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U.S. DEPARTMENT OF COMMERCE
Bureau of International Commerce
Washington, D.C. 20230

Date: May 21, 1970

~~CONFIDENTIAL~~

Reply to Attn of: BIC-806

Subject: Request for CIA Support in Updating the 1967 Petroleum and Petrochemicals Task Force Report.

To:

Director, Office of Economic Research
CIA Headquarters

At the May 7 meeting of the Operating Committee, the Chairman requested the Departments and Agencies which had participated in the 1967 Task Force on Petroleum and Petro-chemicals to update their information and views on this subject, and to submit their information and views to me, as Task Force Chairman, within a month. Thereafter, I would distribute the submissions to Task Force members and call several meetings on the subject. I expressed the view that several meetings over a period of about three weeks would suffice for review of this information and updating of the report.

You will recall that the earlier report covered products, equipment and technology. This is again intended. There are, however, several major differences. These are:

1. Several very active years have passed since the last report and, while the report was never definitively disposed of, much of its action guidance proposals has been informally adopted in practice.

2. The Export Control Act has been replaced by the Export Administration Act with somewhat different guidelines on controls.

3. The control criteria and licensing guidelines are in process of revision.

These new considerations are now to be taken into account.

Aside from general concern that an updating is now timely, the effort is addressed to the specific view by State that certain earlier technical findings, particularly regarding controls and licensing guides on advanced "cracking" technology and equipment, are not now valid and should, therefore, be revised.

In the past your agency has made major contributions to our study efforts in this field. I, therefore, urgently request your full participation in the present effort. Recognizing the time that has elapsed since May 7, I shall move the submission deadline to June 22 in order to provide a full month for your report.

Please advise me of your decision.

21 MAY 1970

J. Mishell George
Acting Chairman, Operating Committee

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25 MAY 1970

Mr. J. Mishell George
Acting Chairman, ACEP Operating Committee
Bureau of International Commerce
Department of Commerce

Dear Mishell:

I have your memorandum of 21 May requesting the updating of the CIA contribution to the 1967 Petroleum and Petrochemicals Task Force report. The present commitments of our petroleum people will make it impossible for us to start on this report until about 15 July. This would mean a submission date of 15 August.

We have reviewed the 1967 report and believe that a good deal of it is still valid. We do not share the view attributed to the Department of State that certain earlier technical findings, particularly regarding advanced cracking technology and equipment are now invalid. We believe that existing guidance is adequate for the next several months.

We regret our inability to comply with your requirement on the date specified.

Sincerely yours,

Director
Economic Research

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4 SEP 1970

MEMORANDUM FOR: J. Mishell George, Bureau of International Commerce, U.S. Department of Commerce

SUBJECT : CIA Contribution to Updating the 1967 Petroleum and Petrochemical Task Force Report

Attached is our response to your request for support in updating the 1967 Task Force report. The materials were prepared by my Office. Either or both of these analysts will be able to participate in the meetings you propose to hold.

[redacted]
Director
Economic Research

Attach. a/s

(3 Sept 70)

4 SEP 1970

Update of the 1967 Petroleum and Petrochemicals Task Force Report

Summary and Conclusions

The basic findings of the 1967 report, are still valid. The problems that the USSR faces in developing its petroleum industry during the next decade will be more difficult than those of the past. As the center of production for oil and gas moves eastward to the permafrost regions of Siberia and the Far North, Soviet need for modern technology and equipment for exploration and development will become greater. To satisfy growing demands for higher quality oil products the pace of building secondary refining facilities must be increased significantly. To distribute the gas and oil in the quantities planned, the construction of large-diameter pipelines must be stepped up sharply. Up to the present time, however, Soviet industry has been unable to provide all of the required equipment and technical data, and there are numerous indications in the Soviet press and journals that considerable amounts of equipment and technology will have to be procured from the industrialized nations of the Free World. In recent years, Soviet exports of oil have been the largest single source of hard currency foreign exchange used to purchase such technology and equipment. There is considerable doubt, however, that in the latter part of the 1970's production goals can be met. If the USSR wishes to continue to supply most of the oil required by Eastern Europe and to maintain other exports at or near present levels, it may have to import sizable quantities of Middle East oil by 1980.

Technological difficulties and lags in construction continue to frustrate achievement of some of the quantitative and qualitative goals set for production

of petrochemicals in the USSR and Eastern Europe. Nevertheless, production of at least a few basic petrochemicals and related end-products has been rising rapidly largely as a result of extensive purchases of equipment and technology from the Free World. Such purchases probably will continue during 1971-75. Recent negotiations and purchases suggest that US process technology and know-how are preferred over those available in Western Europe or Japan.

