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ECONOMIC INTELLIGENCE REPORT 12

BASIC AROMATIC CHEMICALS IN EAST GERMANY

CIA/RR 56

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S-E-C-R-E-T

ECONOMIC INTELLIGENCE REPORT

BASIC AROMATIC CHEMICALS IN EAST GERMANY

CIA/RR 56

(ORR Project 22.160)

CENTRAL INTELLIGENCE AGENCY

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FOREWORD

The purpose of this report is to describe the East German supply, distribution, and consumption of basic aromatic chemicals obtained from coal and the intermediates and products derived from them.

The scope of this report is limited to consideration of the aromatic series of organic chemical compounds. Detailed discussion is restricted to those aromatic compounds, generally known as aromatic chemicals, which, because of supply factors or industrial applications, are of primary importance to the chemical industry of East Germany. These chemicals are benzene, toluene, xylene, naphthalene, phenol, cresol, and aniline. Other aromatic chemicals, such as xylenol, anthracene, and pyridine and other tar bases, are discussed only briefly; at the present time they are of secondary importance in East Germany.

Although most basic aromatic chemicals produced in East Germany are byproducts of the recovery and processing of coal tar from the coking and illuminating gas industries, analyses of the technology of those industries are not presented in this report. Such analyses are readily available in other publications.

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BASIC AROMATIC CHEMICALS IN EAST GERMANY*

Summary

The aromatic chemicals industry of East Germany is an essential component of the country's industrial economy and is a significant contributor to the economic development of the Soviet Bloc. The East German industry is more highly developed than that of any of the other Satellites, and in the production of some industrial chemicals it probably exceeds that of the USSR.

In East Germany, the basic aromatic compounds,** or chemicals, are derived from coal and its tar. The aromatic chemicals of major importance to East Germany are benzol,*** toluol, xylol, naphthalene, phenol, cresol, and aniline. These chemicals constitute the raw materials, or "building blocks," for many important industrial products -- rubber, explosives, plastics, synthetic fibers, dyestuffs, insecticides, pharmaceuticals, photographic film, solvents, tanned leather, and synthetic essential oils.

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* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 August 1954.

** The term aromatic compounds was originally applied to various naturally-occurring substances with an agreeable aroma (such as oil of wintergreen, vanillin, etc.) obtained from resins, balsams, and volatile oils, but was later restricted to benzene and compounds related to benzene (C_6H_6) whose molecular structures consist of one or more closed-chain or rings, chiefly of carbon atoms.

*** Benzol (benzene) is a definite chemical substance, C_6H_6, and should not be confused with "benzine," which is a petroleum ether, a complex mixture of hydrocarbons. To avoid confusion, the term benzol will be used in this report when reference is made to those chemicals based on the hydrocarbon benzene. In like manner, toluol will be used instead of toluene, and xylol instead of xylene. Exceptions will be made only when it is necessary to distinguish the pure chemical substances from the crude or refined product.

Numerous sectors of the economies of the other Soviet Bloc countries are reliant upon the intermediates and end products produced by East Germany from aromatic chemicals. Perhaps the most significant uses of aromatic chemicals, both in the Satellites and in the USSR, are in the production of explosives and in the manufacture of other military end products such as aircraft tires, parachute materials, and color-film dyes.

At the present time, East Germany is incapable of producing several of the aromatic chemicals (benzol, toluol, naphthalene, and aniline) in quantities sufficient to cover domestic requirements. Import of these chemicals is necessary to close the gap between domestic output and demand. Benzol and naphthalene are imported in great quantities from the USSR, Poland, and Czechoslovakia. All imports of toluol originate from the USSR. As no aniline is known to be produced in East Germany, the total supply must be imported, mainly from the USSR and Poland. Although phenol is in short supply, no imports have been reported, probably because phenol is scarce in the Soviet Bloc.

A materials balance for the important aromatic chemicals in East Germany can be estimated for 1954 on the basis of production estimates and preliminary plans for foreign trade. East Germany is expected to produce about 10,800 metric tons* of refined benzol, to import 22,000 tons, and to export 4,000 tons. Thus, domestic consumption** of refined benzol will be about 29,200 tons during 1954. Toluol production is estimated as 4,000 tons and 3,200 tons more are to be imported. As there are no planned exports of toluol, East German consumption of toluol is estimated as 7,200 tons. The estimated production of xylol in 1954 is about 1,000 tons, and because no imports or exports are planned, domestic consumption will equal production. Production of naphthalene is estimated as 5,800 tons, and planned imports total 17,000 tons. No exports of naphthalene are anticipated, so consumption will equal the sum of production and imports, 22,800 tons. The production of refined phenol in East Germany during 1954 is estimated to be about 11,800 tons, of which only 50 tons are scheduled for export. Since no refined phenol imports are planned, domestic consumption should be about 11,750 tons. Production of cresols is estimated

* Tonnages throughout this report are given in metric tons.
** As there is no evidence that more than negligible quantities of aromatic chemicals will be stockpiled in East Germany in 1954, it can be assumed that total supply equals consumption.

at about 17,900 tons, and planned exports total 1,600 tons. East German consumption of cresol is estimated as 16,300 tons. All aniline consumed by East Germany is available only from import. The aniline import plan figure for 1954 is 2,100 tons.

Subsequent to 1952, available data are incomplete on the consumption of basic aromatic chemicals in East Germany. The preparation of reasonably complete consumption patterns was possible for 1952. The consumption patterns show that the major consumer of aromatic chemicals in East Germany was the rubber industry. The manufacture and fabrication of synthetic rubber consumed about three-fifths of the total supply of benzol, one-third of the supply of naphthalene, and two-thirds of the supply of aniline. East German industries manufacturing synthetic materials such as plastics, resins, lacquers, and fibers required the second largest proportion of the total supply of aromatic chemicals. These industries consumed about four-fifths of the phenol, three-fifths of the cresol, and one-third of the naphthalene total supplies. Aromatic chemicals employed as solvents and diluents in various industries accounted for the third largest use. Approximately four-fifths of the total supply of xylol, one-half of the supply of toluol, one-seventh of the supply of naphthalene, and one-tenth of the supplies of benzol and cresol were used for solvents and diluents. In terms of quantitative consumption of aromatic chemicals, the East German explosives industry was relatively unimportant in 1952. It is significant, however, that about one-fifth of the total supply of toluol was used in the production of explosives, and about 8 percent of the aniline was probably used in the manufacture of smokeless powder stabilizers.

The aromatic chemicals industry of East Germany has adequate supplies of process materials and energy. Coal, especially bituminous coal, and electric power shortages are frequent threats to the industry, but thus far they have not affected production to a serious degree. The major input of the industry is bituminous coal, and it is estimated that the consumption of coal in 1952 was 2.8 million tons. Manpower requirements for the actual production of the basic aromatic chemicals in East Germany are small; an estimated 2,260 employees were engaged during 1952.

Among the basic aromatic chemicals required by East Germany, only one, cresol, is produced in quantities which permit sizable exports. A planned export of 4,000 tons of benzol in 1954 was made possible, however, because the USSR cancelled its annual import of ethylbenzene from East Germany. The East German Five Year Plan (1951-55) calls for increased production of most of the aromatic chemicals, but it appears likely that actual production by 1955 will fall short of plan figures. Possibilities of expanding production appreciably after 1955 depend upon new plant construction and the relief of present equipment and power shortages, and they do not appear favorable.

Potential areas of vulnerability in the East German aromatic chemicals industry are the concentration of production in a relatively few plants, the necessity of importing major quantities of some of the aromatic chemicals of primary importance, the dependence on an over-burdened railroad system, and the continuous threat of coal and electric power shortages.

The aromatic chemicals industry is a possible indicator of Soviet intentions to the extent that its use pattern may show a shift of emphasis from peacetime industrial uses to production of absolute military uses. At the present time, there is no clear indication of such a shift.

I. Introduction.

A. History of the Industry.

The history of the production of aromatic chemicals from coal in Germany is closely related to the history of the production of coke. Before 1900 the center of German coke manufacture was in the eastern area (Silesia and Saxony), but the Ruhr coking industry grew rapidly, and by the time of the outbreak of World War II the Ruhr was the most important coking district in Germany. In 1939, Western Germany was producing nearly five times as much coke as the eastern portion. In 1943 about 70 million tons of coal were carbonized at coking plants and 10 million tons at gas plants in the western area. 1/* During 1938, about 372,000 tons of coal were carbonized by cokeries and 1.75 million tons by gas plants in the present area of East Germany. 2/

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After 1930, practically all bituminous-coal (or hard coal)* tar produced in Germany was distilled. The tar-distilling plants obtained the greater proportion of their coal tar from coke ovens. Prior to World War II, only about 20 percent of the total was produced in gas plants. In 1943, approximately 2.3 million tons of tar were processed by German tar-distilling companies. Eastern distilleries, including those in Silesia, processed about 450,000 tons of tar, less than one-fifth of the total production in Germany. The distilleries in the area which is now East Germany processed only about 137,000 tons, less than 6 percent of the total tar processed in all Germany. 3/

The German coal-tar industry developed to great lengths the commercial separation of coal-tar components. The production of certain coal chemicals was commercially possible only because some plants processed large quantities of tar. For this reason, production of coal chemicals was confined almost entirely to syndicates specializing in tar processing. One of the largest of these syndicates, Ruetgerswerke AG, owned two distilleries in the present area of East Germany. These plants were located at Erkner (near Berlin) and Niederau (in Saxony near Meissen). In 1943, both plants together processed about one-fifth of all tar processed (518,000 tons) by Ruetgerswerke AG.**

In addition to bituminous-coal tar, which is obtained by high-temperature (usually about 900°C) carbonization of the coal, a comparable amount of a second kind of tar was produced during World War II. This was obtained by low-temperature (500 to 600°C) carbonization (LTC) of brown coal.*** Based on the quantities of tar processed, the high-temperature and low-temperature tar industries were about equal in size in 1943, but they differed so much in all other respects that they were virtually two separate industries.

Low-temperature carbonization was introduced in Germany on a large commercial scale just prior to World War II. Because of the imminence of the war and because Germany had only a limited supply of natural petroleum, the rearmament program included the erection of synthetic-oil plants capable of utilizing brown coal and

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* The term hard coal is used in European terminology to include both anthracite and bituminous coal. The German term used is Steinkohle.
** For a map showing the major producing and consuming plants in the East German aromatic chemicals industry, see inside back cover.
*** The term brown coal is used in European terminology to describe all grades of brown coal and lignite.

bituminous coal. The costs of the processes were very high, compared with the cost of natural petroleum, but development was necessary for self-sufficiency, an important consideration for Germany in time of war. Low-temperature tar from brown coal and, to a much less extent, from bituminous coal ultimately was the basis for a substantial part of Germany's liquid-fuel output. During the war, large low-temperature carbonization plants provided substantial supplies of coke particularly suitable for the Fischer-Tropsch synthesis of liquid and solid products, of fuel oil for the navy, of motor spirits, and of oil for hydrogenation in the manufacture of gasoline and diesel oil.

The low-temperature tar oils had high contents of phenolic substances. Phenols extracted from tar oils were useful in the production of high-quality diesel oils. Extraction processes were developed, and plants were erected in the present confines of East Germany to treat the middle-oil fractions of low-temperature brown-coal tars. Only a few plants, however, were equipped for refining the crude phenols obtained and for the production of refined phenol and cresols.

The effluents from tar-producing and tar-processing plants, because of their phenolic content, pollute municipal water supplies when dumped into rivers. By the end of the war effluent treatment to remove phenols was highly developed in Germany. The effluents from coal-carbonization plants were also a substantial source of crude phenols for industry. Special processes suitable for use with the liquors from low-temperature carbonization plants had to be developed. Two plants (at Leuna and Boehlen) in which is now East Germany were equipped to recover phenols from effluents.

Crude benzol production and refining plants throughout Germany were concentrated mainly in the various coal-producing areas. Of the total crude benzol produced, less than 2 percent was obtained from the distillation of hard-coal tar, the remainder originating from the washing of coke-oven and gas-plant gas. In 1943, the Ruhr area contributed about 54 percent of the total production of refined benzol and its homologs, while the eastern area (Silesia and Saxony) provided only about 18 percent. The total output amounted to about 690,000 tons (equivalent to about 206 million US gallons), including 40,000 tons from small gas plants. 4/ During 1938, in the area which is now East Germany, the production of crude benzol was 17,100 tons. 5/

The postwar division of Germany into occupation zones isolated East Germany from adequate supplies of coking coal. The hard-coal deposits in the Zwickau-Oelsnitz district are hardly worth mentioning, but they do furnish much of the raw material for two cokeries in that region, August Bebel (formerly Estav) and Karl Marx (formerly Gewerkschaft Morgenstern), both outmoded installations. War damages and dismantling in the August Bebel plant reduced its prewar capacity by about 30 percent. In 1950, funds finally were approved to obtain materials to repair badly damaged coke batteries so that former capacity could be attained and further deterioration of equipment could be arrested. No large expansion is expected at either cokery. 6/

Poland is the main source of supply for hard coal to sustain the East German gas economy. The gas-consumption structure in East Germany explains why many large production areas contain a great number of small plants located close to the individual areas of consumption. Before the war, most gas plants were operated as communal enterprises by public authorities, but a number were privately owned -- particularly the plants servicing Leipzig and Dessau. The most essential obstacles to be overcome following the war were war damage and the difficulties in obtaining the necessary hard coal. Before the war, there were 225 gas plants using hard coal in the area of East Germany, but at the beginning of 1946, only 133 plants were in operation. In 1946, all gas plants, excluding those in Berlin, consumed 920,000 tons of hard coal to produce 676,000 tons of gas coke, 25,200 tons of gas tar, and about 2,500 tons of crude benzol. 7/ The coke output represented a reduction of about 60 percent from the 1943 output. 8/ Production of gas coke in 1947 increased over that of 1946 because there were 182 plants in operation. 9/ In 1952, although there were about 210 gas plants operating on hard coal, only 194 plants were expected to be able to produce gas tar. One source reports that the number of plants using hard coal is expected to decline by the end of 1955 because smaller enterprises will be consolidated into large production plants and gas combines will be established. 10/

Of the two large hard-coal tar distilleries (at Erkner and Niederau) existing in East Germany before the end of the war, only the Erkner plant remains. Niederau was dismantled in 1945. Erkner suffered little war damage and, except for naphthalene production, was capable of full-capacity operation, provided sufficient tar was made available. 11/ This plant has a capacity greater than can be utilized by the raw materials available within East Germany. The plant is considered one of the key installations in the present economy of the country. Since 1951, capacities for distillation of benzol and production of naphthalene have been enlarged. Further enlargement, except for production of phenol, is territorially impossible, but present capacity suffices for taking all hard-coal tar from the gas plants in the area. The small tar distilleries at Velten and Doebeln can process some tar, but the intermediates must be shipped to Erkner for final processing. 12/

The construction of a coking plant was planned for the VEB (Volkseigene Betrieb -- People's-Owned Enterprise) Eisenhuetten Kombinat Ost (Ironworks Combine East) in Stalinstadt (formerly Fuerstenberg/Oder). The required hard coal was to be obtained from Upper Silesia, but Poland decided to deliver only coke. A byproducts installation at this coking plant was to produce 47,000 tons of tar per year by 1955, which was then to be processed in a new tar distillery built within the combine. It was intended that this distillery would make unnecessary the previously planned construction of a similar distillery at Luetzkendorf. The proposed, but later canceled, tar distillery at Eisenhuetten Kombinat Ost was to have an annual capacity of 100,000 tons, but because 50,000 tons of tar would have to come mainly from gas plants in the Saxony area, the location was unfavorable. 13/ It is now known that East Germany has abandoned all plans for constructing any large plants for processing hard-coal tar. 14/

During 1951 a Fischer-Tropsch gas-synthesis plant at Luetzkendorf was dismantled, probably because operations proved too costly. Up to this time, Luetzkendorf had been a small contributor of benzol, a byproduct of the manufacture of synthetic fuels. Some of the plant's equipment may have been sent to a second Fischer-Tropsch installation at Schwarzheide, but there is no information to indicate that this plant produces benzol (or toluol) in quantity. 15/

The processing of effluents from low-temperature carbonization plants and hydrogenation plants utilizing brown coal, its tar, or its oils has been developed to a higher degree in the postwar period. Additional plants now have units to recover crude phenols, and future plans include more plants to adopt recovery methods. Only three plants are capable, however, of producing refined phenol and its homologs, for apparently no new plants have been constructed since the dismantling of Niederau.

B. Technology.

1. Crude Benzol and Hard-Coal Tar.

The carbonization of coal is the destructive heating of the coal in the absence of air, resulting in the formation of a solid (coke) in the retort and the evolution of a number of volatile products. High-temperature carbonization (HTC) (usually above 900°C) is used for the production of metallurgical or foundry cokes and for the manufacture of gas in byproduct coke ovens and in gas retorts. The volatile products consist essentially of gas, ammonia, tar, and light oil. From the tar and light oil are produced various aromatic coal chemicals. Up to a few years ago, the volatile products were commonly called byproducts, but their importance justifies the term coal chemicals, by which they are now commonly known. The yields and character of the carbonization products depend primarily on the severity, duration, and nature of the heat treatment.

The light oil represents only about 1 percent of the volume of the coke-oven gas. Recovery of light oil is generally practiced in coke ovens, but it was not until the demand for toluol became insistent during World War I that plants for the recovery of light oil were introduced into municipal gas plants. The principal constituents of light oil (hereafter called crude benzol) from hard coal are benzol, toluol, and xylol (a mixture of xylene isomers). The boiling points of the crude benzol components rise progressively by temperature intervals and consequently can be separated from each other satisfactorily by fractional distillation. A number of the xylene isomers, for example, boil at temperatures which are so close together that their separation by distillation is impractical.

The tar produced in the carbonization of hard coal is composed of compounds which range from the relatively simple ones which make up crude benzol to the highly complex substances which form the pitches. The composition of tar depends on the temperature of carbonization and, to a lesser extent, on the nature of the coal used. High-temperature, hard-coal tars contain significant proportions of aromatic compounds such as naphthalene, phenol, cresols, and xylenols. Of more than 200 compounds which exist in tar, a relatively few are recovered on a commercial scale.

The only large tar distillery remaining in East Germany -- VEB Teerdestillation- und Chemische Fabrik Erkner (near Berlin) --

has seven tar-distilling stills, mounted vertically directly below cast-iron fractionating columns, each of which has from 20 to 40 trays. The equipment operates on a batch basis. Thus direct fractionation of tar in one cycle produces fractions of tar which are sufficiently close for all subsequent processing. It is claimed that this procedure facilitates direct manufacture, with a fairly high degree of purity, of compounds such as naphthalene and acenaphthene. Figure 1* is a graphic presentation, based on the 1952 production plan, of the flow of materials and the resulting end products at the Erkner distillery. 16/

During the tar fractionation, a middle oil containing tar acids, naphthalene, and tar bases (pyridine -- for synthesis of vitamins and pharmaceuticals) is recovered. The tar acids are phenolic compounds and include phenol, cresols, and xylenols. After the removal of the tar acids and tar bases (pyridine), crude naphthalene is recovered from the middle oil, usually by a crystallization process in boxes, or pans. The Erkner plant had 45 boxes in 1952. 17/ After crystallization is complete, the naphthalene crystals are centrifuged and washed with hot water to remove entrained oil. Pressing the crystals in a steel cylinder with a heated (40°C) hydraulic press removes the last traces of oil, and most other impurities are carried away as lower melting portions dissolve. Erkner's refined naphthalene product, "warm-pressed" naphthalene, melts at 78.8 C, contains few impurities, and is satisfactory for most industrial uses. It is believed that no pure naphthalene is now produced at Erkner.

2. Crude Tar Acids (Crude Phenols).

Crude tar acids are the acidic (phenolic) constituents of tar and consist of phenol and its homologs, the cresols and xylenols and higher phenols boiling at 250 to 360°C. The bulk of the tar acids obtained in East Germany originates from brown coal and its tar and oils rather than from hard-coal tar. The great abundance of brown-coal deposits in the area appears to assure ample future supplies of tar acids, provided satisfactory and economical means to recover the acids are employed.

The process of carbonizing brown coal at temperatures approximating 500 to 600°C is known as low-temperature carbonization. The most important effect of low-temperature carbonization is a higher yield of tar than is produced in gas plants and coke-oven installations employing a high-temperature carbonization process on hard

* Following p. 10.

Figure 1

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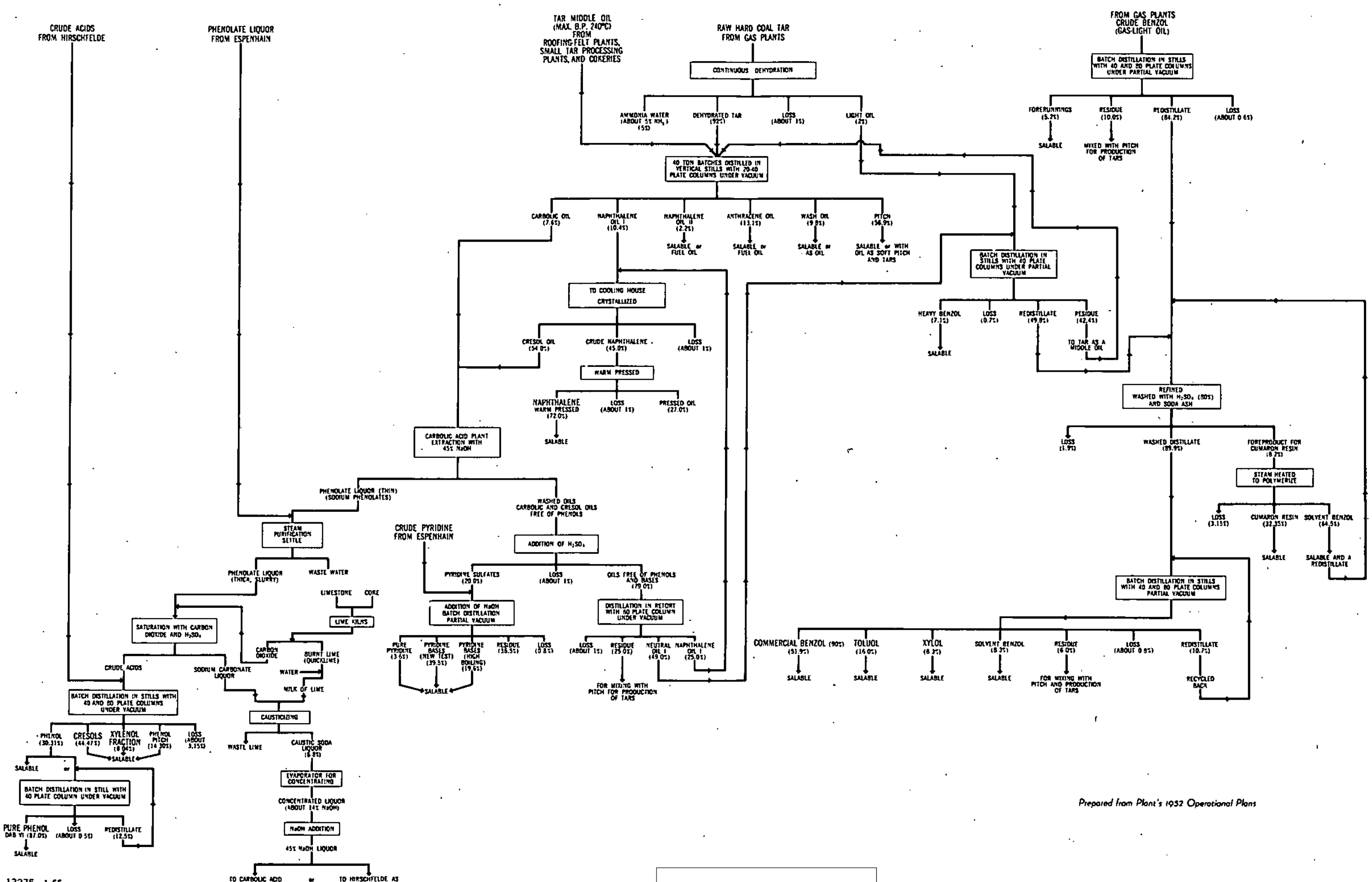
EAST GERMANY

PROCESS FLOW CHART FOR RAW HARD-COAL TAR, CRUDE BENZOL, AND CRUDE PHENOLS

VEB TEERDESTILLATION-UND CHEMISCHE FABRIK ERKNER



Prepared from Plant's 1952 Operational Plans

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coal. The low-temperature tar, compared with hard-coal tar, contains a higher percentage of tar acids but almost no other aromatic chemical compounds.

