and paper	N.A.	14	US and UK	Probably Braila	N.A.	Perhaps a part of the above contract
Nylon	2,450 per year	5	West Germany	Savinesti	1960	Nylon-6 type
Caprolactam	2,625 per year					Intermediate for production of nylon
Orlon	5,600 per year	N.A.	West Germany	Savinesti	1961	
Acrylonitrile	6,300 per year	N.A.	West Germany	Savinesti	1961	Intermediate for production of orlon
Orlon	350 per year	N.A.	West Germany	Savinesti	1960	Pilot plant
Rubber and rubber products						
Tires	1 million tires per year	21	UK	Bucharest	N.A.	Now under construction at Popesti-Leordani, a suburb of Bucharest

* Footnotes for Table 5 follow on p. 25.

Table 5

Selected Contracts for the Purchase of Chemical Equipment and Technology
by Rumania from the Free World
1958-60
(Continued)

Type of Plant	Production Capacity (Metric Tons a/)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Fertilizers						
Urea	N.A.	N.A.	France	N.A.	N.A.	Part of a $24-million contract for facilities for plastics, ammonia, and urea
Basic petrochemicals						
Acetylene	N.A.	10	Belgium	N.A.	N.A.	From methane derived from natural gas
Ethylene and propylene	3,900 cubic meters of ethylene and 2,000 cubic meters of propylene per hour	N.A.	UK and Italy	N.A.	N.A.	Italy to provide technical assistance related to doubling plant capacities
"Petrochemical"	N.A.	N.A.	Italy	N.A.	N.A.	Complete plants
"Petrochemical"	N.A.	N.A.	France	Ploesti	N.A.	"Equipment"
Ammonia	N.A.	N.A.	France	N.A.	N.A.	Part of a $24-million contract for facilities for plastics, ammonia, and urea
Other chemicals						
Chlorine and caustic soda	40 per day of chlorine	N.A.	West Germany	Turda	1958	Presumably in operation
Methanol	N.A.	N.A.	West Germany	Ploesti	N.A.	
Benzene hexachloride	700 per year	N.A.	West Germany	Turda	N.A.	Perhaps in operation
Butanol	N.A.	N.A.	Italy	N.A.	N.A.	Obtained in 1959

a. Unless otherwise indicated.
b. Estimated.
c. An application for a renewal of the license to export technical data is under review by the US Department of Commerce.

Table 6

Selected Contracts for the Purchase of Chemical Equipment and Technology
by Hungary from the Free World
1958-60

Type of Plant	Production Capacity (Metric Tons)	Price (Million US $)	Exporting Country	Plant Site	Scheduled Completion Date	Remarks
Plastics, plastics processing, and intermediates						
Polyvinyl chloride	6,000 per year	2	West Germany	Berente	1962	Initially, starting material to be calcium carbide; later, natural gas
"Synthetic resin" and paints	N.A.	N.A.	France	Tiszapalkonya	1960	Seller to supply part of the equipment
Plastics processing	N.A.	N.A.	Netherlands and West Germany	Budapest -		Equipment now in operation at two plants
Chemical fibers and intermediates						
Cellulose	N.A.	7.8	UK	Sztalinvaros	N.A.	Seller to supply part of the equipment; straw to be the raw material
Rubber and rubber products						
Motor vehicle tires	N.A.	N.A.	UK	N.A.		Equipment now in operation
Other chemicals						
Chlorine and caustic soda	9,600 per year of chlorine	3	France	Berente	By 1965	
Chlorine and caustic soda	9,600 per year of chlorine			Budapest	1962	
Argon	150,000 cubic meters per year	0.25	West Germany	Petfurdo	1960	Now in operation; product to be used in welding

APPENDIX B

ESTIMATED VALUE OF IMPORTS OF CHEMICAL PLANTS, EQUIPMENT, AND TECHNOLOGY BY THE SOVIET BLOC FROM THE FREE WORLD 1959-65

This memorandum contains the following specific estimates: (1) that 7.5 to 15 percent (by value) of the equipment (including associated technology) to be installed in chemical plants of the Soviet Bloc during 1959-65 will be imported from the Free World and, as a corollary, (2) that imports by the USSR will total $0.75 billion to $1.5 billion. These estimates were developed according to the following methodology.