Output based on Western-supplied petrochemical equipment and technology will go largely to meet domestic requirements of the Communist countries. Some petrochemicals and related materials, however, will be exported to other Communist countries, or to the Free World in some cases, as payment for imported installations and technology. The industrialized countries of the Free World will remain well ahead of the USSR and Eastern Europe in development and assimilation of new petrochemical technology for at least the next 3-5 years, although Communist capabilities are likely to improve during the period.

A. Exploration and Extraction of Crude Oil and Natural Gas

1. USSR

The USSR has very large resources of petroleum, but many are located far from the major consuming areas, in permafrost regions of Siberia and the Far North where exploitation will be difficult. Exploration and development of these reserves and transport of the petroleum to consumers will require not only sizable allocations of investment, but also modern technology and equipment, much of which is not available in the Soviet Union. Some of the equipment and technical data needed is of US origin and in the last few years, the USSR has

been making great efforts to buy many types of US geophysical, oilfield, and transport equipment. (The Soviet Union has been a net importer of oilfield equipment since the middle 1960's, as shown in Table 1.) During the 1950's and early 1960's large reserves of oil and gas were developed in the Urals-Volga region where the deposits were shallow, easily found in simple geologic structures, and ideally suited for use of the Soviet turbodrill. During this period, however, many of the major fields were overproduced to meet production goals and their producing life was considerably reduced. Faulty technical procedures in water-flooding oilfields to maintain pressure have resulted in unexpected water encroachment in the producing oil zones, reduction in oil recovery, and inability to recover a sizable part of the reserves. According to Soviet sources, production in the Urals-Volga region, which now accounts for 60% of national output of crude oil, should reach its maximum at about 207 million tons in 1970, instead of the 350 million tons originally forecast for this region for 1980.

During the next decade, growth in production of oil and gas will have to come primarily from deposits in western Siberia and Central Asia. In these areas exploration and development will have to be conducted at greater depths and in formations where the turbodrill is inefficient. More rotary drilling is essential, but lack of high quality drill pipe precludes its widespread use. Soviet deep drilling capability is also limited by the lack of high-powered mud pumps, blowout preventors, and high quality drill bits. For example, Soviet data indicate that 8 to 10 months are required to drill a well to depths of 3,000 to 3,500 meters (10,000 to 11,500 feet). In the US such wells are usually drilled

in about a month.

The USSR is the world's second largest producer of crude oil, with output scheduled to reach 350 million tons in 1970. (See Table 2) Plans now call for crude oil production to reach 450 million tons in 1975 and 550-600 million tons in 1980. Of these totals, West Siberia is to provide 100-120 million tons in 1975 and 230-260 million tons in 1980. Production in the West Siberian region is, and will continue to be, plagued with problems and high costs because of the permafrost, extremes of climate, difficult terrain, shortages of equipment and labor, and poor transport and supply facilities. Chronic shortages of suitable drilling rigs, automation equipment, all-terrain vehicles, earth-moving equipment, and building materials exist. There is inadequate planning for construction of roads, railroads pipelines, or electric power facilities before the fields are developed.

Despite the many problems it appears that the 1975 production goal can be attained. This quantity of oil -- 450 million tons -- would be adequate to provide for all domestic needs, to satisfy East European demand for Soviet oil, and still leave substantial quantities for export to other Communist countries and to the Free World. Soviet exports of oil to the Free World have been the largest sizable source of hard currency foreign exchange in recent years and have been used to acquire technology and equipment from the West. (See Table 3 for Soviet Trade in oil in 1968.)

By 1980, however, because of declining output from the fields in the Urals-Volga region and the increasing difficulties of exploitation in Siberia it is

unlikely that production will exceed some 500 million tons, about 50-100 million tons below plan. This level of output would be more than adequate to cover domestic demands, but exports from domestic resources would be sharply reduced. If the USSR continues to provide most of the oil required by Eastern Europe and maintains other exports near present levels, it may have to procure some 80 million tons from Free World sources.