The development of the low-temperature carbonization industry in Germany was the result of the critical demand for liquid fuels before World War II. Brown coal, and the tar and oils derived therefrom, was the basis for the synthetic fuel industry. Plants erected in the present area of East Germany to produce low-temperature tars and oils were equipped to use the Lurgi-Spuelgas process (employs internally heated ovens) rather than the Krupp-Lurgi process, because locally available feed stock, lignitic brown coal, has a high moisture content (25 to 55 percent).

Installations to recover the phenolic byproducts (the tar acids, or crude phenols) were constructed at synthetic fuel plants. The Lurgi firm developed the Metasolvan process, using dilute methyl alcohol as the solvent for extracting the crude phenols from tar oils, to produce good diesel oils. Similar plants were erected toward the end of the war at Altenburg (Rositz plant) and Zittau (Hirschfelde plant) to treat middle oil from brown coal tars, but the war ended just as they were to go into production. The metasolvan process was limited to certain types of oils and specific oil fractions. A much more widely used process for the extraction of crude phenols by the use of caustic soda has since been developed.

Fairly elaborate plants are required to remove phenols from effluent liquors or waste waters (Schwelwasser) of hydrogenation and low-temperature carbonization plants which contaminate local water supplies. The Lurgi firm, with I.G. Farbenindustrie AG, developed the phenosolvan process that uses technical butyl acetate as the solvent; the solvent is subsequently distilled off, leaving the phenols. Plants at Leuna (near Merseburg) and Boehlen reportedly employ this same process. Other processes were developed to dephenolize waste liquors, and many were based on the principle of using selective solvents. One of these, the tricresylphosphate process, is now used by a plant at Zeitz which hydrogenates brown-coal tar and its light oil. Most of the processes, however, proved too costly, particularly when quantities of high-boiling phenols are encountered. A biological dephenolation process whereby residual phenols are destroyed in phenol-thin liquors can be used to minimize stream pollution.

[redacted] research work to support the endeavor to raise the phenol production of East Germany has been continuing. More efficient and economical ways are being sought to recover phenolic compounds employing the basic principles of distillation and extractive separation.* Progress to date appears to have been slow in determining and developing the most economic methods for recovering phenols from middle oils and other fractions of low-temperature tars. A continuing phenol shortage in the postwar period has thwarted expansion in some industries which require phenol as a raw material. Further research effort and capital investments are justified, if only to satisfy the needs of the synthetic plastics industry. 50X1

C. Organization.

1. January 1953.

Most chemical plants in East Germany, as of 1 January 1953, were administered by HV Chemie (Hauptverwaltungen Chemie -- Main Administration for Chemistry). HV Chemie was one of three administrations controlled by the Staatsekretariat fuer Chemie, Stein, und Erden (State Secretariat for Chemistry, Stones, and Earths). The two other administrations were HV Steine und Erden (Main Administration for Stones and Earths) and HV Kali und Nichterzbergbau (Main Administration for Potash and Non-Ore Mining). HV Chemie, in turn, had under its jurisdiction various groups or enterprises, each enterprise consisting of a number of plants. The enterprises were known as VVB's (Verwaltung Volkseigener Betriebe -- Administration of People's-Owned Enterprises). Individual VVB's were composed of plants which, in general, produced similar products. In 1952 there were six centrally administered VVB's: Inorganic Chemistry, Organic Chemistry, Paint and Lacquers, Plastics, Pharmaceutical Products, and Potash and Non-Ores. The names of plant members in each VVB were preceded by the letters VEB (Volkseigene Betriebe -- People's-Owned Enterprises).

On 1 May 1952 the Soviet government returned 66 plants to German ownership. Up to this date these plants were Soviet-owned and had been designated as SAG plants (Sowjetische Aktiengesellschaft** -- Soviet Corporation). Included in the list

* See Appendix D.

** SAG may also mean Staatliche Aktiengesellschaft -- State Corporation.

of plants returned were two very important chemical plants, Elektrochemisches Kombinat Bitterfeld and Farbenfabrik Wolfen. Both plants were formerly owned by I.G. Farbenindustrie AG, but under Soviet control they were members of SAG Kaustik. The USSR also returned to German ownership some synthetic fuel, liquid fuel and oil, and tar (from brown coal) processing plants located at Goelzau, Rositz, Webau, Koepsen, and Mueckenberg. All these plants were members of SAG Synthese. The USSR, on the other hand, retained ownership of synthetic fuel plants at Zeitz and Schwarzheide. Some chemical plants which the USSR also retained were Chemische Werke Buna, Schkopau near Merseburg (SAG Kautschuk), Leunawerke "Walter Ulbricht" at Leuna and Stickstoffwerke Piesteritz (both of SAG Mineralduenger), and Filmfabrik (Agfa) Wolfen and Zelluloidwerk Eilenburg (both of SAG Photoplenka). The central office in East Germany for SAG administration was located at Berlin-Weissensee.

Also existing in 1952 was the State Secretariat for Coal and Energy. One administration under its jurisdiction was HV Kohle (Main Administration for Coal). The latter administered the enterprise VVB Kohle, Zwickau, to which belonged the two Zwickau coking plants, August Bebel and Karl Marx. Most of the East German gas plants were allocated hard coal by the HV Energie (Main Administration for Power). As far as can be determined, the small hard-coal tar distilleries at Doebeln and Velten were private concerns.

All basic planning for East Germany was supervised by Moscow, and, in many instances, even minor decisions had to be submitted to Moscow for approval. The SAG's were expected to work economically under all circumstances, and that was frequently accomplished at the expense of the VEB plants. In general, integrated planning for VEB and SAG plants was not practiced. The East German and Soviet planning offices conferred on planning, but the SAG office was the stronger and was inconsiderate and ruthless. This partly explains difficulties experienced by VEB's in their planning and production; even raw materials to fulfill their quotas were not always made available to them, for the SAG plants always had priority.

2. <u>January 1954</u>.

A number of important organizational changes took place in 1953, especially after October of that year. The secretariats and VVB's were abolished, and in their place were established deputy ministers who assumed control of various economic sectors. A new consolidated Ministry for Heavy Industry was created, with deputy ministers directed by the Minister for Heavy Industry, Fritz Selbmann. Among the deputy ministers are ones for Chemistry, for Coal, and for Power. The Deputy Minister for Chemistry had the following five separate main administrations: Main Administration for Liquid Fuels (HV Fluessige Brennstoff), Main Administration for Heavy Chemistry (HV Schwerchemie), Main Administration for Organic Chemistry (HV Organische Chemie), Main Administration for Synthetic Products (HV Kunststoff), and Main Administration for Potassium and Non-Ore Mining (HV Kali und Nichterzbergbau). In the process of the reorganization, plants were also shifted from one main administration to another, perhaps partly to dissolve groups that would become too powerful because of the importance of some of the member plants.

The Zwickau coking plants are subordinate to the Deputy Minister for Coal. The gas plants are placed under HV Gas, one of the main administrations under the Deputy Minister for Power.

On 1 January 1954, all of the remaining SAG plants that had not been returned in May 1952 were transferred to the East German government, and it became necessary to place these returned plants into the structure. Listed below are the five main administrations of the Deputy Minister for Chemistry, and under each administration is given the names of some of the member plants. 18/

a. Main Administration for Liquid Fuels (HV Fluessige Brennstoffe).

VEB Kombinat "Otto Grotewohl," Boehlen
VEB Mineraloelwerk Luetzkendorf
VEB Teerverarbeitungswerk Rositz
VEB Teerverarbeitungswerk Goelzau
VEB Teerverarbeitungswerk Koepsen
VEB Teerverarbeitungswerk Webau
VEB Teerdestillation- und Chemische Fabrik Erkner
VEB Mineraloelwerk Herrenleite, near Pirna
VEB Mineraloelwerk Klaffenbach
VEB Mineraloelwerk Mittelbach
VEB Hydrierwerk Zeitz/Troeglitz*
VEB Werk Schwarzheide*
VEB Kombinat Espenhain*

* Prior to 1 January 1954, this plant was a SAG, or Soviet-owned, corporation. 19/

b. Main Administration for Heavy Chemistry (HV Schwerchemie).

VEB Elektrochemisches Kombinat Bitterfeld
VEB Farbenfabrik Wolfen
VEB Fahlberg-List, Magdeburg
VEB Chemiewerk Doelau, Greiz/Doelau (formerly Zschimmer and Schwarz plant)
VEB Elektrochemie Hirschfelde
VEB Sprengstoffwerk I, Schoenebeck
VEB Sprengstoffwerk II at Gnaschwitz
VEB Pharmaceutische Werk Oranienburg (formerly Byk plant)
VEB Leunawerke "Walter Ulbricht"*
VEB Stickstoffwerk Piesteritz*
VEB Chemische Werke Buna Schkopau*

c. Main Administration for Organic Chemistry (HV Organische Chemie).

VEB Chemische Fabrik Gruenau, Berlin Gruenau
VEB Chemische Fabrik von Heyden Radebeul/Dresden
VEB Deutsches Hydrierwerk Rodleben, Rodleben/Rosslau
VEB Fettchemie- und Fewawerk Chemnitz (now Karl Marx Stadt)
VEB Schering, Berlin/Adlershof
VEB Russwerk Oranienburg
VEB Schimmel, Miltitz/Leipzig
VEB Farben- und Lackfabrik Leipzig
VEB Lack- und Lackkunstharzfabrik Magdeburg
VEB Lack- und Lackkunstharzfabrik Zwickau
VEB Lack- und Druckfarbenfabrik Coswig
VEB Lackfabrik Spindlersfeld, Berlin/Spindlersfeld
VEB Druckfarben- und Lackfabrik Halle

* Prior to 1 January 1954, this plant was a SAG, or Soviet-owned, corporation. 19/

d. Main Administration for Synthetic Products (HV Kunststoffe).

VEB Kunstseidenwerk "Friedrich Engels," Premnitz*
VEB Kunstfaserwerk "Wilhelm Pieck," Schwarza*
VEB Kunstharz- und Pressmassefabrik (Plasta) Erkner**
VEB Kunstharz- und Pressmassefabrik (Plasta) Espenhain**
VEB Filmfabrik (Agfa) Wolfen***
VEB Zelluloidwerk Eilenburg***

e. Main Administration for Potassium and Non-Ore Mining (HV Kali und Nichterzbergbau).

No plants under this administration are mentioned in this report.

Domestic trade in East Germany is the responsibility of various official organizations called trade centers, or DHZ's (Deutsche Handelszentralen), which are organized along industrial lines. One of these centers is DHZ Kraftstoffe und Mineraloele (sometimes abbreviated as DKMZ), which is responsible for internal deliveries of fuels and mineral oils, including coal tars, benzol (all grades), toluol (all grades), and xylol.**** A second trade center is DHZ Chemie, which is made up of various sections. One section is concerned with coal chemicals such as phenol, cresols, and naphthalene; and another section is concerned with basic chemicals that include products and intermediates derived from aromatic chemicals.

In the field of foreign trade, there is one internationally recognized East German trade company concerned with nearly all imports and exports of chemicals. This company is known as DIA Chemie

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* [redacted] plants producing cellulose and artificial silk would be transferred to the Ministry for Light Industry. 20/ 50X1

** Plants producing Presstoff reportedly would be transferred to the Ministry for Machine Construction. 21/

*** This plant was also a SAG until 1 January 1954. 22/

**** The Soviet-owned Derunapht (Deutsche-Russiscne Naphtha AG) distributes a similar product line.

(Deutscher Innen- und Aussenhandel Chemie). DIA Chemie participates in trade agreements and contracts and administers the foreign-trade plan in chemicals. There are, in addition, semiofficial trading companies, such as Chemiepha, which may or may not conduct their operations with the knowledge of DIA Chemie. The Soviet-owned Derutra (Deutsche-Russische Transport AG) operates as a transport company handling international shipments of many product lines, including aromatic chemicals. Many East German tank cars apparently are owned by Derunapht, which thus becomes involved frequently in shipments of aromatic chemicals.

II. Production and Supply.

Most aromatic coal chemicals currently produced in East Germany are obtained primarily through high-temperature carbonization of bituminous coal. The principal source of tar acids (phenol, cresols, and xylenols), however, is through low-temperature carbonization of brown coals or through hydrogenation of these coals or their tar and oils.

East Germany, in contrast to West Germany and most other countries which also possess well-developed chemical industries, is reliant mainly upon the gas-retort phase, exemplified by city gas plants, rather than upon coke-oven operations of high-temperature carbonization. There are nearly 200 gas plants operating on hard coal in East Germany and there are only 2 small cokeries. The hard-coal gas plants play a decisive role in the gas supply for the country, but they are supplemented by other gas plants using brown coal. In addition to supplying gas, the hard-coal gas plants have great responsibility for the production of coke suitable for foundries, of raw coal tar, and of crude benzol for the chemical industry. Not all of the hard-coal gas plants in East Germany have facilities to recover both crude benzol and tar. Only about one-quarter of the plants appear capable of recovering crude benzol, but they account for almost 79 percent of the output in the country. All of the benzol and about 80 percent of the tar obtained is shipped to one processing plant, VEB Teerdestillation- und Chemische Fabrik Erkner at Erkner near Berlin. The 2 coking plants at Zwickau, Karl Marx and August Bebel, produce about 10 percent of the hard-coal tar and about 20 percent of the crude benzol produced in East Germany, and they process most of their own production.

There are approximately nine plants processing brown coal and brown-coal tar and light oils. Together they produce a large quantity of crude phenols, including phenolate liquors. Only three plants, however, are known to be capable of processing crude phenols and to obtain refined phenol and cresols. The largest producer of refined phenol and cresols is VEB Leunawerke "Walter Ulbricht" at Merseburg, which produces more than one-half of East Germany's total production.

East Germany's production of several aromatic hydrocarbons (benzol, toluol, and naphthalene) is wholly insufficient to meet the country's needs. Import is necessary to make up the differences between production and demand. It is estimated that in 1952, East Germany contributed its domestic production toward gross supply in the following percentages: less than 30 percent of the refined benzol; less than 40 percent of the toluol; about 20 percent of the naphthalene; and 100 percent of the xylol, refined phenol, and cresols. There were apparently no imports of xylol, refined phenol, and cresols, but phenol supplies were particularly short of the desired requirements. Imports of benzol and naphthalene in 1952 came from the USSR, Poland, and Czechoslovakia, but some naphthalene was received from Western countries. The USSR was reportedly the only supplier of toluol and of the bulk of the aniline imports. In addition to the imports of certain basic aromatic chemicals, a variety of chemicals derived from these aromatics were also imported. The USSR supplied the largest share of these other imports.

East German exports of some basic aromatic coal chemicals and of various derived intermediates and products amounted to about 40,000 tons in 1952. Pure toluol, xylol, phenol (pure and crude grades), and certain cresol fractions were exported. Xylenol shipments in large quantities were also made, but this commodity has not been seriously considered in this report. Exports of toluol, xylol, and phenol were shipped chiefly to Soviet Bloc countries, and cresols went largely to the Free World. A large toluol export to Hungary was significant because it was undoubtedly intended for use in explosives manufacture. The derived chemicals and products exported were many. They included such general-use categories as insecticides and pesticides, synthetic rubber manufacture and rubber chemicals, plasticizers and softeners for plastics and resins manufacture, photographic chemicals, dyestuffs and intermediates, solvents, pharmaceuticals and medicinals, and chemicals for the manufacture of explosives. Exports of products and derived chemicals favored the Soviet Bloc countries. Commodities sent to the West were generally distinctive in that they were good earners of hard currencies and served as barter goods for obtaining essential raw materials and equipment.

No sure evidence was found that prior to 1953 any aromatic coal chemical had been stockpiled in an East German strategic reserve. There were indications that establishment of State Reserves was to be greatly emphasized in 1953, and these chemicals may now be included. Plant operational stocks were reportedly not to exceed a 75-day supply.

A. Domestic Production.

1. Refined Benzol.

Virtually all of the crude benzol produced by the gas plants in East Germany (including East Berlin) is shipped by rail to VEB Teerdestillation- und Chemische Fabrik Erkner, where it is refined. Before the end of World War II, the crude benzol from these plants was distributed between the two plants at Erkner and Niederau (near Meissen). In 1945 the Niederau installation was lost to the area through Soviet dismantling. The Erkner plant, however, still had capacity to process more crude benzol than the combined output from all existing gas plants. [redacted] 50X1 During 1951 and 1952, Erkner's crude benzol input was expected to come from gas plants within the various East German political divisions in the following percentages:

	1951 [24]	1952 [25]
Mecklenburg	1.1	3.7
Brandenburg	6.9	4.6
Saxony-Anhalt	17.9	25.2
Saxony	38.8	30.5
Thuringia	4.4	5.4
East Berlin	30.9	30.6
Total	100.0	100.0

Provisions were made at Erkner to assure that processing capacity would remain in line with increasing output from the gas plants, as the latter became more efficient and as additional plants utilizing hard coal were restored. [redacted] in 1951 50X1

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Erkner had an annual capacity for processing 11,000 tons of crude benzol, and during that year an investment of 300,000 DME (East German marks) was appropriated to construct a 100,000-liter benzol-distillation still in order to raise capacity to about 20,000 tons per year. 26/ A later report (mid-1952) revealed that such a still was installed. 27/

During 1952, Erkner encountered operational difficulties, principally because the flow of crude benzol stocks from the gas plants was too often irregular. The blame for the disruptions in flow was placed on the railroads for failing to provide sufficient numbers of tank cars at the proper times. The benzol rectification plant also suffered a large reduction in output because of the loss, for nearly a month, of one large still which had to be dismantled and cleaned. 28/ Erkner was reported to have received 14,545 tons of crude benzol for processing in 1952. The scheduled 1953 input of crude benzol was 15,500 tons. The reported 1953 plan yield of refined benzol from crude benzol was 48.07 percent, and an additional yield of 0.24 percent was expected from the raw hard-coal tar to be processed. 29/ Actual yields obtained in 1952 were the same as those of the 1953 Plan. 30/

The processing of crude benzol at Erkner produces both pure benzol and a refined industrial benzol called "90er Handelsbenzol."* Other products recovered include toluol, xylol, solvent and heavy benzols. [redacted] 50X1

50X1

The two cokeries at Zwickau, Karl Marx and August Bebel, are believed to process most of their own crude benzol production. There is the possibility that other plants may produce a little refined benzol -- for example, the two small tar distilleries, VEB Chemische Fabrik Doebeln (formerly Oswald Greiner plant) and VEB Chemische Fabrik Velten (formerly Schieweck and Company plant), and perhaps the large gas plant at Magdeburg. There is no available information, however, to substantiate this conjecture, and output, if

* 90er benzol is the distillate recovered at 100°C and consists of 90 percent pure benzol. Pure benzol for industrial use, such as for nitration purposes, is the distillate recovered within a maximum tolerance of 0.8°C above or below 80.1°C.

any, is not believed to be substantial. Total estimated East German production of refined benzol, as well as estimates of plant outputs, for the years 1949 through 1955 is presented in Table 1.

Table 1

Estimated Production of Refined Benzol in East Germany by Producing Plants 1949-55

Metric Tons

	Production			
Year	Total	VEB Teerdestillation- und Chemische Fabrik Erkner	Karl Marx and August Bebel Cokeries a/	Other b/
1949	6,690	4,100 c/ 31/	2,569 32/ 2,073 c/ 33/	31
1950	8,520 34/ 8,300 c/ 37/	5,704 35/ 5,900 c/ 38/	2,800 d/ 2,400 c/ 39/	16
1951	10,150 e/ 9,400 c/ 42/	7,172 41/ 6,890 c/ 43/	2,950 2,430 c/ 44/	28
1952	10,300 f/ 11,200 c/ 47/	7,247 46/ 7,335 c/ 48/	3,000	53
1953	10,810 12,400 c/	7,712 49/ 7,654 c/ 50/ 7,591 c/ g/ 51/	3,050	50
1954	11,200 13,500 c/ 52/	8,000 7,682 c/ 53/	3,100	100
1955	11,700 15,100 c/ 54/	8,400 7,682 c/ 55/	3,200	100

a. Estimates for the years 1950-55 are based upon probable percentage yields of refined benzol applied to the estimated coke production by the cokeries. Yield factors range from 1.10 to 1.19 percent of the coke. See Appendix C, Table 32, p. 169, below.
b. Figures shown represent the difference between the sum of the Erkner plant and cokeries estimate and the East German estimate.
c. Plan figure.
d. Estimate based on reported actual output for 11 months of 1950 (2,551 MT). 36/
e. Estimate based on first half year output (5,540 MT) and first 9 months' output (7,798 MT). 40/
f. Estimate based on output for first quarter of 1952 (2,586 MT). 45/
g. Revised 1953 production plan effective 1 August 1953.

The Erkner plant supplies some of its benzol product, perhaps over 15 percent, to 2 large East German chemical plants, VEB Farbenfabrik Wolfen and VEB Elektrochemisches Kombinat (ECK) Bitterfeld. In addition, Erkner probably furnishes a third, still larger, plant, VEB Chemische Werke Buna at Schkopau, an even greater consumer of benzol, but no details are available. The benzol demands of the Schkopau, Wolfen, and Bitterfeld plants are largely filled through import from Soviet Bloc countries -- the USSR, Poland, and Czechoslovakia. Erkner's contribution probably amounts to only about 10 percent of the combined requirement of Wolfen and Bitterfeld. 56/ The cokeries at Zwickau have also supplied Wolfen and Bitterfeld. Perhaps over 25 percent of the cokeries' output goes to the 2 plants, but the amount represents less than 10 percent of their demand. It is presumed that in 1953 the Wolfen and Bitterfeld plants received from East Germany no more than one-fifth of their combined benzol need.

2. Toluol.

The large tar distillery, VEB Teerdestillation- und Chemische Fabrik at Erkner and the two Zwickau cokeries, August Bebel and Karl Marx, recover toluol in the processing of crude benzol produced in East Germany. A Fischer-Tropsch unit at VEB Mineraloelwerk Luetzkendorf appears to have been a source for toluol synthesized from heptane, 57/ but the unit was dismantled in the spring of 1951. 58/ One report has stated that a second Fischer-Tropsch unit, located at VEB Werk Schwarzheide, also produces synthetic toluol, but there is no confirmation of this statement. 59/ Some toluol is produced as a byproduct in the manufacture of monostyrene. The sole East German producer of styrene, which is used in the manufacture of synthetic rubber, is SAG Chemische Werke Buna, Schkopau. The toluol yield is reported to have been as high as 6 percent of the plant's total styrene output.* 60/

The production of toluol as a byproduct at Schkopau is an important source for toluol-short East Germany. The same may be said of the toluol obtained in refining and purifying imported crude benzol. It is reported that at least three large chemical plants, VEB Chemische Werke Buna at Schkopau, VEB Elektrochemisches Kombinat Bitterfeld, and VEB Farbenfabrik Wolfen, have facilities

* US yields are reported to be about 3 pounds of toluol per 100 pounds of styrene.

to purify imported crude benzol. The three plants must have pure, or nearly pure, hydrocarbons as raw materials to manufacture other chemicals and end products of good quality. Available information on these plants is insufficiently detailed, and it is not possible to determine what quantities of toluol are produced by them. Variously reported shipments to these three plants have included both "pure" and crude benzol grades, but what toluol amount was subsequently obtained from these shipments is unknown. It is possible that the total amount of toluol realized from imported crude benzol represents an appreciable addition to the over-all toluol availability; the addition could have been as much as 1,000 to 2,000 tons during 1953.

Erkner was able to produce only 96.9 percent of its 1952 toluol production plan. Plan underfulfillment was explained by one source as follows: difficulties were experienced because of the same transportation problems that affected refined benzol production and partly because of an increase in output of half-finished washed toluol and a shift to solvent benzol, which resulted in considerable overfulfillment of the latter product. 61/ The 1953 planned yield factor for toluol from crude benzol was reported as 13.95 percent (1952 actual yield was 14.21 percent), 62/ and from crude hard-coal tar an additional toluol yield of 0.13 percent was expected. 63/

Table 2* gives estimates of toluol production in East Germany for the years 1949 through 1955. Also given are output estimates for individual producing plants.

The Schkopau synthetic rubber plant can supply its own requirements for toluol, and its need is probably not significant. The Bitterfeld plant is reported to have received shipments during late 1951 and early 1952 from the Zwickau cokeries, from the Schkopau plant, and from the USSR. 64/ The latest information (1950) on the dye factory at Wolfen indicated that the plant received toluol from the Zwickau cokeries, from the Erkner and Schkopau plants, and from the USSR (via Schoenebeck, East Germany). 65/

3. Xylol.

Xylol is known to be produced only by the large tar distillation plant, VEB Teerdestillation- und Chemische Fabrik

* Table 2 follows on p. 24.