indicated that during 1959-65 as much as 10 percent by weight of the chemical equipment required for all branches of the Soviet Bloc economies would be sought in the Free World. however, that shortages in Poland were mainly in chemical equipment required by the chemical industry as distinguished from chemical equipment required by other industries.** If a similar situation prevails in other Bloc countries, the percent of the equipment of the chemical industry to be purchased from the Free World might well exceed 10 percent. Moreover, imports from the Free World might be increased above the level originally scheduled if plans for domestic production of chemical equipment are not fulfilled. On the basis of this information a range of 5 to 15 percent was tentatively assigned.

As a partial check on the plausibility of this estimate, the percentages were applied to the Soviet investment plan for chemicals and compared with other data on orders already placed and with deliveries in 1959 as reported in Soviet statistics. The dollar value of equipment to be invested in the Soviet chemical industry during 1959-65 is estimated to be $10 billion. This estimate was derived by assuming that 40 percent of the 100 billion rubles scheduled to be invested in the chemical industry is to be in the form of equipment (and associated technology), a percentage which is in accordance with Soviet sources, and that the appropriate ruble/dollar ratio in the case of chemical equipment is 4 to 1. Thus the range of 5 to 15 percent yields an estimate of Soviet imports of $0.5 billion to $1.5 billion.

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** In Poland, about one-fourth of the projected total requirement for chemical equipment is accounted for by other industries, and in the Soviet Bloc as a whole the share is about two-fifths.

When compared with information from Soviet sources on deliveries in 1959, the estimate does not appear to be unreasonable. Soviet trade statistics for 1959 show imports of "equipment for the chemical industry" valued at 311 million rubles, or, on the assumption of a ruble/dollar ratio of 4 to 1 about $78 million. If deliveries continued at this rate during 1960-65 -- which would seem to be a conservative projection, as deliveries of equipment to the Soviet chemical industry are scheduled to rise rapidly during the next few years -- the total value of imports during the 7-year period would be in excess of $0.5 billion. Moreover, this category may not include some of the general industrial equipment, such as pumps and compressors, earmarked for chemical plants. On the other hand, if it is assumed that the 1959 ratio between imports and deliveries to the chemical industry (311 million to 1.9 billion)* continued to hold during the remaining years of the plan period and that the Soviet investment plan is fulfilled 100 percent (which seems unlikely), the value of imports would be $1.6 billion ($10 billion times 311 million divided by 1.9 billion).

The estimate of $0.5 billion to $1.5 billion likewise does not appear to be inconsistent with the partial information on contracts signed by the USSR in 1958-60. The value of 35 of the major contracts (mostly complete plants) clearly exceeds $350 million (from Table 1**), and additional contracts for individual pieces of equipment and subunits are known to have been signed. Thus, even if no additional orders are placed, deliveries should exceed $500 million. As a considerable volume of new orders is expected to be placed in the near future, the minimum figure for the USSR was adjusted upward to $750 million, and the lower limit of 5 percent as the estimated share of Soviet Bloc equipment to be purchased in the Free World was raised to 7.5 percent. With respect to the reasonableness of a maximum of $1.5 billion in imports by the USSR, it seems likely that most of the contracts (at least contracts for complete plants) for delivery before the end of 1965 will have to be signed by the end of 1962. If this assumption is correct, the total value of deliveries in 1959-65 will exceed $1.5 billion only if the rate of orders placed in 1961-62 turns out to be substantially higher than the rate in 1958-60 -- a development that seems unlikely.

* See p. 3, above.
** Appendix A, p. 17, above.

APPENDIX C

SOURCE REFERENCES

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

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

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

All sources in this memorandum are evaluated RR 2 unless otherwise indicated.

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