Substitution of natural gas cannot be expected to relieve the pressure on the Soviet oil industry. Despite the publicity given to large Soviet reserves of gas and to recent Soviet sales of gas to Western Europe, the problems of the gas industry are more serious than those of the oil industry, and it is unlikely that gas production goals can be met during the next decade. During the past 10 years, annual goals for production of gas were seldom achieved because of shortages of line pipe, lack of production and transport equipment, inadequate supplies of consumer equipment to use the gas, and the lack of storage facilities to meet peak-load demands. The cumulative effect of these failures is evident in the fact that production in 1970 is now expected to be 197 billion cubic meters (see Table 2) instead of the 310-325 billion, forecast for this year in the early 1960's. The chief obstacle to reaching production goals in 1975 and 1980 will be lack of large-diameter pipe to transport the gas. (See Section B.)

If all contracts are fulfilled, the USSR will be a net exporter of some 6 billion cubic meters of natural gas in 1975 and as much as 20 billion by 1980. Imports from Afghanistan and Iran should total about 14 billion cubic meters in 1975 and 1980. Soviet exports to Western Europe will reach 9 billion cubic

meters in 1975 in accordance with existing agreements, and total exports to the Free World could be about 15 billion cubic meters if France and Japan sign contracts still being discussed. Soviet exports to Eastern Europe will rise from about 2.5 billion cubic meters in 1970 to about 11 billion in 1975 and perhaps to 15-20 billion in 1980.

2. Eastern Europe

There has been little change in total production of crude oil in the Communist countries of Eastern Europe in recent years (a little more than 16 million tons annually, see Table 2) and no significant change is forecast for the future. Output of natural gas, however, has risen at an average annual rate of about 12% since 1965 and plans call for continued efforts to increase output, especially in Poland and Hungary. Because of the growing demand for oil and gas in these countries, plans call for greater imports of these fuels, primarily from the USSR.

Eastern Europe, excluding Romania which is a net exporter of oil, depends on the USSR for about 85% of its oil supplies and for a considerable amount of oil-field equipment and technical advice. Plans call for Eastern Europe to import at least 60 million tons of oil from the USSR by 1975, compared to about 36 million tons at the present time. Most of this oil will be delivered via the Friendship crude oil pipeline system (from the USSR to Czechoslovakia, Hungary, Poland, and East Germany) which is being expanded and will reach a total capacity of some 50 million tons by the mid-1970's. At the same time the USSR has also encouraged these countries to seek oil from the Free World. During the past 2 years

agreements have been made with Middle East countries -- Iran, Iraq, Syria -- to import oil in modest quantities during the 1970's in exchange for East European equipment and manufactured goods.

Since the 1967 report most of the East European countries have procured or sought to obtain equipment and technical data for exploration and production work from the US and other countries of the industrialized West. As stated in the earlier report, such imports probably have contributed to their technological advancement, but have not facilitated any significant increase in the production of petroleum that would make the area self-sufficient.

Table 1

Total Value of Soviet Trade in Oilfield Equipment in Selected Years

(Millions of US Dollars)

Year	Imports	Exports
1960	5.7	29.2
1962	23.5	32.5
1964	27.0	20.0
1965	24.0	17.5
1966	32.5	17.8
1967	41.7	16.8
1968	19.0	15.5

Table 2

Production of Crude Oil and Natural Gas in the USSR and Eastern Europe

Country	Crude Oil (Million Metric Tons) 1967	1968	1969	1970 plan	Natural Gas (Billion Cubic Meters) 1967	1968	1969	1970 Plan
USSR	288.1	309.2	328	350	157.4	169.1	181.3	197
Romania	13.2	13.3	13.2	13.3	20.7	21.9	24.1	25
Hungary	1.7	1.8	1.8	1.8	2.0	2.7	3.2	3.5
Poland	0.4	0.5	0.4	0.4	1.5	2.4	3.8	4.2
Bulgaria	0.5	0.5	0.3	0.4	0.3	0.5	0.6	1.0
Czechoslovakia	0.2	0.2	0.2	0.2	1.0	1.1	1.0	0.9
East Germany	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total	304.3	325.7	344.1	366.3	183.1	197.9	214.2	231.8

Table 3

Soviet Trade in Petroleum, 1968

(Million Metric Tons)

	Crude Oil	Petroleum Products	Total
Exports to:			
Free World	26.7	18.0	44.7
Communist Countries	32.5	9.0	41.5
Eastern Europe	27.3	5.0	32.3
Far East	0	1.3	1.3
Other	5.2	2.7	7.9
Total	59.2	27.0	86.2
Imports from:			
Eastern European Communist Countries	0	1.1	1.1
Free World	0	Negl.	Negl.
Total	0	1.1	1.1

B. Transportation of Crude Oil, Petroleum Products, and Natural Gas

USSR

At the end of 1969 the pipeline network in the USSR consisted of about 63,000 kilometers (39,000 miles) of gas lines and 37,000 kilometers (23,000 miles) of oil lines -- mostly for crude oil transport. This total network is only about 15% of that in the US. Before 1965, railroads carried more oil than any other mode of transport, at a cost about 3 times that of movement of pipeline. Since 1965, however, pipeline transport has accounted for the largest share of total tons carried. Development of oil pipelines was delayed in the early 1960's as priority was given to building the gas pipeline system.