Table 2

Estimated Production of Toluol in East Germany
by Producing Plants
1949-55

Metric Tons

	Production			
Year	Total a/	VEB Teerdestillation- und Chemische Fabrik Erkner	Karl Marx and August Bebel Cokeries b/	VEB Chemische Werke Buna c/
1949	1,800	1,200	240 66/	360
		900 d/ 67/	267 d/ 68/	
1950	2,500	1,622 69/	320	535
		1,310 d/ 70/	250 d/ 71/	
1951	3,100	1,935 72/	350	800 e/
	2,025 d/ 74/	1,700 d/ 75/	291 d/ 76/	
1952	3,460	2,188 f/ 77/	370	900
	2,936 d/ 78/	2,259 d/ 79/		
1953	3,900	2,495 g/ 80/	380	1,000
		2,272 d/ h/ 81/		
		2,286 d/ i/ 82/		
1954	4,000	2,550	380	1,100
		2,287 d/ 83/		
1955	4,300	2,700	390	1,200
		2,287 d/ 84/		

a. Annual planned production for years 1951 and 1952 does not include Schkopau's output. Estimated totals are the sums of individual plant outputs. The figures are rounded.
b. Estimates for 1950-55 were derived from probable percentage yields of toluol to the estimated coke production by the cokeries. Yield factors range from 0.125 to 0.145 percent of the coke. See Appendix C, Table 32, p. 169, below, for estimated coke production by the cokeries in corresponding years.
c. Estimates made for byproduct toluol output at Schkopau were based on a probable yield of 4 to 6 percent of the styrene output, with figures rounded off.
d. Plan figure.
e. Estimate based on actual reported output during 9 months of 1951 (603 MT). 73/

Table 2

Estimated Production of Toluol in East Germany
by Producing Plants
1949-55
(Continued)

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f. Includes 1,353 tons of purified toluol and 835 tons of pure toluol.
g. Includes 1,506 tons of purified toluol and 989 tons of pure toluol.
h. Includes 1,522 tons of purified toluol and 750 tons of pure toluol.
i. Revised 1953 production plan effective 1 August 1953 (1,321 tons of purified toluol and 965 tons of pure toluol).

Erkner, and the two small cokeries, August Bebel and Karl Marx at Zwickau. A "xylol substitute" (for solvent and diluent purposes) has been reported to be made at the Fischer-Tropsch gas-synthesis unit installed at VEB Werk Schwarzheide. 85/

The chemical plants, VEB Elektrochemisches Kombinat, Bitterfeld, SAG Chemische Werke Buna Schkopau, and Farbenfabrik Wolfen, are probably able to separate the xylol-solvent naphtha mixture from crude benzol in the process of rectifying the latter to produce refined or pure benzol and refined toluol. This is actually done at Schkopau, where it appears that no further refining is done beyond the fraction called xylol-solvent naphtha. Schkopau was reported to have produced 28 tons of the fraction during 1950, and the 1951 plan called for 30 tons. 86/ This plant supplied over one-half of its 1950 output to the Wolfen dye plant. 87/ Wolfen, in addition, regularly receives small quantities of xylol from the Erkner plant. 88/

The Erkner plant is the main xylol producer in East Germany. This plant failed to fulfill its 1952 production plan by 13.1 percent. The basic reason given for underfulfillment was a steady increase in solvent benzol output in lieu of xylol, apparently caused by a change in the composition of the raw materials (crude benzol and tar). This fact was explained, in turn, by an apparent change in the quality of imported Polish hard coal received by East Germany, a change which was expected to continue indefinitely. Erkner attempted to have its plan target reduced, but the controlling Berlin office refused, complaining that the requirements of lacquer factories would have to be converted from xylol to solvent benzol. 89/ The 1953 scheduled yield factor for xylol from crude benzol was set at 5.20 percent (1952 actual yield was 5.05 percent), 90/ and the yield from crude hard-coal tar was set at 0.05 percent. 91/

Refined xylol (or industrial xylol) of coal origin is a mixture of hydrocarbons, including three xylene isomers. The normal proportions of the xylene isomers present in refined xylol derived from coal, as opposed to petroleum hydroforming sources, are about 15 percent ortho, 15 percent para, and 70 percent meta. Grades of xylol depend upon the sharpness of fractionation and are described partly by a specific boiling point range of the product. The separation of individual isomers from one another must be accomplished by methods other than usual straight fractionation because their boiling points are nearly identical (meta-xylene, 139.3°C; para-xylene, 139.4°C; ortho-xylene, 144°C). A similarity in chemical structure and in physical properties creates formidable purification problems.

East Germany is not currently able to separate the isomers on a commercial scale. The Erkner plant has achieved a fraction cut boiling between 137.5°C and 140°C with its distillation column, which has 80 trays and an efficiency of about 50 theoretical trays. This fraction, amounting to only 4 tons, was made in 1952 on special order by VEB Farbenfabrik Wolfen for the purpose of obtaining a cut high in meta-xylene content (40 percent) in order to prepare a color film component. The usual xylol fraction supplied to consumers by Erkner boils between 135°C and 145°C. 92/

Prior to 1952 there appears to have been little demand in East Germany for individual xylene isomers. Supplies were obtainable from West Germany whenever a requirement arose -- for example, Wolfen could make dyes with meta-xylene obtained from Leverkusen. Wolfen reportedly imported 28 tons of this isomer during 1950. 93/ A later report (early 1952) indicated Wolfen was still importing from Leverkusen. 94/

Table 3* gives estimates of xylol production for East Germany during the years 1949 through 1955. Outputs of individual known producing plants are also given.

* Table 3 follows on p. 27.

Table 3

Estimated Production of Xylol in East Germany
by Producing Plants
1949-55

Metric Tons

Year	Production		
	Total a/	VEB Teerdestillation- und Chemische Fabrik Erkner	Karl Marx and August Bebel Cokeries b/
1949	460	400	58 95/
		380 c/ 96/	48 c/ 97/
1950	660	604 98/	59
		520 c/ 99/	50 c/ 100/
1951	840	775 101/	66
	696 c/ 102/	630 c/ 103/	51.5 c/ 104/
1952	850	781 105/	71
	1,048 c/ 106/	899 c/ 107/	
1953	900	827 108/	80
		848 c/ 109/	
		781 c/ d/ 110/	
1954	1,000	915	85
		854 c/ 111/	
1955	1,150	1,050	86
		854 c/ 112/	

a. Estimated annual totals are the sums of individual plant outputs. The figures are rounded.
b. Estimates for 1950-55 were derived from probable percentage yields of xylol to the estimated coke production by the cokeries. Yield factors range from 0.023 to 0.032 percent of the coke output. See Appendix C, Table 32, p. 169, below, for coke output estimates for corresponding years.
c. Plan figure.
d. Revised 1953 production plan effective 1 August 1953.

4. Naphthalene.

The 1945 dismantling of the Niederau tar distillery of the former Ruetgerswerke AG of Berlin reduced the East German capacity for naphthalene production by about one-third. Moreover, another Reutgers installation, VEB Teerdestillation- und Chemische Fabrik Erkner, sustained war damage in the plant's naphthalene cooling and warm-press departments. For several years after the war, these conditions affecting naphthalene supply were not drastically serious, for the raw material (hard-coal tar) output in East Germany was limited, and industrial recovery in general was retarded through dismantlings and widespread disorganization and confusion. By 1949, however, the economy was recovering enough to impose increasingly greater demands upon the East German chemical industry for basic chemical raw materials. Where plant capacities were inadequate to produce whatever chemicals were needed and in amounts sufficient to fill requirements, numerous critical situations developed. Importations of chemicals in short supply were necessary to offset East German deficiencies. One good example was the naphthalene supply; capacity to produce the product fell behind growing demands, necessitating a steady increase in naphthalene imports.

The demands made upon the Erkner plant to produce naphthalene became greater with each year, for this plant was the principal supplier of naphthalene and it processed the bulk of the hard-coal tar produced in East Germany. Annual quotas of naphthalene production for Erkner increased rapidly, but they were unrealistic. In Erkner's 1950 investment plan, provision was made to construct a badly needed naphthalene warm-press unit. A warm-press unit employs the cheapest and most effective method for the purification of naphthalene and will yield a product suitable for further processing to the pure grade, if that is required. It was also considered essential to construct a new naphthalene washing unit and a distillation unit. In addition, it was anticipated that when a warm-press unit was installed the plant could release and utilize a centrifuge to increase production of acenaphthene, fluorene, anthracene, and possibly other technically pure hydrocarbons. Up to this point, the operation of the centrifuge had allowed only limited outputs of these hydrocarbons.

[redacted] the Erkner plant had placed an order for a naphthalene press with a West German firm by the name of Harburger Eisen- und Bronzewerk AG, Hamburg/Harburg. [redacted] 50X1

50X1

50X1

It has been mentioned before that Erkner processes high-temperature hard-coal tar produced by numerous gas plants in East Germany and tar received by import from West European and Soviet Bloc countries. Erkner, in addition, receives from various tar paper, roofing board, and roofing felt manufacturing plants -- for example, the Riedel Roofing Felt Factory (Hans Burchard) in Rostock -- a supply of middle-oil fraction (distilling off up to 240°C) which is obtained from primary distillation of hard-coal tar.

There have been no recent reports indicating that Erkner is now producing a pure naphthalene product having a softening point (SP) of 79.5°C to 80.0°C. During 1950, two naphthalene grades were produced: a very crude product of SP 70°C, but satisfactory for manufacturing carbon black (for buna synthetic rubber) and the hydrogenated naphthalenes, tetralin and decalin (both solvents); and a centrifuge grade of SP 78°C to 78.5°C, which was suitable for phthalic anhydride manufacture. By 1952 the warm-pressed material, SP 78.8°C, was the principal naphthalene product. This grade was satisfactory for most industrial purposes. At Erkner the 1952 yields of warm-pressed naphthalene from the crude tar and middle oil fraction were 4.43 percent and 8.1 percent, respectively. The percentage yield of naphthalene planned for 1953 was 4.37 percent of the coal-tar input and only 3.50 percent of the middle oil fraction. 115/

The Zwickau cokeries, Karl Marx and August Bebel, are also producers of naphthalene, but their combined output is probably less than one-fourth as great as Erkner's production. No specific information defining the quality of their product is available, but probably all of it is a crude grade of about SP 70°C. In 1949 the cokeries obtained a combined naphthalene yield of 0.429 percent of the coke output (0.60 percent at the Karl Marx plant), or 9.74 percent of the tar production (16.39 percent at Karl Marx). 116/ Under better operating conditions, the efficiency may improve, particularly at the August Bebel plant.

Two small high-temperature hard-coal tar distillation plants of private ownership are known to be crude naphthalene producers, but their combined output is considered to be very small. These tar distilleries are Chemische Fabrik Doebeln (formerly Oswald Greiner) and Chemische Fabrik Velten (formerly Schieweck and Company) in Velten. A possible third small producer is the Riedel tar roofing-board plant at Rostock. Current naphthalene production rates or capacities at these three plants are unknown.

There is no available information relating to the pattern of disposition of naphthalene from individual producers to specific consuming plants. It is presumed that naphthalene is distributed among several large consuming plants, such as VEB Chemische Werke Buna Schkopau, VEB Farbenfabrik Wolfen, VEB Deutsches Hydriewerk Rodleben, VEB Russwerk Oranienburg, and THB (Treuhandbetrieb) Werk Westeregeln, formerly Deutsche Solvay Werke Westeregeln. Further details regarding the consumption and uses of naphthalene are to be found in III, below, and in Appendix A.

Naphthalene (all grades combined) production estimates for East Germany for the years 1949-55 are given in Table 4. Output estimates for individual plants are also given.

Table 4

Estimated Production of Naphthalene in East Germany, by Producing Plants 1949-55

Metric Tons

	Production			
Year	Total a/*	VEB Teerdestillation- und Chemische Fabrik Erkner	Karl Marx and August Bebel Cokeries	Other b/
1949	2,400	1,300 2,082 c/ 118/	1,033 117/ 760 c/ 119/	17
1950	3,800 4,222 c/ e/ 121/ 3,358 e/ 124/	2,747 d/ 120/ 2,200 c/ 122/ 2,800 c/ 125/	1,000 1,000 c/ 123/	100
1951	4,000 4,040 c/ 127/	3,122 f/ 126/ 3,000 c/ 128/	815 g/ 940 c/ 129/	85 70 c/ 130/

* Footnotes for Table 4 follow on p. 31.

Table 4

Estimated Production of Naphthalene
in East Germany, by Producing Plants
1949-55
(Continued)

Metric Tons

		Production		
Year	Total a/	VEB Teerdestillation- und Chemische Fabrik Erkner	Karl Marx and August Bebel Cokeries	Other b/
1952	4,700	3,757 131/ 3,100 c/ 132/	900	50
1953	5,500	4,375 133/ 3,800 c/ 134/ 4,162 c/ h/ 135/	1,000	100
1954	5,800	4,600 4,293 c/ 136/	1,100	100
1955	6,200	4,900 4,293 c/ 137/	1,200	100

a. Estimated annual totals are the sums of individual plant outputs. The figures are rounded.
b. Other plants are presumed to include two small tar distilleries at Doebeln and Velten and a tar roofing-board plant at Riedel. These plants have been reported as privately owned works.
c. Plan figure.
d. Including 971 tons of crude naphthalene produced and sold.
e. Reported amount but apparently includes crude naphthalene. The factor used to convert crude naphthalene to the refined grade is 1.26 to 1.0.
f. Including 908 tons of crude naphthalene produced and sold.

Table 4

Estimated Production of Naphthalene
in East Germany, by Producing Plants
1949-55
(Continued).

g. Estimates for the cokeries for years 1951 through 1955 were derived from probable percentage yields of naphthalene to the estimated coke production by the cokeries. Yields range from 0.311 to 0.450 percent of the coke output. See Appendix C, Table 32, p. 169, below for coke output estimates for corresponding years.
h. Revised 1953 production plan effective 1 August 1953.

5. Refined Phenol.

By the end of World War II, there were in all Germany only a few tar-processing plants equipped to process crude phenols and obtain refined (including pure grade) phenol, the cresols, and the xylenols. These plants received their feed stocks of crude tar acids from various kinds of producing plants in the form of tar oils, crude phenol oils, and phenolate liquors. Today, East Germany is believed to have only three plants capable of producing refined phenol, the cresols, and the xylenols on a commercial scale. The three plants are SAG Leunawerke "Walter Ulbricht" at Leuna near Merseburg; VEB Teerdestillation- und Chemische Fabrik Erkner at Erkner near Berlin; and VEB Farbenfabrik Wolfen at Wolfen. Before being dismantled by the USSR in 1945, a tar distillery at Niederau (near Meissen) also produced pure phenol, about 2,500 tons a year. 138/ In addition, the Niederau plant was known as a producer of synthetic phenol made from benzol by a chlorination process. Synthetic phenol capacity was reported to have been 6,000 tons a year. 139/

No synthetic phenol is now produced in East Germany. The synthesis of phenol from benzol is not considered practical, for benzol is even less available then phenol. West Germany, on the other hand, produced 10,100 tons of phenol in 1951, 38 percent of it synthetic.*

* Natural phenol output in the US is between 11,000 and 14,000 tons per year, but this represents only about 6 percent of the total phenol produced; the remainder is made synthetically.

At the present time the Leuna plant is considered the largest producer of refined phenol in East Germany. Leuna's phenol distillation unit is an up-to-date, automatically controlled unit capable of processing 24,000 tons of crude phenol stock per year. 140/ Information has been scanty on Leuna's phenol production since the end of the war. Actual output in 1946 was reported as 728 tons, and the 1948 goal was stated as 2,400 tons. 141/ The estimates of phenol production for 1950 and subsequent years (see Table 5*) had to be based partially on data relating to actual and planned outputs of cresols and xylenols at Leuna. [redacted] the 1953 production quota for refined phenol was 6,300 tons** and that Leuna will use 5,250 tons for itself and sell the remainder. 143/ The plant is believed to process some of its own crude phenols stock, but mostly that which is supplied by VEB Kombinat Espenhain. 50X1

The second most important plant for producing refined phenol is the Erkner tar distillery, a former member of Ruetgerswerke AG, Berlin. This plant was reported to have had, in 1951, a capacity for distilling 10,000 tons of crude phenols and for processing an additional 10,000 tons of phenolate liquor annually. 144/ Crude phenol oils produced by plants at Espenhain and Zeitz and phenolate liquors from Hirschfelde and Klaffenbach plants are forwarded to Erkner for refining. In 1947, stock for processing was received from Leuna, but currently Erkner is adequately supplied by other plants. Various plants, including the Karl Marx and August Bebel cokeries at Zwickau and tar roofing-paper and board-manufacturing plants, which process raw hard-coal tar, ship to Erkner their recovered medium fractions or middle oils (boiling up to 240°C) containing tar acids. Many gas plants also send to Erkner raw hard-coal tar, which is an additional source of tar acids.

In 1952, Erkner's total crude tar acids input was 9,052 tons, and 9,645 tons were anticipated for 1953. Raw hard-coal tar output in 1952 was reported to have been 86,591 tons, and the 1953 schedule called for 87,500 tons. The 1952 output norms and expected 1953 norms (in percent) from crude-tar acids, middle oil, and raw hard-coal tar were as follows 145/:

* P. 36, below.
** In 1944, Leuna produced only 4,192 tons of refined phenol. 142/

Percent

	Crude-Tar Acids							
	Espenhain		Hirschfelde		Middle Oil		Raw Hard-Coal Tar	
	1952	1953	1952	1953	1952	1953	1952	1953
Phenol	30.75	24.55	19.44	4.00	6.0	6.0	0.85	0.87
Cresols	34.65	25.50	24.97	4.06	8.9	8.9	1.84	1.77
Xylenols	14.19	14.99	8.79	13.50	1.6	1.6	0.17	0.33
Phenol-cresols mixture			24.65	56.49				
Phenol pitch	12.79	16.24	14.68	14.18	2.2	2.2	0.23	0.25
Water and loss	7.62	18.72	7.47	7.77	1.3	1.3		
Others					59.3	59.3	96.91	96.78
Total	100.00	100.00	100.00	100.00	100.0	100.0	100.00	100.00

The equipment installed at Erkner in 1952 for distilling crude tar acids included 5 batch stills with a combined capacity of 176 cubic meters. Four of the stills had 80-tray columns and 1 still had a 40-tray column. Further distillation results in pure phenol with a yield of about 87 percent. For this operation there was 1 still of 23-cubic-meter capacity (40-tray column) which operated under vacuum on a batch basis. Some of the reported salable products obtained from crude tar acids processed at Erkner are 146/:

Product	Specifications and Description of Product
Pure phenol, DAB 6*	Solidifying point, 39 to 41°C; boiling range, 178 to 182°C; white; 0.5 percent water.
Cresol DAB 4*	Boiling range, 193 to 212°C; red-brown to brown; 0.5 percent water.
Cresol, DAB 4, B 1	Boiling range, 196 to 207°C; red to brown; 34 to 36 percent meta-isomer content; 0.5 percent water.
Orthocresol, pure	Solidifying point, 29 to 31°C; pink to brownish, 0.5 percent water.
Xylenol fraction	Boiling range, 205 to 225°C; red-brown to dark; up to 1 percent water.

* DAB (Deutsche Arzneibuch) is the German pharmacopoeia.

Phenol production data and estimates for Erkner are shown in Table 5.* There is no exact distribution pattern available for Erkner's phenol production, but a considerable portion is supplied to various synthetic plastics and resins manufacturing plants, including VEB Kunstharz- und Pressmassefabrik Erkner, VEB Kunstharz- und Pressmassefabrik Espenhain, VEB Lack- und Lackkunstharzfabrik Schoenebeck-Elbe, and VEB Lack- und Lackkunstharzfabrik Zwickau. Phenol is shipped also to VEB Deutsches Hydrierwerk Rodleben, VEB Fettchemie- und Fewawerk Chemnitz (now Karl Marx Stadt), VEB Pharmaceutischewerk Oranienburg, and VEB Elektrochemie Ammendorf.

The third, and only other, known producer of refined phenol is VEB Farbenfabrik Wolfen. Very little is known of this plant's capacity. The plant was reported to have processed 2,078 tons of crude phenol in 1943. 147/ At that time crude phenol oil from Leuna was the starting material, and installed at Wolfen were three batch-distilling units. Later information (1950) indicated that Wolfen received some pure phenol directly from Leuna and that crude tar acids stock was furnished by the Espenhain and Rositz plants. During 1950, Wolfen received nearly 3,800 tons of crude acids, of which Espenhain supplied about 90 percent. Receipts during the first quarter of 1951 indicate that Wolfen may have received between 4,500 and 5,000 tons of crude tar acids in 1951. 148/ Refined phenol output in 1950 was 1,281 tons. 149/ Of this amount, about one-half was shipped out of the plant; VEB Elektrochemisches Kombinat Bitterfeld received 250 tons, and 310 tons were exported (200 tons to West Germany and 110 tons to Czechoslovakia and Hungary). 150/ The Wolfen plant annually consumes increasing quantities of phenol to manufacture various end products, including synthetic organic tanning agents and ion-exchange resins. East German phenol consumption and uses are discussed in detail in III, below, and in Appendix A.

Table 5 gives output data and estimates for individual phenol-producing plants and over-all East German estimates for refined phenol production from 1949 through 1955.

* Table 5 follows on p. 36.

Table 5

Estimated Production of Refined Phenol in East Germany, by Producing Plants 1949-55

Metric Tons

Year	Total a/	Production: Leunawerke "Walter Ulbricht"	Production: VEB Teerdestillation und Chemische Fabrik Erkner	Production: VEB Farbenfabrik Wolfen
1949	4,300	2,400	800 756 b/ 151/	1,100
1950	5,200	2,580	1,342 152/ 1,300 b/ 154/	1,281 153/
1951	7,900 8,000 b/ 156/	4,500	2,133 155/ 2,000 b/ 157/	1,300 1,300 b/ 158/
1952	9,250 9,600 c/ 160/ 9,000 c/ 162/	5,000	2,634 159/ 2,380 b/ 161/	1,620
1953	10,300 d/ 163/ 13,000 c/ 165/	6,900 6,300 b/ 166/	1,738 164/ 2,344 b/ 167/ 1,687 e/ 168/	1,700
1954	11,800 14,300 c/ 169/	7,500 7,125 b/ 169a/	2,500 2,760 b/ 170/	1,800
1955	13,600 15,300 b/ 171/ 21,000 c/ 173/	8,500	3,200 2,760 b/ 172/	1,900

a. Estimated annual totals are the sums of individual plant outputs. The figures are rounded.
b. Plan figures.
c. Preliminary plan given in the first draft of the East German Five Year Plan (1951-55).
d. Reported total East German production for first 6 months was 5,066 tons.
e. Revised 1953 production plan effective 1 August 1953.

6. Cresols.

The producing plants for cresols in East Germany are the same installations that produce refined and pure phenol: VEB Leunawerke "Walter Ulbricht", at Leuna; VEB Teerdestillation- und Chemische Fabrik Erkner; and VEB Farbenfabrik Wolfen. A fourth plant formerly existed at Niederau, which reportedly produced about 4,000 tons per year of cresols, but the installation was dismantled by the USSR in 1945. 174/ All three currently operating plants are known to separate the ortho-cresol isomer from the cresols mixture. Wolfen, apparently, is capable of separating the three isomers (ortho, meta, and para) from one another, and Erkner also may be equipped for this purpose but does not make separations on a commercial scale. Little is known of Leuna's capabilities, but if it, too, can separate the isomers, it is probably done to a very limited extent.

Anticipated 1953 output norms for cresols from crude tar acids and hard-coal tar are known only for the Erkner plant. They are 38.2 percent and 1.77 percent, respectively. 175/ Various cresol grades and salable products have been reported to be produced and sold by one or more of the three producing plants and are given below:

Cresol Product	Producing Plant
Pure cresol DAB 6	Leuna and Wolfen
Cresol DAB 4	Leuna, Erkner, and Wolfen
Ortho-cresol	Erkner and Wolfen
Meta-cresol	Wolfen
Para-cresol	Wolfen

No specific distribution patterns are available for each cresol-producing plant. There is, however, some fragmentary information. The Leuna plant was scheduled to produce 1,300 tons of cresol DAB 4 during 1953, 176/ and all was to be consigned to VEB Elektrochemisches Kombinat Bitterfeld. 177/ In 1952 the Erkner tar distillery was reported to have supplied cresol to VEB Kunstharz- und Pressmassefabrik Erkner-Berlin and VEB Fettchemie- und Fewawerk Chemnitz (now Karl Marx Stadt) to have supplied ortho-cresol to VEB Deutsches Hydrierwerk Rodleben, Rodleben/Rosslau, and VEB Schimmel, Miltitz near Leipzig. 178/ During 1950 the Wolfen plant sold its cresol products as follows 179/:

Product	Destination	Amount (Metric Tons)
Pure cresol DAB 6	Hamburg, West Germany	30
	VEB Elektrochemisches Kombinat Bitterfeld	18
Cresol DAB 4	VEB Elektrochemisches Kombinat Bitterfeld	460
	Ludwigshafen, West Germany	66
Ortho-cresol	VEB Deutsches Hydrierwerk Rodleben	59
	USSR	20
Meta- and para-cresols	SAG Filmfabrik (Agfa) Wolfen	Negligible

Reported and estimated cresol consumption and uses in East Germany for 1952 are discussed in detail in III, below, and in Appendix A.