In the future, continued priority will be given to construction of gas pipelines, especially to export natural gas to Western Europe and to increase transport of gas from West Siberia to the major consuming areas in the European part of the USSR. During the 1970's, Soviet demand for large-diameter pipe (40 inches and over) and ancillary equipment required to meet goals for transport of gas will far outstrip domestic capability for production. The Soviet Union has contracted for delivery of some 2 million tons of 40, 48, and 56-inch diameter pipe from Austria, West Germany, and Italy during 1970-72 as part of the agreements for delivery of Soviet natural gas to these countries. These quantities of pipe, however, will be in addition to some 16-18 million tons required during 1973-80 if the volumes of gas scheduled for production in 1975 and 1980 are to be transported. Such demands for pipe would require some 2-3 million tons per year. Domestic capacity for production of large diameter pipe now approximates 1 million tons per year and

is not being expanded very rapidly. During the period 1960-68 (5 years of which a NATO embargo on pipe exports was in force), the USSR bought a total of almost 2.5 million tons of large-diameter pipe, valued at about $470 million. Soviet fulfillment of production and transport goals for natural gas in 1980 depends upon constructing 6,000-7,000 kilometers of 99-inch line pipe. No country in the world has the capability to produce such pipe at the present time and it appears that installation of the anticipated amounts of such large pipe is too formidable a task to achieve by 1980.

C. Petroleum Products

The position expressed in the findings on pages 9 and 10 of the 1967 report is still valid. There is no current or foreseeable strategic US concern over the export of petroleum products to the USSR or the Communist countries of Eastern Europe. These countries have, or are acquiring, the basic technology to produce such products to meet civil and military needs.

1. USSR

The apparent consumption of petroleum products in the USSR rose from almost 87 million tons in 1958 to about 194 million tons in 1968, an average annual increase of some 8%. The supply of oil products, in general, has been adequate to satisfy the steadily growing domestic demand. There is, however, some inflexibility in refinery operations resulting at times in a range of product output that does not satisfy seasonal requirements or that does not meet quality specifications. Consequently sporadic local shortages of certain oil products occur. Local shortages also result from inadequate transport facilities during peak periods of consumption. For example, at harvest time when the railroads are overburdened, supplies of diesel fuel tend to be tight.

The yield of refined oil products in the USSR from 1958 to 1968 shows a sharp growth in the output of diesel fuel and residual fuel oil (See Table 4). The rise in the output of residual fuel oil resulted from increased demands of industry, especially for generation of electric power. The increased supply of diesel fuel was occasioned by the widespread use of diesel powered equipment in agriculture and transport. The Soviet Union claims to be self-sufficient in the

supply of lubricating oils but the output of additives for these oils is inadequate to meet all domestic needs. (The determination of strategic uses of additives for lubricating oils should be made by technical specialists, as recommended in the 1967 report.) Supplies of tetra-ethyl lead (TEL) are believed to be more than adequate for domestic requirements, as the USSR has exported more than 1,500 tons per year during 1965-68 and no imports have been reported.

2. Eastern Europe

Modernization and expansion of refineries in Eastern Europe have increased their flexibility and capability to provide a larger share of domestic supplies, primarily from processing imported Soviet crude oil.. However, oil products are still being imported from the USSR but in smaller amounts each year. The countries of Eastern Europe also are increasing exports of products where possible, primarily to neighboring countries in Western Europe, to earn hard currency: Such exports have risen to a level of about 8 million tons per year. The estimated yield of oil products, including those produced from coal, in Eastern Europe in 1968 is shown below:

	Million Tons	Percent
Charge to refining	42	100
Distillate fuels	23.9	55
Gasoline*	9.0	20
Kerosine*	1.7	4
Diesel fuel*	13.2	31
Lubricating oils	1.5	3.5
Residuals and others	14.5	34.5
Gas and loss	2.9	7

* Includes output of synthetic oil products that are not derived from charge to refineries or included in percentage yields.

The Communist countries of Eastern Europe are still deficient in supplies of TEL and additives for lubricating oils and are purchasing these products from Western European firms at infrequent intervals.

Table 4

Soviet Refining Yields, 1958 and 1968

	1958		1968	
	Million Tons	Percent	Million Tons	Percent
Charge to refining	100	100	235	100
Distillate fuels	54	54	121	52
Gasoline	19	19	39	17
Kerosine	14	14	22	9
Diesel fuel	21	21	60	26
Lubricating oils	4	4	8	3
Residuals and others	34	34	87	37
Gas and loss	8	8	19	8

D. Refining Equipment and Technical Data

1. USSR

Oil refining is a technologically backward branch of the Soviet petroleum industry. It lags far behind the US in quality of individual products, product mix, depth of refining, and complexity of refining processes. This situation resulted from failure to allocate necessary investment to refining during the late 1950's and early 1960's,[a] period of rapid growth in production of poorer quality crude oils that were more difficult to process. Many of the Soviet refineries receive crude oil containing 1%-3% water and as much as 1,500 pounds of salt per 1,000 barrels of oil because of the shortage of desalting and water removal equipment at the oilfields. Shipment of these highly corrosive impurities not only is uneconomical use of the pipelines, but also adds to processing costs by forcing refineries to build extensive desalting and water removal facilities.

As of 1 January 1970, total crude oil charge capacity in the USSR was about 285 million tons (5.7 million barrels/day), second only to the US in the world. Soviet capacity is concentrated in some 50 refineries with at least 60% of the total located in the Urals-Volga region and in the European part of the country, near the centers of consumption.

Soviet demand for high quality oil products is increasing, especially for higher octane gasoline and for diesel fuels with a low sulfur content. However, many of the secondary processing facilities -- such as catalytic cracking, catalytic reforming, hydrocracking -- that are necessary to improve quality and to increase flexibility of the product mix, are not being installed as rapidly as needed, or

when completed are not operated at design capacity. Failure to meet construction schedules for building new refineries has necessitated more intensive use of existing facilities to meet the demand for products. For example, thermal cracking units are being used for primary distillation when extra capacity is needed. In 1969, Soviet oil journals reported that not a single new refinery was started during 1961-68 and two important refineries planned in 1965 had not yet reached the blueprint stage.

Despite the lag in construction of new refineries during the present Five Year Plan (1966-70), new primary and secondary units of increased capacity were installed at existing plants. The first primary distillation unit with a capacity of 6 million tons per year (120,000 barrels/day) came on stream in 1969. Soviet journals indicate that the following types of secondary units are being built: (1) catalytic reformers with annual capacities of 600,000 and 1 million tons instead of the smaller 300,000 tons units; (2) catalytic cracking units with capacities of 750,000 and 1.2 million tons/year instead of those with only 500,000 tons a year; and (3) hydrogen treating facilities that have capacities of 1.2 million tons a year rather than the 600,000 and 900,000 tons/year units. Soviet journals mention that problems of developing a commercial hydrocracking process are being solved, but as of early 1970 no such facility was in operation in the USSR.

The Soviet Union has been a net importer of refining equipment for more than a decade. Before 1964 all of the imported refining equipment came from Romania and Czechoslovakia. Since that time, however, the USSR has begun to procure

refining equipment from East Germany, Italy, and France (see Table 5). In 1968 the value of imports of refinery equipment ($40 million) was almost double the value of such imports in 1967, primarily because of the purchase from France of a catalytic reformer and a hydrocracker, neither of which is believed to be in operation yet.

During 1971-75, priority is to be placed on building oil refineries and petrochemical plants east of the Urals to meet the anticipated needs of this area. Also, as the output of motor vehicles increases, the demand for output of higher quality gasolines will rise, thereby increasing the need for such processes as catalytic reforming and catalytic cracking. As the Soviet need for refining equipment and technical data increases, it is likely that greater efforts will be made to obtain them from the industrialized West.

2. Eastern Europe

In the Communist countries of Eastern Europe there has been a continued increase in refinery capacity, both in primary and secondary facilities. The 57 million tons of primary capacity anticipated, in the 1967 report, for the end of 1970 should be attained. During the past few years the East European countries have purchased equipment, technical data, and catalysts for the latest in secondary processing units. With their rising demand for oil products of higher quality it is reasonable to assume that they will continue to try to procure the latest in equipment and technology from the West.