Estimates for cresols production in East Germany, and individual estimates for the producing plants, are given in Table 6.* It should be stated that information available on actual or planned cresols production has been too meager to assist more than superficially in the preparation of estimates given in Table 6.

7. Aniline.

A search of all available information revealed no evidence that aniline is currently produced in East Germany. The aniline requirements of the country must be satisfied entirely through imports, largely originating from the USSR, with occasional shipments from Poland and West Germany.

* Table 6 follows on p. 39.

Table 6

Estimated Production of Cresols in East Germany, by Producing Plants 1949-55

Metric Tons

		Production		
Year	Total a/	Leunawerke "Walter Ulbricht"	VEB Teerdestillation- und Chemische Fabrik Erkner	VEB Farbenfabrik Wolfen
1949	5,500	3,400	1,200 1,114 b/ 179a/	950
1950	6,400	3,516 180/	1,813 181/ 1,600 b/ 182/	1,030
1951	10,100	5,600 5,800 b/ 184/	3,128 183/ 2,950 b/ 185/	1,400 1,400 b/ 186/
1952	12,700	7,000	3,785 c/ 187/ 3,350 b/ 188/	1,900
1953	15,800	9,200 4,300 e/ 190/	4,267 d/ 189/ 4,146 f/ 191/ 4,011 g/ 192/	2,300
1954	17,900	10,600	4,500 5,346 h/ 193/	2,800
1955	20,000	12,000	5,000 5,346 h/ 194/	3,000

a. Estimated annual totals are the sums of individual plant output. The figures are rounded.
b. Plan figure.
c. Including 3,379 tons cresol DAB 4 and 406 tons ortho-cresol.
d. Including 2,424 tons cresol DAB 4, 582 tons ortho-cresol, and 1,261 tons phenol-cresol mixture.
e. Plan figure includes 1,300 tons cresol DAB 4 and 3,000 tons cresol, DAB 6.
f. Plan figure includes 2,853 tons cresol DAB 4, 389 tons ortho-cresol, and 904 tons phenol-cresol mixture.
g. Revised 1953 production plan effective 1 August 1953 (includes 2,344 tons cresol DAB 4, 449 tons ortho-cresol, and 1,218 tons phenol-cresol mixture).
h. Plan figure includes 1,200 tons phenol-cresol mixture.

An aniline-producing plant at VEB Farbenfabrik Wolfen was reported as a planned capital investment for 1954. Immediate construction of the installation appears to have been cancelled, but the aniline plant will be built later and will use the standard process of reducing nitrobenzene. 195/

Aniline is prepared commercially by two different methods, both requiring benzol as the starting material. One method requires nitration of benzol with nitric acid to produce nitrobenzene, which, in turn, is reduced to aniline by treatment with hydrochloric acid in the presence of cast-iron borings (turnings) or powder (free from oil and nonferrous metals). A second method is based on a reaction between monochlorobenzene and an ammonia solution under pressure and with heat in the presence of a catalyst (cuprous oxide).

B. Foreign Trade.*

1. Imports.

a. General.

East Germany's production of basic aromatic hydrocarbons -- benzol, toluol, and naphthalene, for example -- is insufficient to meet the area's requirements. Imports are continually necessary to close the growing gap between production and demand. Various other aromatics (derived from the basic ones) are also imported. The East German organic-chemical industry benefits considerably through importation of various special chemicals such as aniline, dimethylaniline, toluidines, mononitrotoluenes and dinitrotoluenes, and alpha-naphthylamine. Imports of these derived aromatics augment indigenous supplies of benzol, toluol, and naphthalene that otherwise would be reduced in the manufacture of the derived chemicals. Imports of these chemicals make it unnecessary to construct and maintain special installations and to consume valuable raw materials, such as nitric acid, for producing the derived aromatics.

This discussion of imports is restricted primarily to benzol, toluol, naphthalene, and aniline. Only a very brief mention is made of several other aromatic chemicals imported by East Germany. Data and discussion which follow for each commodity are concerned

* See Appendix B for foreign trade in derived aromatic chemicals.

with the source and relative volume of imports and with the degree to which East Germany is dependent upon Soviet Bloc countries or upon Western countries.

East German imports of benzol, toluol, naphthalene, and aniline to cover annual domestic requirements amount to a rather significant total. During 1952, approximately 51,000 tons of these chemicals were shipped to East Germany, and the 1953 total may have approached 55,000 tons. The total value of the 1952 imports is not known, but the 1953 total probably exceeded 27 million rubles. Between 90 to 95 percent of the 1953 imports were to originate in Soviet Bloc countries, and the USSR alone was to contribute between 50 and 55 percent of the total. 196/

b. Benzol.

East Germany has consistently received benzol shipments from only three Soviet Bloc members, the USSR, Poland, and Czechoslovakia. Since the end of World War II, no other countries have been mentioned as exporters to East Germany. The bulk of the benzol imports have come from Poland and the USSR. It is possible that imports from the USSR may be Polish benzol or Czechoslovak benzol re-exported, although the USSR is undoubtedly capable of supplying benzol from its own stocks.

Factual information on East German benzol imports, planned or actual, has been sporadic in respect to annual total imports and amounts supplied by individual countries. The situation is further complicated by the fact that [redacted] 50X1
shipments were "crude" benzol, while other reports mention "pure" benzol imports. It has been necessary to assume that all shipments were of refined, or commercial, benzol.

Table 7* summarizes available data on East German imports of benzol and lists exporting countries.

c. Toluol.

Current imports of toluol by East Germany appear to originate entirely in the USSR. During 1948 and 1949, however, Poland and Czechoslovakia were also supplying East Germany with toluol. Factual information on imports of toluol is more scattered

* Table 7 follows on p. 42.

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Table 7

East German Imports of Benzol
by Countries of Origin
1950-55

Metric Tons

Year	Total Annual Import	Country of Origin	Amount
1950	16,520 197/ (14,000) 198/	USSR Poland Czechoslovakia	(9,900) a/* 199/ N.A. 1,000 b/
1951	20,800 b/ (20,500) 200/	USSR Poland Czechoslovakia	(18,321) (sic) 201/ (8,500) c/ 203/ (9,000) 204/ (1,500) 205/
1952	26,000 b/ 15,288 e/ 206/ (25,000) 207/	USSR Poland Czechoslovakia	(14,500) d/ 208/ (11,000) f/ 209/ 7,500 b/ (4,000) 210/
1953	(27,224) g/ 211/ (27,000) 212/	USSR Poland Czechoslovakia	(14,000) 213/ (10,000) 214/ (3,224) 215/
1954 216/	(22,000) 217/	USSR Poland Czechoslovakia	(9,000) c/ (10,000) (3,000)
1955	(35,000) 218/	USSR Poland Czechoslovakia	(11,000) f/ 219/ N.A. N.A.

* Footnotes for Table 7 follow on p. 43.

Table 7

East German Imports of Benzol,
by Countries of Origin
1950-55
(Continued)

a. Figures in parentheses are either reported official import plans or contract trade agreements.
b. Estimate.
[redacted] 50X1
d. Total quantity in the 1952 trade agreement, including supplement export plan.
e. First 6 months.
f. Established basic export each year by the USSR within the long-term trade agreement of 27 September 1951.
g. Total contracted amount as of 1 April 1953. Total value reported was 10,230,000 rubles.

than is similar information on benzol imports. The scarcity of information is most unfortunate, for toluol availability can relate directly to, and limit the capacity for, explosives (TNT) production. In spite of East German increases in toluol production, the 1952 Plan figure for toluol imports was greater than the 1950 Plan figure by about 46 percent.

Table 8* presents available data on East German imports of toluol.

d. <u>Naphthalene</u>.

The principal difference between East German imports of naphthalene and the imports of other aromatics is that substantial quantities of naphthalene are imported from Western countries. Leading Western suppliers are West Germany, the Netherlands, and Sweden. Imports have been reported as "crude" naphthalene, as "pure" naphthalene, or as just "naphthalene". Lacking more precise information, it is impossible to estimate what quantities of each

* Table 8 follows on p. 44.

Table 8

East German Imports of Toluol from the USSR
1950-54

Metric Tons

Year	Import Plan a/
1950	3,700 220/
1951	4,700 221/
1952	5,400 222/
1953	5,581 b/ 223/
1954	3,200 224/

a. All amounts shown are reported annual import Plan figures.
b. Total amount under contract; original plan was 4,700 tons. Actual delivery during the first quarter 1953 was 1,531 tons. Total value of contracted amount was 2,272,000 rubles.

grade were actually received by East Germany. Moreover, there is available no definite information about the degree to which specific trade agreements (or planned imports) were fulfilled.

The need for naphthalene is very great in East Germany. Frequent references to local shortages have been noted, and, although in some instances deficiencies may have been only temporary ones caused by irregularity of incoming shipments, production of some naphthalene-derived products was curtailed. If Western sources for naphthalene should be withdrawn, the usual supplying countries in the Soviet Bloc -- the USSR, Poland, and Czechoslovakia -- probably would be able to increase their exports to East Germany. Because of current failures on the part of Western countries to deliver naphthalene as prearranged, various East German planning offices have been forced to make readjustments in allocations and plans.

East German naphthalene imports are summarized in Table 9.

Table 9

East German Imports of Naphthalene
by Countries of Origin
1950-54

Metric Tons

Year	Total Annual Import	Country of Origin	Amount
1950	16,900 a/*		
		Soviet Bloc	
	Crude: 9,167 225/	USSR	(4,600) b/ 228/
	(7,000) 226/	Poland	(7,000) 229/
		Czechoslovakia	N.A.
	Pure: 7,772 227/		
		Western Countries	
		West Germany	1,015 230/
			(3,000) 230a/
		Netherlands	1,600 a/
		Sweden	N.A.
1951	(18,600) 231/	Soviet Bloc	
		USSR	(5,100) 232/
		Poland	(4,000) 233/
		Czechoslovakia	(3,500) 234/
		Western Countries	
		West Germany	(3,000) 235/
		Netherlands	(2,000) 236/
		Sweden	(1,000) 237/
1952	18,000 a/	Soviet Bloc	
	(20,000) 238/	USSR	(7,000) 240/
	11,311 c/ 239/	Poland	N.A.
		Czechoslovakia	(2,000) 241/
			(900) (pure) 241a/

* Footnotes for Table 9 follow on p. 46.

Table 9

East German Imports of Naphthalene
by Countries of Origin
1950-54
(Continued)

Metric Tons

Year	Total Annual Import	Country of Origin	Amount
		Western Countries	
		West Germany	825 (incomplete) 242/
		Netherlands	N.A.
		Others	N.A.
1953	(20,500) d/ 243/	Soviet Bloc	
		USSR	(7,000) (pure) e/ 248/
	Crude: (10,500) d/ 244/	Poland	N.A.
	(4,705) e/ 245/	Czechoslovakia	(4,182) (crude) e/ 249/
			(1,250) (pure)
	Pure: (10,000) d/ 246/		
	(8,250) e/ 247/	Western Countries	
		England	(415) (crude) e/ 250/
		Belgium	(108) (crude e/ 251/
1954	(17,000) 252/	Soviet Bloc	
		USSR	(3,000) (crude) 255/
	Crude: (13,000) 253/		(3,000) (pure) 256/
	Pure: (4,000) 254/	Czechoslovakia	(4,000) (crude) 257/
			(1,000) (pure) 258/
		Western Countries f/ 259/	
		Belgium	(700) (crude)
		Netherlands	(4,000) (crude)
		Others	(1,300) (crude)

a. Estimate.
b. Figures in parentheses are either Plan import or trade agreement figures.
c. First 6 months.
d. Total value of planned import was 12,649,000 rubles (crude, 6,796,000 rubles; pure, 5,853,000 rubles).
e. Amounts contracted for as of 1 April 1953.
f. Total from Western sources 6,000 metric tons. 260/

e. Aniline.

Available information indicates that aniline is not produced in East Germany, certainly not on a commercial scale, and that nearly all aniline imports go to the large dyestuffs manufacturing plant, VEB Farbenfabrik Wolfen.

Imports of aniline originate almost entirely in Soviet Bloc countries. Since the beginning of 1950, apparently, East Germany has been mainly dependent upon the USSR and Poland for its aniline requirements.

Table 10 tabulates what are probably the most plausible data relating to East German aniline imports.

Table 10

East German Imports of Aniline
by Countries of Origin
1949-54

Metric Tons

Year	Total Annual Import	Country of Origin	Amount
1949 261/	669	USSR	264
		Poland	242
		Czechoslovakia	65
		Bulgaria	98
1950	1,300 a/*	USSR	(1,080) b/ 262/
		Poland	(200) 263/
1951	(1,100) 264/	USSR	(1,050) 265/
		Poland	(1,100) 266/
1952 266a/	(1,300)	USSR	(1,200)
		Poland	(100)

* Footnotes for Table 10 follow on p. 48.

Table 10

East German Imports of Aniline, by Countries of Origin 1949-54 (Continued)

Metric Tons

Year	Total Annual Import	Country of Origin	Amount
1953	1,686 267/	USSR	(1,468) c/ 269/
	(1,688) 268/	West Germany	(30) c/ 270/
1954	(2,100) 271/	N.A.	

a. Estimate.
b. Figures in parentheses are either Plan import or trade agreement figures.
c. Amounts contracted for as of 1 April 1953. Total contract value was 1,995,000 rubles.

2. Exports.

a. General.

The export by East Germany of some basic aromatic coal chemicals, as well as various intermediates and products derived from coal chemicals, is greater than might be expected, in view of the general inadequacy of East German production of basic aromatic hydrocarbons. Domestic production, however, is reasonably supplemented through imports, mainly from Soviet Bloc countries. Thus, with some exceptions, the entire export activity depends upon successful fulfillment of the import program.

During 1952, East Germany exported about 6,000 tons of the principal aromatic coal chemicals (including xylenols), valued at about 5.5 million rubles. Nearly 80 percent of this amount, however, consisted of the tar-acid aromatics (phenol and its homologs).

On the other hand, 1952 exports, through DIA Chemie* of intermediates and products derived from coal chemicals (excluding finished or semi-finished end products such as synthetic rubber, fibers and plastics, and photographic films) approximated 33,000 tons and were valued at nearly 38 million rubles. 272/

Trade data and information on export of coal chemicals are fragmentary, even for the years 1951 and 1952. In addition, available details on 1953 export plans and actual deliveries are scanty. Most export quantities given in Table 11** reflect legal trade agreements and their fulfilments. Few factual details are known of reparations and "Konto T" deliveries*** to the USSR. Some special or illegal trade with Western countries is suspected to have occurred during 1952. Certain commodities -- pure phenol, pure toluol, and saccharin, for example -- are especially good earners of hard currencies or serve as barter goods for obtaining special and desired equipment from the West. In view of these probably illegal shipments and the paucity of information, it is apparent that a complete export pattern cannot be determined.

b. Basic Aromatic Coal Chemicals.

Basic aromatic coal chemicals exported by East Germany, those specifically considered in this study, include the following: pure toluol, xylol, phenol (both refined and crude grades), and various cresol fractions. Other commodities known to be exported but not considered, include xylenols, pure pyridine, and pyridine fractions. There is no evidence that naphthalene is exported. Benzol apparently was not exported prior to 1953, but because no ethyl benzene was included in the 1954 export plan, a quantity of 4,000 tons of benzol was to be made available for export in 1954. 274/****

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* DIA Chemie -- Deutscher Innen- und Aussenhandel Chemie (East German official trade organization for chemicals).

** Table 11 follows on p. 50.

*** "Konto T" (T-account deliveries). Those goods which are produced in SAG plants under the so-called Konto T are intended for specific Soviet ministries, as opposed to regular deliveries, which go to the usual Soviet importing agencies to be resold to customers in the USSR. Such deliveries are said to be based on the writing-off of mutual debts and would include rental and profit payments. 273/

**** Continued on p. 53.

Table 11

East German Exports of Basic Aromatic Coal Chemicals by Importing Countries 1951-54

Metric Tons

Commodity	Importing Country	Amount 1951 275/	1952 276/	1953 277/	1954 278/
Benzol		0	0	N.A.	4,000 (Plan)
Toluol (Pure)	Hungary	108	1,040	N.A.	N.A.
	Austria	101		N.A.	N.A.
	Switzerland	15	313	N.A.	N.A.
Total		224	1,353	N.A.	N.A.
Xylol	Hungary	20 a/*	20		
Total		20	20	20 (Plan)	N.A.
Phenol (Pure)	Bulgaria	48		N.A.	N.A.
	China	67	96	N.A.	N.A.
	Czechoslovakia	120		N.A.	N.A.
	Poland	117		N.A.	N.A.
	Rumania	19		N.A.	N.A.
	USSR	650	N.A.	N.A.	N.A.
	Africa		30	N.A.	N.A.
	Austria	125		N.A.	N.A.
	Liechtenstein	15		N.A.	N.A.
	Switzerland		49	N.A.	N.A.
Total		1,161	175	660 c/	50 (Plan)

* Footnotes for Table 11 follow on p. 52.

Table 11

East German Exports of Basic Aromatic Coal Chemicals by Importing Countries 1951-54 (Continued)

Metric Tons

		Amount			
Commodity	Importing Country	1951 275/	1952 276/	1953 277/	1954 278/
Phenol (Crude)	Poland	N.A.	1,030	N.A.	N.A.
	Netherlands		15	N.A.	N.A.
	West Germany	1,000 (Plan)	66	N.A.	N.A.
Total		1,000	1,111	2,798 c/	N.A.
Cresol, DAB 4 b/	Bulgaria		7	N.A.	N.A.
	North Korea		31	N.A.	N.A.
	USSR	50 (Plan)		N.A.	N.A.
	Denmark		65 c/	N.A.	N.A.
	England	205	500	N.A.	N.A.
	Netherlands	50 d/		N.A.	N.A.
	Sweden	30		N.A.	N.A.
	Switzerland		45	N.A.	N.A.
	US		50	N.A.	N.A.
	West Germany		30	N.A.	N.A.
Total		335	728	1,000 (Plan)	800 (Plan)
Cresol,				N.A.	N.A.
Ortho (Pure)	China	10		N.A.	N.A.
	Hungary	180		N.A.	N.A.
	USSR	150 (Plan)		N.A.	N.A.
	Belgium	318	15	N.A.	N.A.
	Denmark	40	180	N.A.	N.A.
	England		99	N.A.	N.A.
	Netherlands	96		N.A.	N.A.

Table 11

East German Exports of Basic Aromatic Coal Chemicals by Importing Countries 1951-54 (Continued)

Metric Tons

Commodity	Importing Country	Amount 1951 275/	1952 276/	1953 277/	1954 278/
Cresol, Ortho (Pure) (Continued)	Sweden	30		N.A.	N.A.
	Switzerland	100		N.A.	N.A.
	US	200		N.A.	N.A.
	West Germany		117	N.A.	N.A.
Total		1,124	411	300 (Plan)	300 (Plan)
Cresol, Ortho (fraction)	Hungary		33	N.A.	N.A.
	Belgium	155 d/		N.A.	N.A.
	Switzerland	100 d/		N.A.	N.A.
	US	200 d/		N.A.	N.A.
	West Germany		589	N.A.	N.A.
Total		455	622	N.A.	500 (Plan)

a. Nine months.
b. DAB (Deutsche Arzneibuch) is the German pharmacopoeia.
c. Six months.
d. Ten months.

As shown in Table 11, 1952 exports of toluol, xylol, and phenol went primarily to Soviet Bloc countries, and exports of cresols and its fractions went largely to countries in the Free World. One commodity of special significance is toluol, which was exported mainly to Hungary, probably to supply the Hungarian explosives manufacturing industry with the raw material for making TNT. A second item of significance is pure phenol. There was a marked decrease of pure phenol in exports in 1952 compared to 1951, which supports existing evidence of a phenol shortage in East Germany. It is quite possible, however, that pure phenol was shipped to the USSR during 1952, not as an export but under a reparations account, and that the total quantity shipped by East Germany during the year was actually greater than that reported.

Table 11 shows East German exports of basic aromatic coal chemicals, and importing countries, for 1951-54.

C. Stockpiles.

There is no positive evidence that any aromatic coal chemical was placed in an East German strategic reserve (State Reserve) prior to or during 1952. Definite, but fragmentary, stockpile data have been received for years subsequent to 1952. The State Reserve for medical and pharmaceutical supplies was reported to have received a small quantity (5 tons) of crude cresol during 1953, 279/ and the 1954 Plan for the same reserve included phenol (40 tons) and aniline (15 tons). 280/ Other aromatic chemicals mentioned in the 1954 Plan were salicylic acid (pure), 5 tons; methyl salicylate, 2 tons; acetanilide, 2 tons; para-nitrotoluene, 2 tons; and phenophthalein, 1 ton. 281/

In 1952, several basic coal chemicals were slated for allocation to a "Plan Reserve", but the allocations were small: 156 tons of benzol, 25 tons of toluol, and 20 tons of xylol. 282/ The specific purpose of the Plan Reserve is still unknown, but it is known that the commodities and amounts designated for this reserve had to be regarded as "priority allocations." 283/ One possibility is that those quantities of benzol, toluol, and xylol which were allocated to the Plan Reserve may have been transferred to a State Reserve, at the end of 1952, and became an addition to a strategic stockpile. No similar 1952 allocations for naphthalene, refined phenol, cresols, or aniline were disclosed. Provision was made in official East German statistical reports of 1951 for Plan Reserve allocations, but only for toluol, 180 tons; xylol, 76 tons; and naphthalene, 517 tons. 284/ There is no evidence to indicate that these allocations were completed.

In 1952 there were indications that it was official intent to stockpile various commodities, including chemicals. Stockpile programs in 1950 and 1951 seemed largely directed at correcting shortages and bringing supplies of materials under governmental control. In August of 1951 the work of the Chief Operational Section of the State Reserves, a section within the State Secretariat for Material Procurement, came under Soviet criticism for falling behind schedule in its storage program. 285/ There were no indications that this program was very ambitious with regard to chemicals.

Organizational changes followed, and in September 1952 a State Secretariat for Administration of State Reserves, with cabinet rank, was established. 286/ [redacted] during the spring 50X1
of 1953 the Entwurfsbuero fuer Industriebau (designing office for industrial construction) of the Ministry for Construction was ordered to prepare preliminary plans for the erection of storehouses for the State Secretariat for State Reserves. A total of nearly 30 million 50X1
DME had allegedly been allocated for this project. The plans included one type of reserve depot designed to store chemical products and 50X1
pharmaceuticals. 287/ [redacted] warehouses belonging to the State Reserve do exist, and [redacted] have 50X1
[redacted] chemicals in storage. [redacted] the largest 50X1
warehouse owned by the State Reserve will be at Niederau, near Meissen, the site of a distillery of the former Ruetgerswerke AG, which was dismantled in 1945. This warehouse reportedly will store chemicals. 288/ If Niederau is to be a reserve depot, it is likely the tank farms at Niederau will store quantities of aromatic coal chemicals supplied largely through import. The dye factory at Wolfen (Farbenfabrik) is known to have utilized Niederau as storage for its aniline stock during 1950 and 1951. 289/ Significant stockpiling of chemicals, accompanied with expanded production and large imports of strategic chemicals, might indicate the initiation of a substantial armaments program in East Germany.

For normal operations, adequate stocks of various chemicals, including benzol, naphthalene, and aniline, are reported to be maintained in the warehouses belonging to the large chemical combines like Chemische Werke Buna Schkopau, VEB Elektrochemisches Kombinat Bitterfeld, and VEB Farbenfabrik Wolfen. All three of these plants were Soviet corporations (SAG's) in 1951, and material balance records were kept for them by the Central Supply Accounting Office (ZVK) of the Main Administration for Soviet Property in Germany (USIG) at Berlin-Weissensee. From some of these records it is learned that

toward the end of 1951 these plants, collectively, had in their warehouses about one and one-half months' requirements for benzol and naphthalene, and the Wolfen plant had an aniline stock equivalent of about four months' consumption. 290/ [redacted] 50X1
[redacted] regulations limit chemical plants to a 75-day supply of stocks on hand. 291/ 50X1

D. Material Balances.

The estimated 1951-54 material balances for the principal aromatic coal chemicals and aniline are shown in Table 12.*

III. Consumption.**

The main objective of this report is to determine East German consumption patterns for the principal basic aromatic chemicals -- benzol, toluol, xylol, naphthalene, phenol, cresols, and aniline -- and to describe these patterns as fully as available information will permit. These chemicals are essential to a modern economy, regardless of whether the economy is strictly controlled or is based on free enterprise or whether there exists peace or war. There are no substitutes for the basic aromatic chemicals.