Table 5

Soviet Trade in Refinery Equipment, 1966-68

(Thousands of US Dollars)

IMPORTS:

Year	Total	Country of Origin					
		Romania	East Germany	Czechoslovakia	Italy	France	Other (Unidentified)
1966	12,365	944	2,455	6,962	1,891	0	113
1967	20,652	0	12,045	4,544	755	3,157	151
1968	40,623	5,718	11,083	9,106	0	14,473	243

EXPORTS:

Year	Total	Country of Destination	
		East Germany	Other (Unidentified)
1966	181	174	7
1967	774	0	774
1968	46	0	46

E. Petrochemical Products and Related Equipment and Technology

1. Current Status of Communist Petrochemical Industries

The Communist petrochemical industries continue to grow at a relatively rapid rate although the development of indigenous petrochemical technology has been far from spectacular. According to the Soviet press, annual growth in production of petrochemicals in the USSR has averaged 15-20 percent over the past decade. In Romania, production of the petrochemical industry rose by 37.5 percent in 1969 alone. Combined production of plastics in the USSR and Eastern Europe quintupled during 1959-69. Despite this increase Communist production of plastics in 1969 was still only one-third of that in the European Economic Community (EEC), as it had been in 1959. Moreover, the actual quantitative growth in plastics in the EEC over the decade was more than triple that in the USSR and Eastern Europe. Soviet plans for increasing output of a number of petrochemical-based products during 1966-70 have been reduced, as illustrated by the following data (in thousand metric tons):

Product	Original Soviet Plan for 1970	Revised Soviet Plan for 1970
Plastics	2,100-2,300	1,630
Man-made fibers	780- 830	625
Synthetic rubber (est.)	1,250	860

Although reductions in Soviet and East European plans cannot be attributed solely to technological difficulties, the delays and errors experienced in development of new petrochemical processes and equipment have been major contributing factors. For example, an ethylene plant utilizing Soviet technology has been unable to operate at capacity, adversely affecting output of a polyethylene

plant purchased from a Free World firm. Similarly, the USSR has encountered delays in developing efficient commercial processes or catalysts for production of ammonia, ethylene oxide, polypropylene and a number of other products. The Soviet failure to develop effective petrochemical technology is indirectly reflected by the lack of Free World interest in purchasing such Soviet technology. In recent years the USSR has developed or shared in the development of only a few petrochemical processes that have been sold to Free World firms. The most significant of these processes appear to be for production of isoprene from isobutylene and formaldehyde, and for production of synthetic fatty acids by oxidation of paraffin. One sale of each process was made to the Free World in 1970. The isoprene technology was developed jointly by the USSR and the French Institute of Petroleum. The USSR also claims to have developed a similar isoprene process on its own and has licensed a Free World engineering firm to market the process in North and South America and in Western Europe. Preliminary evidence suggests that both the domestically-developed isoprene process and the fatty acid process will require modification to make them economically acceptable in most Free World countries. That the Soviet isoprene process may not yet be competitive with Free World processes is suggested by the recent Bulgarian interest in purchasing US technology for isoprene.

2. Acquisition of Foreign Technology

Technical data and associated equipment for manufacture of petrochemicals are widely available in Free World countries other than the US, and have been imported in substantial quantities by the Communist countries. Purchases of

this nature during 1967-69 were valued at more than $540 million* or almost 60 percent of total Communist purchases of chemical plant and technology in the same period. Soviet purchases of petrochemical and related equipment and technology accounted for $158 million, or almost 30 percent of the total purchases of this kind by the Communist countries. The value of such purchases from the Free World by each of the European Communist countries during 1967-69 is shown in Table 6, and information on the types of plants purchased, in Table 7. The principal suppliers, in order of rank, were the UK, France, West Germany and Japan. US sales were limited largely to technical data and amounted to a relatively small share of the total. The types of US technology currently of interest to the Communist countries are shown in Table 8.

The USSR and the countries of Eastern Europe will continue to rely heavily on Free World petrochemical technology during 1971-75. In early 1970 East Germany signified intent to purchase chemical plants and technology valued at $150 million from Japan. Included in the installations sought by East Germany are plants for production of ammonia, propylene oxide, and other petrochemicals. Poland will invest heavily during 1971-75 in crude oil facilities, and in petrochemicals and related products such as man-made fibers and synthetic rubber. Whereas oil accounted for 30 percent of the raw materials used to make Polish chemicals in 1969, it is scheduled to account for one-half of a much larger chemical output in 1975. The USSR, in addition to emphasizing the rapid growth of petrochemical-derived synthetic materials, is embarking on an ambitious

* Purchases of petrochemical equipment and technology by the Communist countries in 1958-66 are estimated at about $900 million.

fertilizer program, and may be in the market for additional ammonia, urea and complex fertilizer plants. Hungary, which purchased very little Free World petrochemical equipment and technology through 1969, is planning a very large fertilizer complex, for which contracts were awarded to French and US firms in 1970.