The consumption patterns for each chemical, and the accompanying discussions, which appear in this section disclose where Soviet and East German interests lie, which industries are the dependent and which the preferential ones, and what the degrees of development in various fields are, thus permitting comparisons with other countries.

Although as much factual information as was available for 1953 and 1954 has been included in the commodity discussions, the detailed consumption patterns were based on 1952 data. This was done because the most complete details were available for that year and because the mass demonstrations in June of 1953 created unusual conditions. Also, comparative data for US outputs and consumption have been more readily available for 1952. (See Fig. 2*** for a graphic summarization of the estimated consumption in East Germany of the various basic aromatic chemicals.)****

* Table 12 follows on p. 56.
** See Appendix A for detailed use patterns of basic aromatic chemicals.
*** Following p. 58.
**** Continued on p. 58.

Table 12

Estimated Material Balances for Principal Coal Chemicals and Aniline in East Germany a/*
1951-54

Metric Tons

Commodity	Year	Domestic Production	Import	Stockpile	Gross Supply b/	Export	Net Supply c/
Benzol (Refined)	1951	10,150	20,800	0	30,950	0	31,000
	1952	10,300	26,000	0	36,300	0	36,300
	1953	10,800	27,000	0	37,800	0 d/	37,800
	1954	11,200	22,000	0	33,200	4,000	29,200
Toluol	1951	3,100	4,700	0	7,800	224	7,600
	1952	3,460	5,400	0	8,860	1,353	7,500
	1953	3,900	5,581	0	9,481	0 d/	9,500
	1954	4,000	3,200	0	7,200	0	7,200
Xylol	1951	840	0	0	840	20	800
	1952	850	0	0	850	20	800
	1953	900	0	0	900	20	900
	1954	1,000	0	0	1,000	0	1,000
Naphthalene	1951	4,000	18,600	0	22,600	0	22,600
	1952	4,700	18,000	0	22,700	0	22,700
	1953	5,500	20,500	0	26,000	0	26,000
	1954	5,800	17,000	0	22,800	0	28,800

* Footnotes for Table 12 follow on p. 57.

Table 12

Estimated Material Balances for Principal Coal Chemicals and Aniline in East Germany a/
1951-54
(Continued)

Metric Tons

Commodity	Year	Domestic Production	Import	Stockpile	Gross Supply b/	Export	Net Supply c/
Phenol (Refined)	1951	7,900	0	0	7,900	1,161	6,700
	1952	9,250	0	0	9,250	175	9,100
	1953	10,300	0	0	10,300	660 e/	9,600
	1954	11,800	0	0	11,800	50	11,800
Cresols	1951	10,100	0	0	10,100	1,914	8,200
	1952	12,700	0	0	12,700	1,761	10,900
	1953	15,800	0	0	15,800	1,300	14,500
	1954	17,900	0	0	17,900	1,600	16,300
Aniline	1951	0	1,100	0	1,100	0	1,100
	1952	0	1,300	0	1,300	0	1,300
	1953	0	1,686	0	1,686	0	1,700
	1954	0	2,100	0	2,100	0	2,100

a. Explanatory bases for figures given in this table are to be found under the appropriate sections of this report: Production, Imports, Exports, and Stockpiles. Material balances for 1953 and 1954 are less accurate than for 1951 and 1952 because there is a lack of trade information, especially in exports.
b. Gross supply is the sum of domestic production, import, and stockpile.
c. Net supply is the difference between gross supply and export. Figures are rounded.
d. Exports are believed possible, but there is no definite information.
e. Total amount shipped by East Germany in first 6 months.

East German consumption patterns for the basic aromatic chemicals show that the manufacture and fabrication of synthetic rubber is the most significant consuming industry. Some three-fifths of the gross supply of benzol is utilized to produce ethylbenzene, the starting material for styrene, which, in turn, is a constituent of synthetic rubber of the buna type. In addition, about one-third of the available naphthalene and approximately two-thirds of the total aniline supply is consumed in producing rubber-processing chemicals.

The manufacture of synthetic plastics, bonding agents, resins, lacquers, fibers, and the necessary plasticizers and softeners for the finished products require the next largest proportion of the total supply of aromatic chemicals. Only a small percentage of the benzol supply enters into polystyrene plastics materials, but about four-fifths of the phenol supply is used in producing a synthetic called Perlon (similar to nylon), various plastics, protective coatings, resins, plasticizers, and synthetic tanning substances. The cresols are used to make products similar to those made from phenol, with the exception of Perlon, and approximately three-fifths of the cresols supply is so consumed. About one-third of the gross supply of naphthalene is employed in the manufacture of phthalic anhydride, from which plasticizers and softeners, used chiefly in compounding polyvinyl chloride plastics, are derived.

Some of the aromatic chemicals -- benzol, toluol, and xylol, for example -- are used directly as solvents in formulating lacquers, varnishes, and paints. Other aromatics, including naphthalene, phenol, and the cresols, are the starting points for making chemicals which themselves serve as solvents. An estimated one-tenth of the benzol, about one-half of the toluol, and four-fifths of the xylol supplies are used as solvents. The solvents derived from naphthalene are decalin and tetralin, and jointly they consume about one-seventh of the available naphthalene. Products obtained through hydrogenation of phenol and cresols are also valuable solvents. The quantity of phenol used for solvents manufacture is believed rather small, but almost one-tenth of the supply of cresols is used.

East Germany is an important producer of insecticides and pesticides derived from organic chemicals. Approximately one-sixth of the benzol supply is consumed to prepare dichloro-diphenyl-trichloroethane (DDT), benzenehexachloride (BHC), and the dichlorobenzenes. Some naphthalene is used for termite control and moth repellants, but the volume is unknown and probably represents less

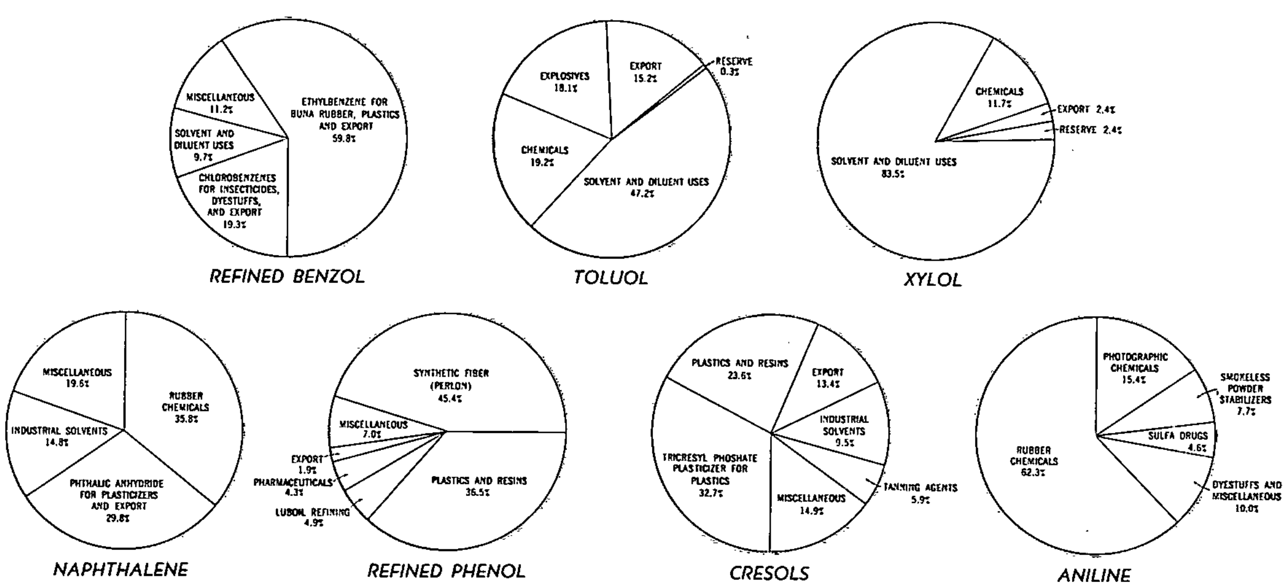
Figure 2

50X1

EAST GERMANY

ESTIMATED CONSUMPTION OF BASIC AROMATIC CHEMICALS

1952



13276 1-55

50X1

than 5 percent of the gross supply. An even smaller percentage of the cresols supply is utilized in preparing fruit tree sprays and powders.

A considerable number of medicinals, pharmaceuticals, drugs, antiseptics, and disinfectants are prepared from the basic aromatics. The sulfa drugs stem mainly from aniline, and about 5 percent of the supply is used for their manufacture. Toluol is the starting material for saccharin, a sugar substitute, and benzoic acid, a food preservative and germicide as well as a stabilizer in the rubber industry. Nearly one-seventh of the gross supply of toluol is used for these two items. Phenol and the cresols possess natural germicidal and antiseptic properties. Cresol is widely used in disinfectant soaps and solutions, and phenol is the source for salicylic acid, a preservative and starting material for making aspirin. Less than one-tenth of the phenol supply, however, is believed to be used for pharmaceuticals.

All of the basic chemicals considered in this report are used in East Germany for the synthesis of complex organic dyes which are used in the manufacture of finished textiles and printing inks and in photography. No quantitative estimates of consumption could be determined, but it appears that somewhat less than one-tenth of the aniline and about one-tenth of the xylol were consumed for dyes.

The explosives industry requires toluol for the production of TNT. Almost one-fifth of the toluol supply is believed to have been consumed in East Germany for the production of TNT during 1952, but sizable toluol exports were sent to Hungary, presumably for the manufacture of explosives. Aniline is the starter from which another explosive, tetryl, is made. There is no evidence to indicate, however, that tetryl is made in East Germany. Smokeless powder stabilizers may also be produced from aniline, and apparently almost 8 percent of the aniline was used for this purpose in 1952.

One additional East German industry, the photographic film industry, plays an important role in supplying photographic chemicals and film to the other Soviet Bloc countries, including the USSR. Both aniline and phenol are starting chemicals for making photographic film developers. Approximately 15 percent of the available aniline is consumed in making hydroquinone. The quantity of phenol used is negligible, but only small amounts of the product called Metol are necessary.

A. Refined Benzol.

The East German benzol consumption pattern is peculiarly different from the use patterns of other countries, especially those of the US. One reason for this difference is that East Germany produces only about 30 percent of its benzol requirements and depends upon import for the remainder. In addition, Soviet control of the area limits the use of benzol to an absolute minimum above requirements for the manufacture of intermediates and end products which are of value to the USSR.

An attempt has been made to determine benzol distribution, requirements, and allocations to various industrial sectors and individual consuming plants within East Germany. Apparently no benzol is consumed to produce aniline, phenol, diphenyl, adipic acid (for nylon manufacture), and cumene (for aviation gasoline). No benzol appears to have been exported prior to 1953 and possibly only a negligible quantity is used as a motor-fuel additive. Furthermore, there is little, if any, benzol consumed to produce maleic anhydride, resorcinol, and synthetic detergents. There is no firm evidence to indicate that benzol had been included in the East German State Material Reserve, nor was benzol mentioned for future consignment to that reserve.

The principal use for benzol in East Germany is in the production of ethylbenzene, the starting material for making styrene, which, in turn, is the basis for the manufacture of synthetic rubber of "Buna-S" types and of polystyrene plastics. An estimated 60 percent of the 1952 gross supply of benzol (36,300 tons) was consumed to produce ethylbenzene, the entire production concentrated in one chemical installation, VEB Chemische Werke Buna at Schkopau. The second largest use of benzol is for monochlorobenzene (MCB) and dichlorobenzenes (DCB), which required nearly 20 percent of the estimated total gross supply of benzol in 1952. The chlorobenzenes were used mainly to produce insecticides, pesticides, and dyestuffs. Table 13* shows the estimated East German benzol consumption pattern for 1952.

* Table 13 follows on p. 61.

Table 13.

Estimated East German Benzol Consumption Pattern
1952

Product or Use	Amount Consumed (Metric Tons)	Percent of Total Consumed
Ethylbenzene (for export, other than for styrene and polystyrene)	7,150	19.7
Styrene (for Buna-S rubber types)	13,600	37.4
Polystyrene Plastics	970	2.7
Monochlorobenzene (other than for DDT) and Dichlorobenzenes	2,700	7.4
DDT (insecticide)	4,300	11.9
Benzene Hexachloride (BHC) (insecticide)	550	1.5
Miscellaneous Chemicals, Pharmaceuticals, and Other Uses	3,374 a/	9.3
Solvent and Diluent Uses	3,500	9.7
East German Plan Reserve	156 292/	0.4
Total	36,300	100.0

a. Residual value obtained by difference.

B. Toluol.

Toluol has many uses, especially as a chemical raw material for syntheses of other organic compounds, and there are no substitutes for toluol. Chemical uses include the manufacture of important intermediates -- benzoic acid; benzaldehyde; nitro-, chloro-, and amino-derivatives -- which are essential for the manufacture of dyes, medicines, pharmaceuticals, perfumes, and the like. Because toluol has high solvent power, relatively low toxicity, and high volatility, it is one of the most valuable aromatic solvents available to industry. Because of its high solvent powers, toluol has found wide use, particularly in the cellulose-base lacquer industry. Its solvent applications include the extraction of fats and alkaloids, utilization in degreasing operations, and the formulation of lacquer thinners, dopes, resinous coatings, rubber cements, rotogravure inks, and paint removers. Toluol is the basic material in manufacturing important commercial and military explosives based on dinitrotoluene (DNT) or trinitrotoluene (TNT). Toluol may also be blended with aviation gasoline, but there is no evidence to indicate this use in East Germany.

East Germany is heavily dependent upon imports to fulfill national demand for toluol. All imports appear to originate in the USSR, which supplied more than 60 percent of the estimated total 1952 gross supply. Because of this fact, it is probable that distribution and allocation of toluol are closely controlled. Principal known consumer plants within the chemical industry include VEB Elektrochemisches Kombinat Bitterfeld; VEB Farbenfabrik Wolfen; VEB Sprengstoffwerk I, Schoenebeck; VEB Zelluloidwerk Eilenburg, VEB Fahlberg-List, Magdeburg; and a considerable but unknown number of lacquer, varnish, and paint factories.

There is little definitive information on toluol consumption by plants, products, and uses -- especially information on chemicals and explosives manufactured from toluol. It is estimated that about one-fifth of the 1952 toluol gross supply was employed in manufacturing TNT and DNT exclusively for explosives.* Almost an equal amount went into organic chemicals manufacture, and nearly one-half of the supply was utilized as solvents and diluents. There is no evidence to show that toluol has been allocated to any East German State Material Reserve as a part of the strategic stockpile. In 1952, a significant amount of toluol, 15 percent, was exported to Switzerland and Hungary. The toluol supplied to Hungary was probably used for making explosives based on TNT.

Table 14** shows the estimated East German toluol consumption pattern for 1952.

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* No recent US patterns for the use of toluol are available. During the war year 1944, however, the US is estimated to have used 77 percent of its toluol supply for explosives and 17 percent as an additive in aviation gasoline.

** Table 14 follows on p. 63.

Table 14

Estimated East German Toluol Consumption Pattern
1952

Use	Amount Consumed (Metric Tons)	Percent of Total Consumed
Chemical Uses	1,700	19.2
Solvent and Diluent Uses	4,182 a/	47.2
Explosives	1,600	18.1
Export	1,353 293/	15.2
East German Plan Reserve	25 294/	0.3
Total	8,860	100.0

a. A residual value obtained by difference.

C. Xylol.

Xylol has few industrial applications in East Germany at the present time. This aromatic is used largely as a solvent in the lacquer industry and to a lesser degree in the manufacture of dye intermediates and color-film dye components and for other chemical uses. Because of limited stocks, an insignificant quantity of xylol, if any, is used as an additive for motor fuels.* East Germany exports an almost negligible quantity of xylol. There is no definite evidence that the commodity is stockpiled for strategic purposes -- that is, included among items placed in the East German State Material Reserve.

* The xylol consumption pattern of the US is radically different. In the US, xylol is used extensively as an additive in aviation fuels for rich mixture performance. During and since World War II, most US xylol has come from petroleum refineries (85 percent in 1951), and the huge xylol output has accompanied the demand for high-octane fuel and for toluol for explosives. Some US hydroformers, operating on petroleum stocks containing mixed xylenes, are capable of separating the isomers. Both meta- and para-isomers are excellent blending agents in aviation-grade gasoline, but the ortho form is not desirable in hightest fuels.

It has been stated previously that industrial-grade xylol is a mixture of three isomers: ortho-xylene, meta-xylene, and para-xylene. Because of technical limitations, East Germany has not yet been capable of separating the three isomers on a commercial scale. There was, however, very little demand for individual isomers before 1952. Small requirements of meta-xylene by VEB Farbenfabrik Wolfen for the manufacture of dyestuff intermediates has been successfully covered by imports from West Germany.

The para-isomer of xylene is the starting material for producing terephthalic acid which, in turn, is one of the raw materials for manufacturing a polyester (terephthalate) fiber called Dacron (by DuPont) in the US and Terylene in the UK, where it was developed. By the end of 1951, East Germany was only in the experimental stage of producing terylene fiber, and -- unless large quantities of para-xylene become available through import -- or a new process is found that does not require para-xylene -- the manufacture of terylene-based products in East Germany is not likely to go beyond the laboratory stage.

Table 15 shows the estimated East German xylol consumption pattern for 1952.

Table 15

Estimated East Germany Xylol Consumption Pattern
1952

Use	Amount Consumed (Metric Tons)	Percent of Total Consumed
Chemical Uses	100	11.7
Solvent and Diluent Uses	710	83.5
Export	20 295/	2.4
East German Plan Reserve	20 296/	2.4
Total	850	100.0

D. Naphthalene.

Naphthalene is one of the most important of all industrial organic chemicals, an essential raw material for the preparation of hundreds of products. From such naphthalene-derived intermediates as the naphthols, naphthylamines, and phthalic anhydride, are formed a great many dyestuffs and colors for the textile, paper, lacquer, and paint industries. Its partial oxidation product, phthalic anhydride, is used extensively in East Germany for manufacturing plasticizers and softeners, which are important in synthetic resins, lacquers, and varnishes, and polyvinyl chloride plastic materials.

Hydrogenation of naphthalene yields the important industrial solvents, decalin and tetralin. Products of the sulfonation of naphthalene are used in dyestuffs and special-purpose chemicals, for which in the synthetic rubber industry, there are no substitutes. Naphthalene is the source for another rubber chemical, a reinforcing carbon black, used mainly for the manufacture of rubber tires. A continuing shortage of the rubber chemicals derived from naphthalene would affect a national economy by limiting the life of its rubber tires. When chlorinated, naphthalene may be used to produce a lubricating oil additive, a pour-point depressor, which makes the oil more effective in cold weather. Another chlorinated naphthalene serves as a wood preservative. Naphthalene and its derivatives have a great many special applications -- the manufacture of insect repellents, wetting agents, pharmaceutical products, and synthetic tanning agents, to mention a few uses involving synthesis of organic chemical products.

The production of phthalic anhydride in East Germany represents the largest single use for naphthalene and in 1952 required about 30 percent of an estimated gross supply of 22,700 tons. The manufacture of carbon black, hydrogenated naphthalenes, and beta-naphthol together accounted for more than 40 percent of the remainder of the naphthalene consumed. It is believed that almost one-half of the naphthalene was consumed by two chemical plants, the VEB Chemische Werke Buna Schkopau and VEB Farbenfabrik Wolfen. The Schkopau plant probably used more than three times the amount that Wolfen did. There is no evidence to indicate that naphthalene has been placed in a strategic stockpile. Table 16 shows the estimated East German naphthalene consumption pattern for 1952.*

* Table 16 follows on p. 66.

Table 16

Estimated East German Naphthalene Consumption Pattern a/
1952

Product or Use	Amount Consumed (Metric Tons)	Percent of Total Consumed
Hydrogenated Naphthalenes (Decalin and Tetralin)	3,350	14.8
Phthalic Anhydride	6,760	29.8
Beta-Naphthol	2,500	11.0
"Emulgator 1,000" (an emulsifier for Buna rubber)	1,800	7.9
Carbon Black	3,840	16.9
Miscellaneous Uses	4,450	19.6
Total	22,700	100.0

a. In the US the principal end uses of naphthalene in 1953 (estimated) were: phthalic anhydride, about 70 percent; beta-naphthol, nearly 8 percent; other dye intermediates, 4.6 percent; household and insecticidal uses, 5.4 percent; chlorinated and hydrogenated naphthalenes, 2.7 percent; and surfactants, tanning agents, and textile uses, 2.7 percent.

E. Refined Phenol.

Refined phenol is currently in great demand in East Germany. A shortage exists even though the area has the potential to produce adequate supplies. The exploitation of this potential requires the development of successful and economical methods for separating phenol from the crude tar acids recovered by the low-temperature carbonization plants. Phenol stocks are being extended as far as possible, but the industry manufacturing phenol-based plastics and resins must shift to other tar acids, (cresols and xylenols) as raw material substitutes.

East Germany used little more than an estimated one-third of its production of phenol for the manufacture of plastics (excluding polyamide fibers) and resins. Because the metallurgical resources of East Germany are too small to satisfy demand, it is essential to employ plastics at an increasing rate as substitutes for iron and nonferrous metals.

The largest single use of phenol in East Germany is in the manufacture of caprolactam, the intermediate from which a polyamide, Perlon L (Luran)is produced.* An estimated 45 percent of the total 1952 phenol supply went into caprolactam for Perlon L, a plastic similar to nylon. Caprolactam is one of the production target items listed within the framework of the East German Five Year Plan (1951-55). One plant, VEB Leunawerke "Walter Ulbricht" at Merseburg, produces all of the caprolactam made in East Germany, but other plants process the material into Perlon products.

The consumption of phenol for the manufacture of plastics, resins, and caprolactam overshadows all other uses of the chemical in East Germany. Only about 20 percent of the estimated 1952 gross supply remained to cover other requirements and manufactured products -- exports, refining of lubricating oils, pharmaceuticals and medicinals, salicylic acid, ion-exchange resins (Wofatit), triphenyl phosphate (a plasticizer), photographic chemicals and materials, weedkillers (2,4-D), dye intermediates, synthetic organic tanning agents, and

* In the US the most important use of phenol is in the manufacture of resinous condensation products by reaction with formaldehyde. These products are used in the manufacture of molded and laminated materials, heat-hardening varnishes, impregnating compounds, and printing inks. Plastics and resins derived from phenol consume from 60 to 75 percent of the total US production of phenol.

other miscellaneous products.* Soviet Bloc countries appear to be favored in exports of phenol. Communist China possibly received the bulk of the phenol exported in 1952, and in the previous year the USSR was the principal recipient. There is no evidence to indicate that phenol was stockpiled in any East German State Material Reserve during 1952, but the 1954 plan does include a small quantity allocated to the State Material Reserve for medical and pharmaceutical supplies.

Table 17 shows the estimated East German refined phenol consumption pattern for 1952.

Table 17

Estimated East German Refined Phenol Consumption Pattern
1952

Product or Use	Amount Consumed (Metric Tons)	Percent of Total Consumed
Caprolactam (for Perlon -- similar to nylon)	4,200	45.4
Plastics and Resins (except Wofatit and synthetic tannins)	3,000	32.5
Refining Lubricating Oils	450	4.9
Pharmaceuticals	400 (Plan) 297/	4.3
Ion-exchange Resins (Wofatit)	300	3.2
Salicylic Acid	235	2.5
Triphenyl Phosphate	125	1.3
Miscellaneous	365	4.0
Export	175 298/	1.9
Total	9,250	100.0

* Several interesting comparisons can be made showing close similarities between the phenol end-use patterns of the US (for 1951) and of East Germany (for 1952). East Germany used nearly 5 percent of its phenol supply for refining lubricating oils (the US, 3 percent), about 2.5 percent to produce salicylic acid (the US, 1.6 percent), almost 1 percent for manufacturing "2, 4-D"-type weedkillers (the US, 5.9 percent), and about 2 percent was exported (the US, 5.4 percent).

F. Cresol.

Cresol has many uses and applications parallel to those of phenol. Cresol is a substitute for phenol in numerous applications, as also is xylenol. For example, phenolic resins made from cresols exhibit better color stability than do similar resins made from pure phenol.