The Communist countries clearly intend to export some of the petrochemical and related products obtained as a result of purchasing Free World technology. Czechoslovakia, which has been negotiating for the purchase of US polybutylene technology, reportedly plans to export to Western Europe one-quarter to one-third of the output of the plant it will build. During 1971-75 Romania plans to increase substantially present exports of polyvinyl chloride, polyethylene, polyester fibers and synthetic rubber. For example, in 1974, some 50 percent of the total scheduled output of 100,000 tons of synthetic rubber is to be exported. Although significant Communist penetration of petrochemical markets in the larger Free World countries is unlikely in the next 3-5 years, some Communist petrochemical products will be sold in these countries, either directly or indirectly if Communist products are accepted as partial payment by Free World suppliers of petrochemical technology and plants.

3. Impact of Current Controls

Clearly, US export controls have not prevented the Communist countries from acquiring much of the petrochemical plant and technology they sought from other Free World countries. In some cases, however, US denial probably delayed such purchases or forced the Communist countries to purchase technology that was less effective than that developed in the US. As early as 1958 the USSR attempted

to obtain from a US firm a one-stage process for production of butadiene from butane. An export license for this technology was denied and the USSR has been producing butadiene by a less efficient two-stage process and by a high-cost, outmoded process utilizing ethyl alcohol. Finally, in 1970, the USSR contracted to purchase a butadiene plant from Japan, but at least part of the technology will come from the US firm involved in the 1958 license request.

The USSR also tried (in 1965-67) to purchase US technology for catalysts used in the manufacture of ammonia. An export license was again denied. The USSR is building a plant to produce improved ammonia catalysts using Soviet technology, but the plant is not scheduled for initial operation until 1971 and, as of September 1969, it was reported that virtually nothing had been done.

Thus, at least in a few cases, denial by the US did not result in immediate purchase from other Free World countries. Furthermore, at least certain US processes probably were more economical or yielded a product of higher quality, although supporting evidence is difficult to obtain. The USSR reportedly has not been entirely satisfied with the polyethylene process and equipment ordered from the UK in 1963 and used at four Soviet plants.

Despite the examples cited, the Communist countries have purchased increasing quantities of technical data and equipment from the Free World as Free World countries have developed greater capability in the petrochemical field and as US attitudes on denial have changed. The previous inter-agency task force on petroleum and petrochemicals recommended in 1967 that independent non-governmental studies be made to identify petrochemical products, processes and equipment

which were of significant strategic concern to the US or over which the US had unilateral control. These recommendations have not been implemented but would still appear to be valid.

Table 6

Value of Communist Purchases of Free World Petrochemical Equipment and Related Technology, 1967-69*

Purchasing Country	1967	1968	1969	Total, 1967-69	Percent of Total Chemical Plant Purchases, 1967-69
USSR	42.8	51.1	63.6	157.5	45
East Germany	7.7	57.1	31.0	95.8	72
Czechoslovakia	8.9	29.1	55.2	93.2	77
Poland	81.5	6.6	1.5	89.6	85
Bulgaria	6.2	38.4	10.0	54.6	76
Romania	22.8	6.2	23.0	52.0	40
Hungary	0	1.2	0	1.2	26
Total	169.9	189.7	184.3	543.9	59

* Data are partially estimated and exclude the value of a few contracts for which no financial information is available.

Table 7

Petrochemical and Related Plants* Purchased from the Free World, 1967-1969

Buyer and Date of Purchase	Type of Plant	Country of Origin	Value (Million US $)
USSR			
1967	Acrylic fiber	UK	26.3
	Acrylic resins	Belgium	N.A.
	Ammonia	France	5.7
	Detergents	Italy	2.0
	Ethylene oxide/glycol	Japan	11.0
	Vitamin A	France	7.8
1968	Acrylonitrile-butadiene-styrene resin	Japan) US)	12.4
	Complex fertilizer	West Germany) Netherlands)	3.3**
	Lube oil additives	UK	1.9
	Perchloroethylene and carbon tetrachloride	France) US)	4.7
	Polybutadiene equipment	West Germany	0.4
	Vinylidine chloride	Japan	8.4
	Miscellaneous	--	20.0
1969	Ammonia	Japan) US)	24.0
	Lube oil additives	UK	6.0
	Polyester film complex	UK	30.2
	Styrene-butadiene latex	UK	3.4

* A few of these contracts are for individual units of equipment rather than for complete plants.
** Believed to represent only partial value of contract.