The largest single use of cresol in East Germany is for the production of tricresyl phosphate (TCP), an essential plasticizer in polyvinyl chloride plastics and other important plastics, including polystyrene. It is estimated that East Germany used about one-third of the total cresol supply in the manufacture of TCP during 1952. East Germany is estimated to have used about one-fourth of its gross supply of cresol during 1952 for manufacturing phenolic resins and plastics. The field of plastics alone in East Germany consumes approximately 60 percent of the cresol supply.* The demand for cresol in East Germany for making phenolic resins and plastics is understood to be rapidly increasing as a result of the continuing phenol shortage.

Cresol may also be used as a solvent for refining lubrication oils,** a disinfectant*** in Lysol and health soaps, the starting material for making organic solvents, synthetic tanning agents, pesticides (orchard sprays), dyestuff intermediates, flotation reagents, metal cleaning compounds (for aircraft engines), oil additives, and explosives (trinitrocresol). There is no firm evidence, however, to establish what quantities of cresol are consumed for these purposes in East Germany. The production of organic solvents, hydrogenated cresols like Methylhexalin, probably consumes considerable cresol. The manufacture of tanning agents, which are in great demand in East Germany, probably also consumes an appreciable amount of the total cresol supply. Cresol-based disinfectants and soaps are made, but nothing is known about the volume of production. There is no evidence to indicate that cresol is nitrated to produce explosives nor is there evidence to suggest that cresol is used to refine lubricating oils, although East German specialists were reportedly considering this use at one time.

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* Comparable US figures: for TCP, about 25 percent; for phenolic resins and plastics, from 40 to 50 percent.

** Comparable US figure: about 5 percent.

*** Comparable US figure: about 10 percent.

There is no evidence indicating that, prior to 1953, cresol was placed in a strategic reserve such as the East German State Material Reserve. A negligible amount was reported to be included, under a category called "disinfecting drugs," in the 1953 State Material Reserve plan for pharmaceutical supplies.

A compilation of the fulfilled East German exports of cresol (all fractions combined) during 1952 shows that over 95 percent of the exports went to non-Soviet Bloc countries, and the total amounted to more than 10 percent of the East German output. No exports to the USSR were noted in 1952.

Table 18 shows the estimated East German cresol consumption pattern for 1952.

Table 18

Estimated East German Cresol Consumption Pattern
1952

Product or Use	Amount Consumed (Metric Tons)	Percent of Total Consumed
Tricresyl Phosphate	4,150	32.7
Synthetic Resins and Plastics (except Synthetic Tannins)	3,000	23.6
Hydrogenated Cresols (Methylhexalin, etc.)	1,200	9.5
Synthetic Organic Tanning Agents	750	5.9
Miscellaneous Uses	1,900	14.9
Export	1,700	13.4
Total	12,700	100.0

G. Aniline.

Aniline is the source of hundreds of more complex intermediates and finished products. The chief importance of aniline lies in its value as an intermediate in the manufacture of dyes and pigments (for textiles, leather, and printing inks), pharmaceuticals and drugs, rubber chemicals, photographic chemicals (developers and dyes), smokeless powder stabilizers, and the explosive tetryl. Another application, recently developed, is its use as a rocket fuel, used in combination with fuming nitric acid. Production of this special fuel is of considerable military interest, at least in the US. Because aniline has such a great number of uses and it has no substitutes, the entire war or peacetime economy of a country would be crippled if the aniline supply were curtailed.

There is no evidence to indicate that aniline is produced in East Germany, and supply is, apparently, completely dependent upon import.* The total East German import of aniline during 1952 has been estimated at 1,300 tons (see II, B, 1, above).

No East German exports of aniline have been reported. Prior to 1954, aniline was not mentioned as an item to be included in the East German State Material Reserve. The 1954 plan for medical and pharmaceutical supplies of the State Material Reserve, however, showed an allocation of 15 tons of aniline. 299/

Because of the relatively large size of the synthetic rubber industry in East Germany, considerable quantities of rubber chemicals are needed. The manufacture of rubber antioxidants, including phenyl-beta-naphthylamine and diphenylamine, and a series of vulcanization accelerators under the trade name (Vulkazit) are believed to consume approximately 65 percent of East Germany's total aniline supply; the preparation of dyestuffs, pigments, and intermediates consumes less than 10 percent; the manufacture of photographic chemicals, especially the developer hydroquinone, consumes about 15 percent; and the preparation of drugs and pharmaceuticals, primarily sulfa drugs, uses approximately 5 percent.** East Germany is believed

* The US produced about 43,500 metric tons in 1952.
** Comparable US figures: rubber chemicals, 60 percent; dyestuff, pigments, and intermediates, 15 to 20 percent; photographic chemicals, 2 percent; drugs and pharmaceuticals, 10 percent.

to have used about 7 percent of the 1952 total aniline supply to make centralite (carbanilide),* and probably most of the output was shipped to Hungary for the manufacture of gunpowder.

East Germany has imported, particularly from the USSR, a number of aniline-derived chemicals. One outstanding item is dimethylaniline (DMA), which is an intermediate for the synthesis of tetryl (tetranitromethylaniline), an initiating explosive and a secondary charge for detonators. DMA is also used to a great extent as an intermediate for the preparation of dyestuffs. An import of 16 tons from the USSR was planned in 1951, and the 1950 import amounted to about 34 tons. 300/ The production of organic dyes by East Germany is apparently inadequate to meet demands, even though organic dyes are exported. This situation may be attributable to failure to produce all the types of dyes required. The 1953 import plan included 1,200 tons of organic dyes valued at 24.1 million rubles, and the dyes were to come mainly from Western countries, probably Switzerland, West Germany, and the UK. 301/

The largest single aniline-consuming plant in East Germany is VEB Farbenfabrik Wolfen. It appears that this plant used about 820 tons in 1950, approximately 1,000 tons in 1951, 302/ and had an anticipated requirement of 1,176 tons in 1952. 303/

Table 19** shows the estimated East German aniline consumption pattern for 1952.

IV. Input Requirements.

A. Raw Materials.

1. General.

Hard coal (bituminous) used in coke-oven plants (cokeries) and gas plants yields two principal crude products which are sources for obtaining refined basic aromatic chemicals: raw hard-coal tar and crude benzol (light oil). The tar recovered from carbonizing hard coal is the source of naphthalene and a limited amount of crude tar acids. The crude benzol product provides most of the refined benzol, toluol, and xylol obtainable from coal. A small amount of crude benzol is recovered in the distilling of coal tar, but this

* During World War II (1944) the US used about 3 percent of the total aniline supply for smokeless powder stabilizers.
** Table 19 follows on p. 73.

Table 19

Estimated East German Aniline Consumption Pattern
1952

Product and Use	Amount Consumed (Metric Tons)	Percent of Total Consumed
Phenyl-Beta-Naphthylamine (PBN) (Rubber Antioxidant)	750	57.7
Vulkazit (Rubber Accelerators)	60	4.6
Hydroquinone (Photographic Developer)	200	15.4
Centralite (Smokeless Powder Stabilizer)	100	7.7
Sulfonamides (Sulfa Drugs)	60	4.6
Miscellaneous	130	10.0
Total	1,300	100.0

fraction of the tar is combined with the main crude benzol product before rectification. Formerly, some crude benzol was produced in East Germany by one plant having a Fischer-Tropsch low-pressure synthesis unit, but this installation was dismantled in 1951.

Brown coal and/or lignite furnish the greatest quantity of crude tar acids (crude phenols) produced in East Germany. Only a very small proportion of the tar acids produced come from hard-coal tar. The tar acids are processed for separation to give refined phenol, cresols, and xylenols.

The three sources -- hard-coal tar, crude benzol, and crude tar acids -- from which East Germany acquires all of its indigenous production of the refined basic aromatic chemicals are discussed in detail in the following paragraphs.

2. Raw Hard-Coal Tar.

The production of raw tar from hard coal in East Germany is confined mainly to installations equipped with gas retorts, as exemplified by the many municipal and city gas plants throughout the area. In 1952 there were 194 of these plants producing hard-coal tar, and their combined output accounted for about 90 percent of the total East German tar output. 304/ (See Appendix C, Table 33.*) The remaining 10 percent of the tar output was produced by two small cokeries located at Zwickau, August Bebel (formerly Estav cokery) and Karl Marx (formerly Morgenstern cokery).

Indigenous tar production, however, is insufficient for domestic requirements, so additional quantities of tar must be obtained by import, mainly from several Western countries, including Denmark, Sweden, Norway, Austria, and West Germany. Tar imports in 1950 amounted to 8,019 tons, 305/ and the annual import plans for 1951 and 1952 were 18,000 tons and 20,000 tons, respectively. 306/ There is no information to indicate the success of these import plans, but they were probably not fulfilled.

Raw tar is required by several East German tar distilleries for processing to produce coal-tar products. Quantities of tar are needed also by a number of roofing-felt (paper or board) manufacturing plants and for road construction and repair. One source reported that, because of the tar shortage in 1951, the East German State Planning Commission had to allocate 5.5 million marks for the purchase of cobbled pavement to meet the road construction schedule. 307/

In 1952, three tar distilleries were scheduled to receive approximately 92 percent of the planned total tar output, 90,067 tons, from gas plants operating on hard coal. The largest of the distilleries is VEB Teerdestillation- und Chemische Fabrik Erkner (near Berlin), which expected to receive 80 percent of the total tar output from the gas plants. The remaining tar deliveries were to be divided between two small tar distilleries, Chemische Fabrik Velten (formerly Schieweck and Company plant) (to receive 5.9 percent of the tar) and Chemische Fabrik Doebeln (formerly Oswald Greiner plant) (to receive 6.4 percent of the tar), and the various East German Land governments (to receive 7.7 percent of the tar). 308/ Tar deliveries to the Land governments probably were to go to a number of tar roofing-felt manufacturing plants and to road construction units. The largest plant known to produce roofing felt in the area is the Riedel plant (formerly Hans Burchard plant) at Rostock.

* P. 171, below.

[redacted] during 1952 the Erkner distillery actually processed about 83,800 tons of raw hard-coal tar containing a maximum water content of 5 percent, but this quantity included about 8,700 tons imported from Denmark, Norway, Sweden, and Austria. 309/ (See Appendix C, Table 34.*) The Zwickau coking plants partially process most of their own tar production but apparently do ship a small amount of the raw tar to Erkner for processing. 50X1

The Erkner plant also receives medium-boiling tar fractions, called the "middle oil" (maximum boiling point of 240°C), from the Zwickau cokeries, from the Velten tar distillery, and from various tar processing plants -- the Biemann plant at Grabow; the Siemens-Plania plant Lichtenberg; Teerverwertung Gotha; the Eggert plant at Wismar; and tar-paper plants at Bruel, Malliss, Woltersdorf, and Rostock (Riedel plant). 310/ The middle oil fraction is processed by Erkner, primarily to recover naphthalene and crude tar acids.

Before 1945 the area which is now East Germany had two large tar distilleries. One was the Erkner plant, and the other was located at Niederau (near Meissen -- in the vicinity of Dresden). Both plants were former members of the second largest tar-distilling organization in Germany, the Ruetgerswerke AG. The USSR dismantled the Niederau plant in 1945.

The norm for tar production by gas plants, based on East German statistical investigations, has been established at 4.3 kilograms of tar, with a maximum of 5 percent water content, per 100 kilograms of coal throughput, where the crude coal has a pure coal content of 82.6 percent. 311/

3. Crude Benzol.

The primary source of crude benzol in East Germany is the city gas plant. Of the 194 city gas plants, including two plants in the Soviet sector of Berlin, that were capable of recovering hard coal tar in 1952, apparently about one-fourth were equipped with benzol scrubbers and could recover crude benzol from the volatile materials produced. There were 48 gas plants scheduled to produce crude benzol during 1952, and together they were to contribute about 78 percent of the entire East German crude benzol production quota. 312/ (See Appendix C.)

* P. 175, below.

The second important source of crude benzol is the cokery. Only two East German cokeries, Karl Marx and August Bebel, use hard coal. Both plants are located at Zwickau in the district (Bezirk) of Chemnitz, formerly Land Saxony. Prior to April 1951, a Fischer-Tropsch low-pressure synthesis unit at VEB Mineraloelwerk Luetzkendorf, Krumpa/Geisteltal, was a producer of synthetic crude benzol. The unit was dismantled in 1951, and some of the equipment was moved to expand the capacity of a similar type of installation at VEB Werk Schwarzheide, near Ruhland/Senftenberg. 313/ There is no evidence to indicate that Schwarzheide will produce synthetic crude benzol.

Annual East German production plans for crude benzol from 1949 to 1952 are available, but no reports have appeared giving actual final outputs for any one of these years. [redacted] 50X1 50X1
Table 20* gives estimates of the production of crude benzol in East Germany from 1949 through 1955.

4. Crude Tar Acids (Crude Phenols).

Conditions in East Germany are most favorable for producing large quantities of crude tar acids. The raw materials, brown coal and lignite, are available in considerable amounts. It was reported in early 1952 that if the quantities of the low-temperature carbonization (LTC) liquors recovered at that time were fully utilized, 9,000 tons of crude phenol containing 3,000 tons of pure phenol could be obtained annually, and if the middle oil phenols from LTC plants were processed completely, it would be possible to recover each year 52,000 tons of crude phenols containing about 12,000 tons of pure phenol. 314/

Current rates of production of crude phenols, however, are not known for all producing LTC plants and hydrogenation plants. Furthermore, the processing conditions; the raw materials; the phenolic content of each tar, oil-fraction, and effluent; and the actual yields of tar acids obtained from each crude phenols source are so varied and complex from plant to plant that it has been impractical to make total estimates of crude phenols production in East Germany by a plant-analysis method. Fragmentary production data and annual quota figures were available for many of the

* Table 20 follows on p. 77.

Table 20

Estimated Production of Crude Benzol in East Germany, by Producing Plants 1949-55

Metric Tons

Year	Production			
	Total	City Gas Plants a/	Karl Marx and August Bebel cokeries b/	VEB Mineraloelwerk Luetzkendorf c/
1949	12,800	8,734 316/	3,449 317/	617
	10,000 d/ 315/		2,850 d/ 318/	800 d/ 319/
1950	14,900	10,100	3,800 e/	
	12,000 d/ 320/		3,200 d/ 322/	1,000 d/ 323/
1951	16,900 f/	12,618	3,950	332 328/
	16,384 d/ 326/		3,340 327/	
1952	18,600 g/	14,600	4,000	
	18,482 d/ 329/	14,413 d/ 330/		
1953	19,600 g/	15,600	4,000	
1954	20,700 g/	16,650	4,050	
1955	21,700 g/	17,600	4,100	

a. Outputs were calculated from probable percentage yields of crude benzol to coke production estimates. Yield factors employed range from 0.74 to 0.88 percent of the gas coke (Gaskoks) produced. See Appendix C for estimated gas-coke production during corresponding years.
b. Procedure used was similar to (a) above in estimating crude benzol outputs by cokeries, except yield factors employed range from 1.49 to 1.52 percent of the estimated coke outputs. See Appendix C for estimated coke (Zechenkoks) production by the cokeries for corresponding years.
c. Production of synthetic crude benzol ceased when the Fischer-Tropsch unit was dismantled in 1951.
d. Plan figure.
e. Estimate based on reported actual output for 11 months 1950 (3,507 MT). 321/
f. Estimate based on first half-year output (8,455 MT) 324/ and first 9 months output (12,676 MT). 325/
g. Estimate representing the sum of the separate output estimates for city gas plants and Zwickau cokeries (Karl Marx and August Bebel).

significant producing plants and are presented in Table 21.* Another table, in Appendix C, lists the same plants and provides information about the raw materials used, the specific sources of the crude phenols, and the method or process employed to recover them at each installation. East German plants reported to be currently producing crude phenol oils are located at Espenhain, Boehlen, Zeitz, Rositz, Leuna, and Goelzau, and plants presently producing phenolate liquors are at Hirschfelde, Goelzau, Boehlen, and Klaffenbach.

The largest producer of crude phenol oil is VEB Kombinat Espenhain at Espenhain. Most of its phenolic product is obtained from LTC spent liquors and the remainder from heavy benzine or naphtha (gasoline). Two crude phenol extracting towers are in operation, each capable of handling 850 cubic meters of LTC waste waters daily and lowering the phenol content from 8 to 0.75 grams per liter. The Koppers steam-circulation process is employed with caustic soda lye. The phenol extraction plant for heavy benzine is understood to extract 40 tons of crude acid daily. Espenhain processes the phenolate liquors from plants at Boehlen and Hirschfelde. 331/ Espenhain's crude phenol product is shipped mainly to VEB Leunawerke "Walter Ulbricht," at Leuna near Merseburg, but some (about 10 percent) is sent to VEB Teerdestillation- und Chemische Fabrik Erkner for refining. During 1952, Erkner received 3,291 tons from Espenhain, and the 1953 plan called for 5,550 tons (containing 16.5 percent water). 332/ A reported analysis of Espenhain's crude phenol oil showed it to contain the following 333/:

24.6 percent phenol
25.5 percent cresols
21.1 percent xylenols
10.1 percent phenol pitch
16.5 percent water
(2.2 percent loss)

Table 21 shows actual and planned East German production of crude phenols, by producing plants, from 1949 through 1955.

* Table 21 follows on p. 79.

Table 21

Actual and Planned Production of Crude Phenols in East Germany, by Producing Plants 1949-55 a/*

Metric Tons

Plant and Location	Production b/
Crude Phenol Oil	
VEB Kombinat Espenhain, Espenhain (near Borna)	1951 (30,000) 334/ 1952 38,098 335/ 1953 40,391 336/ 1954 (41,500) 337/
VEB Kombinat "Otto Grotewohl," Boehlen (near Leipzig)	1950 310 338/ 1951 469 339/ 1952 493 340/ 1953 (897) c/ 342/
VEB Hydrierwerk Zeitz/Weissenfels	1950 1,392 343/ 1951 (1,450) 344/ 1952 (9,720) 345/ 1954 (2,092) 346/
VEB Teerverarbeitungswerk Rositz (near Altenburg)	1950 3,459 347/ 1951 4,201 348/ 1952 5,058 349/ 1953 5,964 d/ 350/ 1954 (6,300) 352/ 1955 (6,300) 353/
VEB Leunawerke "Walter Ulbricht," Leuna (near Merseburg)	1950 (1,575) (2nd Quarter) 354/ 1950 5,000 (Approximate) 355/ Annual capacity 24,000 356/
VEB Grosskokerei "Matyas Rakosi," Lauchhammer (near Ruhland)	Ultimate annual capacity 1,700 357/

* Footnotes for Table 21 follow on p. 80.

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Table 21

Actual and Planned Production of Crude Phenols
in East Germany, by Producing Plants
1949-55 a/
(Continued)

Metric Tons

Plant and Location		Production b/
Crude Phenol Oil (Continued)		
VEB Teerverarbeitungswerk Goelzau/Weissandt	1952	(1,120) 358/
	1953	4,219 e/ 360/
	1954	(4,500) 361/
	1955	(4,500) 362/
Phenolate Liquor (Sodium Phenolates)		
VEB Elektrochemie Hirschfelde (near Zittau)	1949	8,096 363/
	1950	(8,200) 364/
VEB Mineraloelwerk Klaffenbach, Klaffenbach Erzgebirge	1952	(390) 365/
	1953	34 f/ 366/
VEB Teerverarbeitungswerk Goelzau, Goelzau/Weissandt	1953	1,547 367/
	1954	(3,200) 368/
	1955	(3,200) 369/
VEB Kombinat "Otto Grotewohl," Boehlen (near Leipzig)	1950	43,375 370/
	1951	46,662 371/
	1952	53,589 g/ 372/
	1953	(52,577) h/ 374/

a. Production information is not complete for all plants through 1955.
b. Data shown in parentheses are annual production quotas.
c. Original plan for 1953 was 840 tons. Actual output for first 9 months was 648 tons. 341/
d. Original 1953 quota was 5,500 tons, 351/ but the revised quota was 4,885 tons.

Table 21

Actual and Planned Production of Crude Phenols in East Germany, by Producing Plants 1949-55 a/ (Continued)

e. Original 1953 quota was 3,860 tons. Revised 1953 quota was 4,003 tons. 359/
f. Original 1953 quota was 300 tons and the revised quota was 34 tons.
g. Quantity includes 49,373 tons from brown-coal tar and 4,216 tons from hydrogenation.
h. Original 1953 quota was 50,000 tons. Actual output for first 9 months was 39,696 tons. 373/

A tar-processing plant near Altenburg, VEB Teerverarbeitungswerk Rositz, recovers crude phenols from heavy benzine or naphtha fractions by absorption with caustic soda. In 1951, Rositz was not equipped to recover phenols from LTC waste waters, output of which was then at the rate of 180 cubic meters a day. 375/ No subsequent information indicates that Rositz now is capable of dephenolating its process effluents. The plant produces a product called "R-III" or "middle-oil phenol," but apparently its phenolic constituents have not been successfully exploited to date. The product may have possibilities in direct utilization as a phenolic raw material for manufacturing synthetic plastics. "R-III" reportedly boils between 170 and 300°C, and a sample analysis showed the following composition 376/:

64 percent crude phenols mixture
8 percent bases
4 percent acids
24 percent neutral oils

The crude phenols mixture consisted of:

11 percent phenol
29 percent cresols (including 11 percent ortho cresol)
28 percent xylenols
32 percent higher phenols

There is little available information about the production of crude phenol oil at VEB Leunawerke "Walter Ulbricht." The plant is known to recover phenols from hydrogenation (Bergius process) waste waters and heavy benzine fractions by absorption with caustic soda. 377/ Another plant, VEB Kombinat "Otto Grotewohl" at Boehlen near Leipzig, uses a Phenosolvan process unit to recover crude phenol oil from hydrogenation (Bergius process) waste waters, output of which was 10 cubic meters per hour by 1951. On the other hand, the Bergius hydrogenation plant near Weissenfels, VEB Hydrierwerk Zeitz, recovers phenols by using the Tricresyl phosphate process. By 1951 this plant was processing hourly 30 cubic meters of waste waters having a phenol content of 5 to 6 grams per liter. 378/ An analysis of Zeitz's crude phenol oil indicates that it contained the following 379/:

16 to 20 percent phenol
40 to 50 percent cresols
20 to 25 percent xylenols
10 to 15 percent water
4 to 5 percent other elements with higher boiling points
0.05 percent neutral oil

A newly constructed plant at Lauchhammer (near Ruhland) named VEB Grosskokerei "Matyas Rakosi," Lauchhammer, is expected to produce crude phenols, but the status of current operations is unknown. The VEB Teerverarbeitungswerk Goelzau was reported to have planned experiments for 1953 to determine a more economical way of freeing phenols from LTC liquors by developing a wash oil, with a high binding property for phenols to treat the LTC water. 380/

The Erkner distillery was directed to erect, by the end of 1953, a 735,000-eastmark dephenolating installation 381/ in which the "Phenosolvan" process would be employed. The phenol-containing waste waters from VEB Teerverarbeitungswerk Koepsen at Koethen and VEB Teerverarbeitungswerk Webau near Radegast were to be dephenolized in a different manner. These plants were to use as the solvent a diesel oil fraction from brown-coal distillation. The process is expected to give a crude phenols recovery of 80 to 85 percent from a daily throughput of 100 to 110 cubic meters of water containing about 350 kilograms of crude phenols. 382/

Some plants remove crude tar acids from tar oils by extraction with a caustic soda solution. The result is a mixed sodium phenolate liquor, generally known as phenolate liquor, or lye. Phenols are recovered from the liquor at refining plants by "springing" with carbon dioxide (or sulfuric acid).

The largest East German producer of phenolate liquor is VEB Kombinat "Otto Grotewohl," at Boehlen. The product is shipped to the Espenhain plant. Another producer is VEB Teerverarbeitungswerk Goelzau, near Weissandt, which makes a 50 percent phenolate liquor. 383/ A petroleum refining plant, VEB Mineraloelwerk Klaffenbach, is understood to be a minor producer of phenolate liquor. A 25 percent liquor produced by VEB Elektrochemie Hirschfelde, second largest producer, is sent to the Erkner plant for refining. 384/ In 1952, Erkner received 2,459 tons from Hirschfelde and was to receive 1,600 tons in 1953. 385/ When processed at Erkner, Hirschfelde's product was reported to yield the following 386/:

11.8 percent phenol
10.6 percent cresols
4.6 percent xylenols
3.0 percent phenol pitch
12.8 percent solid caustic soda
54.7 percent water
(2.5 percent loss)

The Goelzau plant also produces a "phenol resin," but composition and applications are not known. Goelzau's revised 1953 production goal for the resin was 779 tons, but the actual output was 915 tons. 387/ A "phenol extract" is reported to be made by VEP Mineraloelwerk Luetzkendorf at Krumpa. The nature of the "extract" is unknown, but output was 1,196 tons in 1950, and the 1952 production plan was 2,400 tons. 388/

It is obvious that production possibilities for tar acids derived from brown coal in East Germany far overshadow those for whatever quantity of tar acids can be realized from indigenous production of hard-coal tar. None of the hard-coal tar producers, the gas plants and cokeries, are presently capable of separating tar acids from the tar. In all of East Germany the Erkner plant is the sole installation which processes hard-coal tar and its fractions for tar acids.