Table 7

Petrochemical and Related Plants Purchased from the Free World,
1967-1969
(continued)

Buyer and Date of Purchase	Type of Plant	Country of Origin	Value (Million US $)
Bulgaria			
1967	Carbon bisulfide	Italy) US)	2.7
	Polystyrene and ABS	France) US)	3.5
1968	Fertilizer complex	UK) France) Belgium) Netherlands)	38.4
1969	Dimethyl terephthalate	West Germany	10.0
Czechoslovakia			
1967	Ammonia/urea equipment	UK	0.5 (est.)
	Paraxylene	UK	8.4
1968	Acetylene-ethylene) Vinyl chloride)	West Germany	10.0
	Benzene, toluene and xylene	West Germany	5.0
	Phthalic anhydride	France	4.1
	Polypropylene	Japan) US)	10.0

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Table 7

Petrochemical and Related Plants Purchased from the Free World,
1967-1969
(continued)

Buyer and Date of Purchase	Type of Plant	Country of Origin	Value (Million US $)
Czechoslovakia			
1969	Acrylonitrile-butadiene-styrene (ABS)	Italy	4.7
	Ammonia/urea	West Germany	22.5
	Cumene	UK	N.A.
	Cyclohexanone	US) West Germany)	9.6 (est.)
	Epichlorohydrin	Netherlands	2.5
	Polystyrene and ABS	France	9.0
	Urea	Netherlands) West Germany)	6.9
East Germany			
1967	Compressors for nitrogen fertilizer	Belgium	0.7
	Polybutadiene	Japan) West Germany)	7.0
1968	Polyethylene	UK) US)	7.4
	Polyurethane	France) US)	49.7
1969	Terephthalic acid and xylene	UK) US)	31.0

Table 7

Petrochemical and Related Plants Purchased from the Free World, 1967-1969
(continued)

Buyer and Date of Purchase	Type of Plant	Country of Origin	Value (Million US $)
Hungary			
1968	Ammonia	West Germany	1.2
Poland			
1967	Ammonia, ammonium nitrate, and nitric acid	France	60.0
	Process technology for benzene, toluene and xylene	US	N.A.
	Butadiene	UK	14.0
	Compressors for ethylene plant	US	1.4
	Dimethyl terephthalate	West Germany	6.1
1968	Acetylene (compression and purification equipment)	West Germany	N.A.
	Ammonia (synthesis separation unit)	UK	0.6
	Polyethylene	UK	6.0
1969	Caprolactam purification equipment	Switzerland	N.A.
	Polyethylene	Japan	1.5
Romania			
1967	Ammonia	UK	15.4
	Ammonium nitrate	France	4.0 (est.)

Table 7

Petrochemical and Related Plants Purchased from the Free World, 1967-1969
(continued)

Buyer and Date of Purchase	Type of Plant	Country of Origin	Value (Million US $)
Romania			
1967	Benzene	Italy) US)	1.4
	Polystyrene	UK	2.0 (est.)
1968	Alkylamines	UK	2.4
	Maleic anhydride	UK) US)	3.8
1969	Ammonia	West Germany	17.5
	Chlorinated solvents	France	0.5
	Urea	Belgium) West Germany)	5.0

Table 8

Types of US Petrochemical and Related Technology
Being Sought by Communist Countries in
January-June 1970

Communist Country	Type of Technology/Plant
USSR	Acrylonitrile copolymers
	Ammonia
	Benzene and ethyl benzene
	Butyl rubber
	Ethylene and propylene
	Phthalic anhydride
	Polybutylene and polyisobutylene
	Polyethylene
	Polypropylene
	Polystyrene
	Polyurethane
	Styrene
	Vinyl chloride monomer
Bulgaria	Ethylene
	Hydrogen
	Isoprene
	Propylene
Czechoslovakia	Nitrogen products
	Phenol
	Polyethylene
	Polypropylene
East Germany	Ammonia
	Aromatics
	Caprolactam
	Carbon black
	Polyethylene
	Urea

Table 8

Types of US Petrochemical and Related Technology
Being Sought by Communist Countries in
January-June 1970
(continued)

Communist Country	Type of Technology/Plant
Hungary	Complex fertilizer
	Cumene-phenol
	Ethylene
	Polyvinyl chloride
Poland	Ethylene
Romania	Caprolactam
	Ethylene
	Polyisoprene