Table 22 presents actual and planned production of crude phenols in East Germany from 1949 through 1955.

Table 22

Actual and Planned Production of Crude Phenols in East Germany 1949-55

Metric Tons

Year	Production
1949	23,500 389/
1950	26,749 a/ 391/
1951	33,766 b/ c/ 392/
1952	45,700 d/ 393/
	41,650 b/ e/ 395/
1953	45,800 b/ f/ g/ 398/
1954	61,000 b/ c/ h/ 399/
1955	70,000 b/ c/ h/ 400/

a. The 1950 production plan was 25,010 tons. 390/
b. Plan figure.
c. Original production quota stated in the East German Five Year Plan (1951-55).
d. Estimate based on reported actual production for 8 months of 1952 (30,456 tons).
e. Annual production quota. Original 1952 plan stated in the East German Five Year Plan was 44,500 tons. 394/
f. Revised 1953 production quota. Actual output for first 6 months was 23,700 tons. 396/
g. Original 1953 production quota was 53,000 tons, as given in the Five Year Plan. 397/
h. Actual output is not likely to exceed annual quota set in the Five Year Plan.

B. Manpower.

The manpower requirement for the production of aromatic coal chemicals in East Germany is not large, and there appears to be an adequate supply of all required skills. The processing of raw hard-coal tar and crude benzol is practically monopolized by one plant, VEB Teerdestillation- und Chemische Fabrik Erkner. This plant has a larger number of employees directly engaged in the production of coal chemicals than has any other plant in East Germany. Available employment data on the Erkner plant have been generally complete. It has been reported that the manpower requirements (excluding apprentices) at Erkner increased in 1951 to 116 percent and in 1952 to 121 percent of those of 1950 and that, from a plan point of view, requirements in all professional groups were satisfied. At the same time, worker productivity was 135 percent in 1951 and 141 percent in 1952 of the 1950 figure. 401/

The two cokeries at Zwickau are equipped with byproduct recovery units and are capable of processing most of their own production of tar and benzol. Thus the number of workers actually connected with the byproduct plants, not total employment, is the desired figure; the latter would include workers for coke-oven operations. There is no available information, however, on the manpower requirements for the operation of the byproduct plants at the Zwickau cokeries, and it has been necessary to base an estimate on US practices.

No reported manpower data are available on the number of personnel actually concerned with the recovery and readying for shipment of tar and crude benzol at the nearly 200 East German hard-coal gas plants. Only an arbitrary estimate can be given. The same is true for the number of workers required by almost 10 crude phenols producing plants and 2 plants, besides Erkner, which process these crude phenols. There is available no current labor employment information on the small tar distilleries at Doebeln and Velten. Table 23* gives the estimated East German manpower requirements for the production of aromatic coal chemicals in 1952.

* Table 23 follows on p. 86.

Table 23

Estimated East German Manpower Requirements
for the Production of Aromatic Coal Chemicals
1952

Producing Plants	Estimated Total Number of Employees
Gas Plants (for tar and crude benzol recovery only)	1,200 a/
Cokeries (for coke byproduct plant only)	70 b/
Erkner Tar Distillery	640 c/
Doebeln and Velten Tar Distilleries	100 d/
Plants Producing and Processing Crude Phenols	250 e/
Total	2,260

a. Estimate for 194 gas plants. Total workers reported employed by 180 gas plants in December of 1948 were 10,605. 402/
b. Total workers reported employed by 2 cokeries in December of 1948 were 511. 403/ US manpower requirement for a byproduct plant of a cokery is 1.7 man-hours per metric ton of coal consumed.
c. Erkner employed 634 (total) on 1 January 1952. 404/
d. These plants and the Riedel roofing-felt plant at Rostock employed 80 workers in December of 1948. 405/
e. Estimate.

C. Process Materials and Energy.

The coal chemical industry in East Germany has adequate supplies of process materials and, except hard coal, of energy. Aside from hard coal, over-all requirements are relatively small in comparison with the rest of the East German chemical industry and other heavy industries. Because indigenous hard-coal resources are lacking and import deliveries and allocations are sporadic, coal supplies at city gas plants are often meager, and production losses sometimes occur. Fortunately for the industry, requirements are small for sulfuric acid, which is critically short throughout East Germany.

[redacted] 50X1

[redacted] In many instances, however, it has been necessary to estimate input requirements, particularly for coke byproduct plants and crude phenols processing installations, on the basis of US practices and input factors or on German operations prior to the end of World War II. Those estimated requirements for 1952 given in Table 24 are incomplete, and a number of the estimates are crude. Production and processing procedures vary so greatly, depending on local factors, that it is impossible to make accurate estimates. The bulk of the estimates of principal inputs, however, are reasonably /accurate.* 50X1

Table 24

Estimated East German Material and Energy Requirements for the Production of Aromatic Coal Chemicals
1952

Input	Quantity
Bituminous Coal (for coke, raw tar, and crude benzol)	
Gas Plants	2,440,000 tons a/**
Cokeries	350,000 tons b/
Total	2,790,000 tons
Electricity	
VEB Teerdestillation- und Chemische Fabrik Erkner	4,300,000 kilowatt-hours 406/
Cokeries	3,700,000 kilowatt-hours c/
VEB Chemische Fabrik Doebeln and VEB Chemische Fabrik Velten	153,000 kilowatt-hours d/
Boehlen (Phenolate-Liquor Plants)	2,870,000 kilowatt-hours e/

* Continued on p. 91.
** Footnotes for Table 24 follow on p. 91.

Table 24

Estimated East German Material and Energy Requirements
for the Production of Aromatic Coal Chemicals
1952
(Continued)

Input	Quantity
Electricity (Continued)	
Other Phenolate-Liquor-Producing Plants	590,000 kilowatt-hours f/
Crude Phenol-Oil Producing Plants	2,970,000 kilowatt-hours g/
Total	14,583,000 kilowatt-hours
Steam	
VEB Teerdestillation- und Chemische Fabrik Erkner (at 19 atmospheres pressure)	187,000 tons h/
Gas Plants (for recovering crude benzol)	73,000 tons j/
Cokeries	108,000 tons k/
VEB Chemische Fabrik Doebeln and VEB Chemische Fabrik Velten	7,800 tons l/
VEB Kombinat "Otto Grotewohl," Boehlen (Phenolate-Liquor Plants)	74,500 tons m/
Other Phenolate-Liquor Producing Plants	18,200 tons n/
Crude Phenol-Oil Producing Plants	81,000 tons o/
Total	549,500 tons
Lime	
VEB Teerdestillation- und Chemische Fabrik Erkner	8,400 tons p/
Cokeries	300 tons q/
Crude Phenols-Processing Plants (except Erkner Plant)	11,500 tons r/
Total	20,200 tons

Table 24

Estimated East German Material and Energy Requirements
for the Production of Aromatic Coal Chemicals
1952
(Continued)

Input	Quantity
Coke	
VEB Teerdestillation- und Chemische Fabrik Erkner	1,000 tons 418/
Other Plants, including Cokeries and Crude Phenols-Processing Plants (except Erkner Plant)	14,200 tons s/
Total	15,200 tons
Caustic Soda (100 Percent NaOH)	
VEB Teerdestillation- und Chemische Fabrik Erkner	668 tons 420/
VEB Kombinat "Otto Grotewohl," Boehlen (Phenolate-Liquor Plants)	2,068 tons 421/
Other Phenolate-Liquor-Producing Plants	415 tons t/
Crude Phenols-Processing Plants (except Erkner plant)	1,000 tons u/
Total	4,151 tons
Sulfuric Acid (100 percent acid basis)	
VEB Teerdestillation- und Chemische Fabrik Erkner	1,050 tons 423/
Cokeries	3,600 tons v/
Total	4,650 tons

a. Based on an estimated total coke production of 1.7 million tons and a coke yield of 69.5 percent of the coal charged to the gas retorts.
b. Based on an estimated total coke production of 264,000 tons and a coke yield of 76.0 percent of the coal charged to the coke ovens.
c. Based on 14 kilowatt-hours per ton of coke produced and an estimated coke output of 264,000 tons.
d. Based on 13.8 kilowatt-hours per ton of raw tar processed and an estimated tar processing total of 11,100 tons.

Table 24

Estimated East German Material and Energy Requirements
for the Production of Aromatic Coal Chemicals
1952
(Continued)

e. Based on a reported consumption of 53.5 kilowatt-hours per ton of phenolate liquor produced and an output of 53,600 tons of phenolate liquor in 1952. 407/

f. Based on a consumption of 55 kilowatt-hours per ton of phenolate liquor and an estimated output of 10,700 tons of phenolate liquor. 408/

g. Based on an estimated consumption of 66 kilowatt-hours per ton of crude phenol oil and an estimated output of 45,000 tons of crude phenol oil. 409/

h. Reported steam consumption for the first half of 1952 was 93,900 tons, and total quantity of products produced was 50,014 tons (1.88 tons of steam per 1 ton of product). 410/ Total 1952 output of products was 99,853 tons. 411/

j. Based on reported norm of 5 tons of steam required per 1 ton of crude benzol produced. 412/ Estimated crude benzol output from gas plants in 1952 was 14,600 tons.

k. Based on 900 pounds of steam per ton of coke and an estimated coke output of 264,000 tons.

l. Based on an arbitrary estimate of 0.7 kilowatt-hours required for 1 ton of tar processed and a total tar processing of 11,100 tons.

m. Based on a reported consumption of 1.39 tons of steam per ton of phenolate liquor produced an output of 53,600 tons of phenolate liquor in 1952. 413/

n. Based on a consumption of 1.7 tons of steam per ton of phenolate liquor and an estimated output of 10,700 tons of phenolate liquor. 414/

o. Based on an estimated consumption of 1.8 tons of steam per ton of crude phenol oil produced and an estimated output of 45,000 tons of crude phenol oil. 415/

p. Based on a reported relationship of 1 ton of lime per 0.12 ton of coke (for burning) 416/ and a reported coke consumption in 1952 of 1,000 tons. 417/

q. Based on a requirement of 3.0 pounds of lime per 1.0 ton of coke produced and an estimated coke output of 264,000 tons.

r. Based on 46 kg. of lime per 100 kg. of crude phenols processed and an estimated 25,000 tons of crude phenols processed in 1952.

s. Based on 8.35 tons of lime per 1.0 ton of coke (for burning) 419/ and an estimated requirement of 11,800 tons of lime (see Lime, above).

Table 24

Estimated East German Material and Energy Requirements for the Production of Aromatic Coal Chemicals
1952
(Continued)

t. Based on 3.88 kg. of caustic soda per 100 kg. of phenolate liquor produced (as reported for the Boehlen Plant) 422/ and an estimated 10,700 tons of phenolate liquor produced.
u. Based on 4 kg. of caustic soda per 100 kg. of crude phenols processed and an estimated 25,000 tons of crude phenols processed in 1952.
v. Based on 39 pounds of sulfuric acid (60° Baumé or 77.7 percent acid content) per ton of coke produced and an estimated coke output of 264,000 tons.

Bituminous coal estimates shown in Table 24 represent only the coal required for the production of coke (including coke breeze), raw coal tar, and crude benzol by coking plants and gas plants. No attempt has been made to estimate coal requirements for electricity, process steam, heating, and other uses, for plant operating conditions vary widely. Similar problems exist for calculating plant requirements for water, and no estimates have been made.

V. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

It has been previously stated that East Germany is incapable of producing several of the basic aromatic chemicals in the quantities that the country requires. It is estimated that in 1952 less than 30 percent of the gross supply of benzol came from East German producers; about 40 percent of the toluol supply; about 20 percent of the naphthalene supply; and none of the aniline. The production of xylol, phenol, and cresols in 1952 seems to have satisfied minimum requirements; there were no reported imports of these chemicals, but actual demands, especially for xylol and phenol, were discernibly greater than production.

The Five Year Plan (1951-55) calls for the production of 15,100 tons of refined benzol and an import of 35,000 tons. 424/ Based on available information, the fulfillment of the 1955 benzol plan does not appear likely; actual output may fall short by about 20 percent. The production of raw hard-coal tar, according to the Five Year Plan, is to be 140,500 tons in 1955, and an additional 20,000 tons will be imported. 425/ Current information, however, indicates that tar production in 1955 will be only a little more than 80 percent of plan. (See Appendix C, Table 32.*) Under the Five Year Plan, output of pure phenol in 1955, is to be 15,300 tons, and no imports are contemplated. 426/ Actual phenol production in 1955 probably will be about 90 percent of the Five Year Plan figure.

The possibilities of expanding production appreciably after 1955 do not appear favorable. Much depends, of course, on the degree of success that will be attained in realizing the potential supply of aromatic chemicals available from brown coal. Additional production gained from brown coal sources can hardly be anticipated in quantity before 1960, at the earliest, because new plants must be built. In the meantime, equipment and power shortages, other than those which now exist, may arise, and they will impede progress in the new approach to solving the problem of deficiencies in aromatic chemicals.

B. Vulnerabilities.

From a military point of view, East Germany is, apparently, exceptionally vulnerable in respect to the production and refining of coal chemicals for direct utilization by the chemical industry and other economic sectors. The situation exists mainly because there is only one significant plant, VEB Teerdestillation- und Chemische Fabrik Erkner (near Berlin), which is capable of processing large quantities of raw materials -- raw hard-coal tar and crude benzol. It is estimated that in 1952 Erkner produced from indigenous supplies of the raw materials just mentioned the following products, in percentages of the total East German output: 70 percent of the refined benzol, 63 percent of the toluol, 92 percent of the xylol, 80 percent of the naphthalene, and almost 30 percent of the refined phenol and the cresols. Only VEB Leunawerke "Walter Ulbricht" outproduces Erkner on refined phenol and the cresols, producing about 55 percent of the country's total output.

* P. 169, below.

The bulk of the raw tar and crude benzol for Erkner originates from the many gas plants. Numerous small installations among these plants, however, are antiquated and are unsuitable for the normal production and recovery of byproducts such as coke, tar, crude benzol, and ammonium sulfate.

The East German economy, apparently, is also quite vulnerable because nearly all of the well-developed and complex organic-chemical industry is centralized in a few large chemical combines. These plants or combines manufacture the intermediates and derived aromatics from coal chemicals, and upon these products the economy is definitely dependent. These plants also contribute significantly to other Soviet Bloc countries, particularly to the USSR. A list of the outstanding plants would include the following: VEB Farbenfabrik Wolfen; VEB Chemische Werke Buna Schkopau; VEB Elektrochemisches Kombinat Bitterfeld; VEB Leunawerke "Walter Ulbricht"; and VEB Deutsches Hydrierwerk Rodleben.

The Wolfen plant manufactures a surprisingly wide range of products. Some of the products are rubber chemicals, dyestuffs and dye intermediates, pharmaceuticals and drugs, photographic chemicals and color film dyes, synthetic materials (for example, ion-exchange resins for the sugar industry and for water purification and leather-tanning agents), and stabilizers for smokeless powder. Without Wolfen's production of rubber chemicals, the entire rubber manufacturing and fabricating industry in East Germany would collapse, provided that imports from the USSR or the West were unavailable. The plant is the largest dyestuffs and photographic chemicals producer in the country and probably in the Soviet Satellites.

The synthetic rubber (buna) plant at Schkopau would eease operations if the ethylbenzene and styrene production units were destroyed. Schkopau also makes necessary rubber chemicals not produced at Wolfen. Other products made by Schkopau include valuable plasticizers for the plastics and explosives industries. The Bitterfeld plant provides the country with insecticides, plasticizers for the plastic industry, salicylic acid, weed killers, and starting materials for dyes manufacture at Wolfen. If Bitterfeld's monochlorobenzene plant were eliminated, East Germany's production of organic insecticides (DDT and others) would be at least halved. The Leunawerke is the sole producer of caprolactam, the base for the "Perlon" fiber, a synthetic similar to nylon. The Perlon fiber and cord industries rest on Leuna's output. The hydrogenation plant at Rodleben is very important for its production of organic solvents and also for its sulfa drugs.

Lack of vital materials brings on production bottlenecks. Reported shortages of various materials indicate weaknesses in the East German economy and point to potential vulnerabilities in time of war. Particularly scarce items appear to include stainless and other high-quality steels, sheet metal, seamless boiler tubes, tube bends, retorts, pressure vessels, electric motors and mountings, parts for electric generators, damp-resistant cables, vacuum pumps, welding electrodes, welding flanges, wire ropes, nuts and bolts, and sulfuric acid. 427/

The inadequacies of the East German rail transportation system interrupted continuous operations during 1952 and jeopardized production quotas at Erkner. [redacted] 50X1
because of the tank-car shortage, sporadic deliveries of crude benzol from the gas plants to Erkner were contributory to the non-fulfillment of refined benzol and toluol production plans. On a number of occasions, Erkner had to use tank cars from its own limited tank-car park to supply the plant with raw materials produced by the gas plants. On the other hand, there were times when the gas plants were not supplied with the necessary hard coal and their production was sporadic. In February 1952, coal stocks at Erkner were so low that the plant was faced with the problem of either keeping up production or keeping the plant warm in order to avoid damage from frost. 428/

If the scarcity of materials continues as before and the other limiting factors still exist in the next few years, the ambitions for self-sufficiency, such as developing to a commercial scale the production of aromatic chemicals from brown coal, cannot be realized.

C. Intentions.

In general, the objectives of the East German chemical industry appear to be based mainly on a desire to attain a greater degree of self-sufficiency, especially in relation to the West. Self-sufficiency is to be accomplished through technological advancements and more exhaustive utilization of domestic resources. Attention and effort are directed currently toward developing potential sources for essential chemical raw materials now in short supply, some of which must be imported at great cost. At the same time, technical experts are endeavoring to produce synthetically new products or substitutes that do not require the scant raw materials. These substitutes, or "ersatz" products, often may be as satisfactory as, or even better than, products formerly made from scarce raw materials.

The segment of the East German organic-chemical industry concerned with aromatic chemicals is very much integrated in the over-all national economy and to a considerable degree, moreover, in the economies of other Soviet Bloc countries, including the USSR. Various sectors of the East German economy -- domestic, industrial, and military -- are vitally dependent on the availabilities and the allocations of aromatic chemicals. Definite shifts in allocations between these sectors will denote change in emphasis and most certainly serve as indicators of Soviet economic, military, and political intentions.

Under the "New Course," which allegedly stresses increases and improvements in the production of consumer goods for raising the living standard of the people, aromatic chemicals can be expected to play a significant role. The domestic sector being favored under the "New Course" should receive higher priorities in raw materials, resulting in a larger volume of goods for the population: products manufactured from synthetics (fibers, plastics, and resins); agricultural and household chemicals, including insecticides, pesticides, and herbicides; pharmaceuticals and medicinals; leather-tanning agents; dyestuffs; and perfumes.

Implementation of the "New Course" policy in East Germany apparently was not undertaken seriously until the fall of 1953, and available information is too meager to show conclusively that significant shifts in allocations actually have occurred.

During the first half of 1953, reductions in planned capital investments for various segments of the industrial economy were effected. The investments of the State Secretariat for Chemistry were cut by about 25 percent. The investments of the Main Administration for Organic Chemistry (Hauptverwaltung Organische Chemie) were not reduced; on the contrary, its investment plant was raised by about 5 percent.

It is both interesting and significant that under the "New Course" policy there was no reduction in the 1953 capital investment plan for the principal East German explosives manufacturing plant, VEB Sprengstoffwerk I, Schoenebeck. A planned investment amounting to 3,890,000 DME was mainly for the construction of a new trinitrotoluene (TNT) installation. 429/ The building of a new TNT installation at Schoenebeck represents only a partial project for renovating this plant but is classified as a first priority project. When completed in 1955, the plant will have an annual production of 6,000 tons of TNT, a monthly output of three times the 1953 monthly quota. 430/

APPENDIX A

DETAILED USE PATTERNS FOR BASIC AROMATIC CHEMICALS IN EAST GERMANY

The following sections contain expanded discussions of the various uses of basic aromatic chemicals in East Germany. Where information is available, specific plants and economic sectors are identified with uses and derived products associated with each aromatic chemical. The production, aromatic chemical inputs, and industrial applications of the major intermediates and end products produced in East Germany are also discussed.

1. Refined Benzol.

a. Ethylbenzene.

This alkylated benzene is produced in East Germany for three basic purposes: (1) The manufacture of Buna-S-type synthetic rubber, a copolymer of butadiene with a synthetic resin monomer (styrene); (2) the manufacture of an elastoplastic, polystyrene; and (3) as an export (reparations or profit deliveries) commodity to the USSR. The formerly Soviet-owned plant, VEB Chemische Werke Buna Schkopau, is the only East German producer of ethylbenzene and synthetic rubber (buna). Maximum output of ethylbenzene at Schkopau before the end of World War II was attained in 1943, when 23,900 tons were produced. 431/ This may be compared with an estimated 25,800 tons produced in 1952, an amount requiring about 21,700 tons of commercial benzol. Schkopau's 1953 production goal called for the production of 31,850 tons of ethylbenzene (equivalent to 26,800 tons of benzol). 432/ The 1954 production plan was reported as 26,430 tons (equivalent to 20,325 tons of pure benzol or 21,593 tons of 90 percent grade benzol.) 433/

[redacted] 6,000 tons of ethylbenzene were to be shipped to the USSR in 1952, but final delivery was more probably near 8,500 tons, representing a benzol consumption of 7,150 tons. 434/ Prior to 1954, Schkopau is known to have shipped ethylbenzene to the USSR under so-called "T-deliveries," that is, deliveries of plant profits in the form of commodities. These shipments represented additional quantities of 50X1 products beyond those quantities established in concluded trade agreements. The original 1953 export quota for ethylbenzene was 12,000 tons, 435/ but the quota was revised to 6,617 tons before the end of the year. 436/ An export plan for 5,000 tons in 1954 was later cancelled and no exports were contemplated. 437/

b. Synthetic Rubber (Buna-S).

The production of Buna-S synthetic rubber, similar to US-made GR-S rubber, at Schkopau shall include for this report only Buna-S3, Buna-SS 3, Igetex-S (about 35 percent Buna-S3) and Igetex-SS Special (about 50 percent Buna-SS 3) types. Total Buna-S production in 1952 is estimated at nearly 55,000 tons, which required about 13,600 tons of benzol. The Buna-S estimate is the sum of the reported actual output of 27,236 tons in the first half of 1952 and 27,756 tons planned for the second half. 438/ The average styrene content of the combined Buna-S rubbers in 1952 is calculated to be 26.2 percent. The Schkopau 1953 production plan included the output of 60,240 tons of Buna-S rubber types. 439/ This is to be compared to the 67,700 tons output of 1943. 440/ The East German 1952 export plan listed 26,000 tons of buna, but actual deliveries from Schkopau totaled 26,893 tons, of which the USSR received 23,950 tons. 441/ It is of special interest to note that the exports of Buna (not including possible deliveries under reparations and T accounts) to the USSR, assuming all to be Buna-S, represent a benzol consumption of about 9,600 tons and 1952 planned total imports of benzol from the USSR were only 11,000 tons.

c. Styrene Monomer.

The estimated 1952 production of styrene monomer in East Germany is 15,420 tons (about 12.5 percent of the US output in 1952), of which almost 94 percent was utilized in the manufacture of Buna-S rubber types, and the remainder was polymerized to polystyrene. In 1952, VEB Chemische Werke Buna Schkopau consumed about 17,300 tons of ethylbenzene for styrene, which is equivalent to about 14,550 tons of benzol, which is 40 percent of the total benzol supply.*

* By comparison, the US consumed almost 32 percent of its total benzol supply for styrene in 1952.

Reported styrene outputs for 1950 and 1951 were 10,034 tons 442/ and 13,095 tons, 443/ respectively. The 1953 quota for styrene was reported as 17,675 tons, and this would require 19,850 tons of ethylbenzene. 444/ The 1954 styrene quota was given as 18,905 tons which would require 21,230 tons of etbylbenzene. 444a/ The highest prewar styrene output at Schkopau appears to have been attained in 1943, when 18,800 tons were made. 445/

d. Polystyrene Plastics.

The estimated production of polystyrene at Schkopau for 1952 is 1,040 tons, which would require 1,020 tons of styrene. The polystyrene output in 1950 was 782 tons. 446/ The 1953 production plan called for a combined output of 1,500 tons of "Polystyrol EF, EFS and BW" types, and 1,538 tons of styrene were required. The preliminary 1954 plan lists 840 tons of "BW" type and 720 tons of the "EF" type. 447/

Schkopau is understood to sell polystyrene in powder form. The Polystyrol BW is transparent and is the result of mass (block) polymerization; it is equivalent to the West German product "Trolitul." Polystyrol EF is opaque and is the result of emulsion polymerization. Most of the polystyrene output is directed to uses other than consumer goods. Polystyrene is used for lacquers, die castings, press moldings, and as "Styroflex" for plastic foil or thread in cable insulations and electrical condenser foils. The product has high dielectric properties and a low power factor and is used as an electric insulator in radio and radio-locating devices. Zelluloidfabrik Eilenburg is a producer of polystyrene die castings.

e. Monochlorobenzene (MCB).

Chlorine compounds of the aromatic type are widely used as intermediates in the dye and pharmaceutical industries. The most important chlorine derivatives are those of benzol and toluol. Chlorination of ring hydrocarbons results in isomers and byproducts, and avoidance of these in the production of any specific compound is often a great problem. In the US, most of the monochlorobenzene (MCB) produced is consumed in the preparation of synthetic phenol and aniline. MCB is also used as a solvent for paints, varnishes, and lacquers and in the manufacture of insecticides, dyestuffs, drugs, and other organic chemicals. Demand for MCB comes practically entirely from the synthetic organic-chemical industry and is often manufactured in the same plant in which it is consumed.

In East Germany the manufacture of the insecticide DDT possibly consumed as much as 62 percent of the 1952 MCB output. Presumably, about 24 percent of the MCB output was used mainly for producing nitrochlorobenzene (both ortho and para forms), dinitrochlorobenzene (DNCB), and miscellaneous organic chemicals (for example, diphenyl oxide). Exports, all to the USSR, amounted to about 14 percent of the MCB output. Some MCB finds its way to Rubezhnoye, USSR, where a dye-manufacturing plant is known to be located. 448/ The 1954 export plan included 1,000 tons of MCB. 449/ Significantly, East Germany does not produce synthetic phenol from MCB, nor is aniline made.

Two chemical plants, VEB Elektrochemisches Kombinat Bitterfeld and VEB Farbenfabrik Wolfen, are known producers of MCB. Total MCB production in 1952 is estimated to have been 7,100 tons, equivalent to about 7,000 tons of benzol. Bitterfeld is apparently the largest producer and had an output of 4,105 tons in 1952 (benzol demand, 4,050 tons), 450/ although the 1952 plan was 3,600 tons. 451/ Bitterfeld's original 1953 quota was reported as 4,200 tons, but a revised plan was issued later calling for 4,463 tons. 452/ Actual 1953 production was 4,743 tons. 453/ Output of MCB at Bitterfeld for other years is as follows:

Year	Tons
1937	3,894 454/
1938	3,016 455/
1939	3,944 456/
1940	3,830 457/
1941	4,091 458/
1942	4,120 459/
1943	4,037 460/
1947	N.A.
1948	833 461/
1949	1,000 (Plan) 462/
1950	1,424 463/
1951	3,021 464/ (Plan, 2,000 tons 465/)

The estimated MCB production at the Wolfen plant in 1952 is 3,000 tons, an amount which should have consumed about 2,950 tons of benzol. Wolfen's 1953 goal is unknown. The production of this plant for previous years follows:

Year	Tons
1937	3,552 466/
1938	3,190 467/
1939	3,322 468/
1940	3,762 469/
1941	4,319 470/
1942	3,919 471/
1943	5,096 472/
1947	1,408 473/
1948	2,400 (Plan) 474/
1949	N.A.
1950	2,580 (estimate based on 2,540 tons benzol used) 475/
1951	N.A.

East Germany is believed to have consumed about 2,700 tons of benzol during 1952 for MCB (other than for DDT demands), and this represents an estimated 7.4 percent of the gross benzol supply. In the same year, the US used 6.1 percent of its benzol supply for MCB (other than as an intermediate for phenol, aniline, and DDT).

f. Dichlorobenzenes (DCB).

The dichlorobenzenes (DCB), ortho and para, are produced either as byproducts recovered in the rectification of crude MCB or by the further chlorination of MCB. The para form is a solid which volatizes at room temperature. It is normally consumed in large quantities as a household moth repellant (replacing naphthalene moth balls), it is used in agriculture to fumigate soil to control the peach-tree borer, it is employed as a deodorant and germicide, and it is used in the manufacture of dyes and intermediates. The ortho form is a liquid and is used as a high-boiling solvent for tars, fats, oils, gums, waxes, and resins and for treating wood to control termites. Both forms are used in organic syntheses. Trichlorobenzene and DCB are two chemicals produced at VEB Farbenfabrik Wolfen from dichlorobenzene.

East Germany exports both isomeric DCB's, but Western countries appeared to have been the only recipients during 1952, receiving about 20 percent of the total output. Known producers of the DCB's are the same as those of MCB. Estimated total 1952 production of DCB is 1,340 tons, which is the sum of the Bitterfeld output and the estimated output at Wolfen. Bitterfeld had a 1952 quota of 785 tons (para, 500 tons; ortho, 285 tons), 476/ but actual production was 617 tons (para, 386 tons; ortho, 231 tons). 477/ Bitterfeld's 1953 quota was originally 750 tons (para, 500 tons; ortho, 250 tons), but the quota was revised downward later during the year to 613 tons (para, 409 tons; ortho, 204 tons). 478/ Actual 1953 production was only 542 tons (para, 332 tons; ortho, 210 tons). 479/ The 1954 quota was reported as 480 tons (para, 300 tons; ortho, 180 tons). 480/ The 1951 goal was 450 tons, but the plant made 612 tons. 481/ The highest prewar production attained at Bitterfeld was in 1940, when 1,184 tons (para, 788 tons; ortho, 396 tons) were produced. 482/

There is little available information on VEB Farbenfabrik Wolfen's postwar production of DCB. Based on a production estimate for MCB at Wolfen, the 1952 output of DCB at Wolfen is estimated at 720 tons. The previous high was in 1943, when 1,288 tons (para, 788 tons; ortho, 500 tons) were produced. 483/

g. DDT (Dichloro-Diphenyl-Trichloroethane).

DDT is obtained when chloral hydrate is condensed with chlorobenzene in the presence of sulfuric acid. Production is aimed toward the para-para isomer, which carries the insecticidal properties, but the technical grade always contains some of the other isomers. The insecticidal action of DDT is considered one of the important chemical discoveries of World War II.

East Germany has considerable capacity to produce DDT. Production of the insecticide has increased rapidly in recent years. The product is distributed to agriculture and forestry and to export, and negligible quantities are allocated to hospitals, pharmacy, and home use. The first producer, and still the largest, is VEB Elektrochemisches Kombinat Bitterfeld. This plant produced 526 tons in 1950, 484/ 1,634 tons in 1951, 485/ and 2,886 tons in 1952. 486/ The 1952 and 1953 goals were 2,960 tons 487/ and 3,600 tons (original plan -- revised 1953 plan was 3,750 tons 488/), respectively. 489/ The 1953 output was 4,049 tons. 490/ The Bitterfeld 1954 goal was reported as 4,140 tons. 491/

Two other plants are in operation, VEB Schering at the Berlin Adlershof and VEB Fettchemie- und Fewawerk Chemnitz (now Karl Marx Stadt). Schering produced 828 tons in 1952, and the Chemnitz plant produced 1,040 tons. 492/ The Schering and Chemnitz plants had 1953 production quotas of 1,000 tons and 2,000 tons, respectively. 493/ Thus, by addition, the total 1953 DDT quota is 6,600 tons (100 percent DDT effective content). 494/ The sum of the 1952 outputs of the 3 producing plants adds up to 4,753 tons (100 percent DDT basis). This amount of DDT would require approximately 4,400 tons of MCB or, in terms of benzol input, 4,300 tons. The benzol required represents 11.9 percent of the gross benzol supply. The US used only about 5.4 percent of its 1952 benzol supply for DDT.

It is understood that East Germany exported about 60 percent (2,970 tons, calculated on a basis of 100-percent DDT) of its 4,753-ton output in 1952. In terms of monetary value, this amounts to over 24 million rubles. 495/ Reportedly, no exports were made to countries outside the Soviet Bloc. The USSR, Czechoslovakia, and Poland, in that order, were the largest importers of DDT. The other Bloc countries, perhaps, obtained most of their 1952 DDT requirements from East Germany. (See Appendix B, Table 26,* for details on DDT exports.) The insecticide is usually compounded into various powdered and emulsion forms and frequently is mixed with another insecticide, benzene hexachloride (BHC). The DDT content in these preparations varies from 5, 25, 40, and 100 percent DDT, and the preparations are sold under numerous trade names, "Gesarol" (from Schering and Bitterfeld), "Duolit" (from Fettchemie), and "Duplexan" (from Bitterfeld), for example.

h. Dinitrochlorobenzene (DNCB).

Dinitrochlorobenzene (DNCB) is obtained by nitrating MCB first to ortho and para nitrochlorobenzenes. Upon further nitration, both isomers yield the dinitro compound. DNCB is an important intermediate for the preparation of various sulfur dyes and of picric acid. There is insufficient information with which to make a reasonable estimate on how much DNCB is made in East Germany. Farbenfabrik Wolfen may be the only producing installation in the area, as there has been no mention of the product connected with Bitterfeld's production or shipments. Wolfen is known to have produced crude nitrochlorobenzene (NCB) before the end of the war. Output of NCB was 1,662 tons in 1937; 1,151 tons in 1942; and only 866 tons in 1943. 496/

In chemical trade circles, considerable interest recently arose concerning exports of DNCB to Communist China, as this chemical probably was employed by China, at least in part, in manufacturing

* P. 156, below.

picric acid, an explosive. DNCB is readily converted to dinitrophenol by means of sodium hydroxide and then nitrated to trinitrophenol (picric acid). Picric acid is reported to be used by the Communist Chinese as a high explosive filler and booster in munitions. Nearly all of East Germany's 1952 export of DNCB went to China, some 812 tons (about 1 million rubles in value). 497/ To date, however, there are no positive indications that picric acid is made from DNCB on a commercial scale in East Germany. VEB Farbenfabrik Wolfen has been mentioned as a producer of picric acid and picramic acid (by partial reduction of picric acid). 498/

i. Benzene Hexachloride (BHC).

Benzene hexachloride (BHC) is an insecticide developed by the British toward the end of the war. The product is manufactured by the complete chlorination of benzol in ultra-violet light. BHC is particularly effective as a component of insecticides toxic to flies, roaches, grasshoppers, aphids, boll weevils, and the like. The technical grade contains at least five isomers, but the gamma geometric isomer is the most active biologically. The gamma isomer content in the technical or commercial grade is about 10 to 15 percent. When the gamma isomer is concentrated to not less than 99 percent purity, the product is called lindane. East Germany refers to BHC as hexachlorocyclohexane, or "Hexa products" when compounded.

The production of BHC began during 1950 at VEB Elektrochemisches Kombinat Bitterfeld, and since 1950, production has been expanding rapidly in East Germany. There are, however, no actual production data on total BHC output in East Germany during 1952. Four plants are producers of BHC: VEB Elektrochemisches Kombinat Bitterfeld; VEB Schering, Berlin Adlershof; VEB Fahlberg-List, Magdeburg; and VEB Fettchemie- und Fewawerk Chemnitz (now Karl Marx Stadt). These four plants compound the insecticide into dusts and sprays and one additional plant, VEB Farbenfabrik Wolfen, also does this.

Gross production of BHC preparations at the Bitterfeld plant during 1951 was reported as 389 tons, 499/ but the 1952 quota was stated to be 1,000 tons. 500/ Bitterfeld's chief BHC preparation is called "Duplexan" which contains only 1.2 percent of 85 percent "Hexa-effective" ingredient (the gamma isomer). Actual output of Duplexan was 723 tons in 1952, equivalent to about 8.7 tons of 85 percent BHC . 501/

Production plans or actual outputs of the other BHC producers previous to 1953 are unavailable. The 1953 production goals for BHC (of 85 percent gamma content) of the individual plants have been reported as follows: Bitterfeld, 25 tons (original goal; the revised goal was 14 tons 502/); Schering, 25 tons; Fahlberg-List, 32 tons; and Fettchemie, 93 tons. The total output quota for East Germany during 1953 was, therefore, 175 tons (of 85 percent gamma content). 503/ To prepare an estimate for 1952, it is necessary to assume a total output of 90 tons (85 percent gamma) from all plants during the year. To make this amount of BHC, it is estimated that about 500 tons of pure benzol (or about 550 tons of commercial benzol) were consumed. The basis for this calculation was a source reporting pure benzol input at the Fettchemie plant to manufacture 85 percent gamma BHC. Factors determined were 10.0 tons of pure benzol yields 1.76 tons of the product. 504/

East Germany is estimated to have used about 1.5 percent of its gross supply of benzol in 1952 for BHC manufacture; the US used about 2.3 percent of its benzol supply.

Research work at Bitterfeld to prepare pure gamma concentrate, or lindane, was unsuccessful in 1952 and again was included in the 1953 research program. 505/ Bitterfeld's 1953 investment plans include an installation for the manufacture of 60 tons per annum of pure gamma concentrate. 506/

Preparations from BHC are sold by the producing plants under specific trade names. Some leading names other than Bitterfeld's product, "Duplexan," are known as "Cartolit powders" (Fettchemie), "Arbitex" (Fahlberg-List), "Gesaktiv" (Schering), and "Mux" (Wolfen). Some Hexa products were exported by East Germany in 1952. The total exports amounted to a value of nearly three-quarters of a million rubles. 507/ Bulgaria and Czechoslovakia were the only countries listed as importers.

j. Miscellaneous Chemicals and Other Uses.

Other chemicals derived from benzol are known to be made in East Germany, but no quantitative production data are available for any of these chemicals. VEB Farbenfabrik Wolfen undoubtedly produces a number of other benzol-derived products. Wolfen is understood to produce nitrobenzene from which it manufactures azobenzene (for benzidine and dyes manufacture), meta-dinitrobenzene, meta-phenylenediamine (which may be made from aniline), and azo dyes. 508/

Other plants, including those which manufacture drugs, vitamins (Vitamin D_2), and pharmaceuticals, use quantities of benzol for processing purposes. The second Wolfen plant, VEB Filmfabrik (Agfa), Wolfen, uses benzol as a solvent for photographic film and for the manufacture of color film components. This plant's 1952 benzol requirement for film production was reported as 40 tons. 509/ Arbitrarily, an amount of 3,374 tons has been assigned as the 1952 benzol consumption for the production of miscellaneous chemicals and other uses. This amount represents a residual value obtained by difference from the total benzol supply (gross) of 36,300 tons and the sum of other benzol uses listed in Table 13.*

k. Solvent and Diluent Uses.

Benzol has wide application as a solvent or diluent in many industries. There are available no data or information to indicate the extent to which benzol is employed in East Germany as a solvent or diluent. It seems plausible that 3,500 tons of benzol, nearly 10 percent of the estimated total supply, was used for these purposes. Paints, varnishes, lacquers, and liquid cements and glues should be expected to consume appreciable quantities of benzol. The Bitterfeld plant is known to produce a glue or cement solution, probably for polyvinyl chloride plastics application. It is estimated that about 250 tons of benzol were used by this plant in 1952 to manufacture an adhesive solution. 510/

Benzol would be used as a solvent by plants other than chemical plants. Allocations in 1952 were planned for various ministries and state secretariats, for example, 1,116 tons to the Secretariat for Coal and Power; 74 tons to the Ministry for Construction and the Secretariat for Building; 40 tons to the Ministry of Light Industry; and 35 tons to others, including the Ministry for Transportation. In addition, 1,480 tons were allocated (planned) to the various East German Land governments, including Greater Berlin. 511/ It is presumed that most, if not all, of these benzol allocations were for general solvent or diluent purposes. Various Soviet-owned corporations (SAG's), such as AMO, Transmasch, Brikett, and Synthese, were allocated altogether about 200 tons of benzol during 1951, perhaps mostly for solvent use, but there is no comparable figure for 1952. 512/

* P. 61, above.

1. East German Plan Reserve.

[redacted] 156 tons of benzol were to be allocated in 1952 to the East German Plan Reserve. 513/ The purpose of this reserve is not clear, but it is known to be a priority allocation. The possibility exists that any amount placed in the Plan Reserve may be transferred later at the end of the year to a State Material Reserve -- that is, to a strategic stockpile. 50X1

2. Toluol.

a. Chemical Uses.

Information available on East German organic chemical plants has failed to provide much data relating to toluol consumption and the chemical intermediates and products derived therefrom. The available factual information and data were focused largely on VEB Elektrochemisches Kombinat Bitterfeld. This important chemical installation is understood to produce the following derived products: benzal chloride, benzaldehyde, benzoyl chloride, benzotrichloride, benzoic acid, sodium benzoate, and benzyl chloride. It is estimated that Bitterfeld consumed more than 800 tons of toluol during 1952, and much of this undoubtedly went into the manufacture of chemicals. 514/ The large dye-producing plant, VEB Farbenfabrik Wolfen, probably now produces from toluol such intermediates as benzal chloride, benzaldehyde, benzyl chloride, nitrotoluene, and ortho-toluidine and para-toluidine. Toluol consumption at this plant probably does not exceed Bitterfeld's requirements. A third significant consumer is VEB Fahlberg-List, Magdeburg, which appears to be the only East German producer of saccharin, a sweetening agent. As saccharin is made from ortho-toluene sulfonic acid, which is produced along with the para-isomer when toluol is sulfonated, the Fahlberg-List plant is capable of producing chloramine-T, a surgical antiseptic, from the para form. A high-purity grade of toluol is needed to produce these derived chemicals.

Output data for some intermediates produced only by Bitterfeld during 1950 through 1953 are available and are given below (in metric tons):

Intermediate	1950 515/	1951 516/	1952 517/	1953 518/*
Benzotrichloride (crude)	437	627	537	614
Benzotrichloride (pure)	367	555	470 (estimated)	540 (estimated)
Benzoic acid	183	267	218	259
Benzyl chloride/Benzal chloride	N.A.	171	159**	209

Bitterfeld's production of benzotrichloride is utilized for the preparation of benzoic acid. In the US, benzoic acid is now made chiefly by decarboxylation of phthalic acid, but it was previously made through chlorination of toluol to benzotrichloride, with subsequent alkali hydrolysis. One of the 1951 research projects assigned to the VEB Teerdestillation- und Chemische Fabrik Erkner was the production of benzoic acid by catalytic oxidation (employing air) of toluol with vanadium pentoxide as catalyst. 521/ This alternate process is well known, and the purpose of Erkner's research was probably to develop the method economically for East Germany. The Ruetgerswerke at Niederau, now dismantled, formerly produced benzoic acid from sodium benzoic liquors supplied by other Ruetgers works. In 1950, VEB Schering plant at Berlin Adlershof conducted experiments on production of benzoic acid from sodium benzoate liquor produced by Erkner. 522/

Benzoic acid and its sodium benzoate are widely used as a preservative for foods, fats, soft drinks, margarine, fruit juices, and jellies. The acid is employed by the pharmaceutical industry as a mild antiseptic, a wound dressing and diuretic, and a urinary antiseptic. The East German pharmaceutical industry reportedly required 10 tons of pure benzoic acid in 1952. 523/ The textile industry uses benzoic acid as a dyeing assistant, a dye stripping agent, a preservative for sizing, and a mordant in calico printing. Other uses of the acid are for the curing of tobacco, the manufacture of chemicals (sodium and benzyl benzoates), a stabilizer in the rubber industry, and for dyes and color stabilizers in baking varnishes. Various esters -- methyl and benzyl benzoates, for example -- are perfume materials.

* Revised 1953 goal was 454 tons, revised 1953 goal was 204 tons, and 1953 goal was 171 tons. 519/
** Benzyl chloride, 95 tons; benzal chloride, 64 tons. 520/

Benzyl chloride is an intermediate with varied uses, including the production of dyestuffs, perfume bases such as benzyl alcohol and acetate, photographic developer, rubber accelerators, and various pharmaceuticals. VEB Filmfabrik (Agfa) Wolfen required 6 tons of benzyl chloride in 1952 and 16 tons in 1953. 524/ Benzal chloride is the starting point in making benzyl compounds that are used in making dyes.

Saccharin production by VEB Fahlberg-List, Magdeburg, was reported as 334 tons in 1951, 525/ and the 1952 output may have attained 400 tons. Total saccharin exports in 1951 represented nearly three-fourths of the East German production. Exports in 1952, however, were only 42 percent of the 1951 figure, but nearly two-thirds of the amount went to Western countries. In 1953 the Fahlberg-List plant was ordered to ship 15 tons of saccharin to Bulgaria and 55 tons to China. 526/ Saccharin exports in 1954 were to total 200 tons. 527/ Even in competitive Western markets East German saccharin sells for about $2,000 per metric ton. Saccharin is about 550 times as sweet as cane sugar and is employed as a sweetening agent in beverages, foods, toothpastes, syrups, and pharmaceutical preparations. It is particularly valuable to diabetics. The East German pharmacies were reported to have had a requirement for 200 tons of saccharin in 1952. 528/

Knowledge on production of other toluol intermediates in East Germany is very limited. VEB Farbenfabrik Wolfen produces many types of dyes, some of which are derived from toluol. Wolfen's situation is complicated by the fact, that some intermediates used by the plant are imported -- para-nitrotoluene, for example, which is required for preparing p-toluidine, a valuable first component in azo dyes. Total toluol consumption as a raw material for organic chemicals manufacture, excluding dinitrotoluene and trinitrotoluene for explosives, is estimated at 1,700 tons for 1952.

b. Solvent and Diluent Uses.

There are no available data on total East German allocations of toluol for solvent and diluent applications. Because toluol is considered a preferred diluent for lacquers and enamels using nitrocellulose, it is reasonable to expect that East Germany also uses toluol for this purpose. VEB Zelluloidfabrik Eilenburg is one plant employing the aromatic for colloxylin (nitrocellulose) production; the plant required 78 tons in 1952 and 100 tons in 1953. 529/ In

East Germany there are a considerable number of lacquer and enamel manufacturing firms which use toluol. VEB Teerdestillation- und Chemische Fabrik Erkner supplies toluol to VEB Farben- und Lackfabrik Leipzig/Leutzsch, VEB Lackfabrik Teltow/Berlin, VEB Lackfabrik Spindlersfeld/Berlin, VEB Lack- und Lackkunstharzfabrik Magdeburg, and VEB Lack- und Lackkunstharzfabrik Schoenebeck. 530/

Elektrochemische Kombinat Bitterfeld produces an "Igelit" (polyvinyl chloride) stock solution which is a basic solvent for lacquer uses. Output of the solvent in 1952 was 921 tons, of which 820 tons were sold to other consuming plants. 531/ The 1953 goal was only 800 tons. 532/ For the solvent, the pure toluene input is estimated to have been 460 tons in 1952 and 404 tons in 1953. 533/ Bitterfeld also produces an Igelit adhesive solution with a toluol base of about 22 percent. 534/ Output of the solution in 1952 was 383 tons (367 tons sold), and the 1953 plan was 420 tons. 535/ Toluol required to make the glue is estimated at 84 tons for 1952 and more than 90 tons for 1953.

In addition to the plants mentioned above and other chemical plants in East Germany, there are small firms which consume toluol, presumably as a solvent or diluent. Allocations to the Laender in 1952 amounted to about 600 tons. 536/ In 1952 the Ministry for Light Industry was allocated more than 200 tons of toluol, and the Secretariat for Coal and Energy was scheduled to receive nearly the same amount. 537/ Specific uses to which these allocations of toluol were put are unknown, but very likely they were used for solvent and diluent purposes. An arbitrary total of nearly 4,200 tons has been estimated as the toluol consumption in East Germany during 1952 for solvent and diluent uses. This amount represents about 47 percent of the estimated gross supply of toluol (8,860 tons).

c. Explosives.

The only definite producer of trinitrotoluene (TNT) in East Germany is VEB Sprengstoffwerk I, Schoenebeck, formerly Lignose Sprengstoffwerke, GmbH. This plant also produces dinitrotoluene (DNT), an ingredient in "Gelatin-Donarit," which is a mining and commercial dynamite. In 1952, Schoenebeck was reported to be producing, in addition to blasting gelatine, "all kinds of shell explosive charges," but this information has not been confirmed. 538/ A second explosives manufacturing plant, VEB Sprengstoffwerk II, Gnaschwitz (near Bautzen), also produces Gelatin-Donarit but receives

TNT and DNT from Schoenebeck. 539/ Both plants ship out industrial explosives, principally to uranium mining projects under Wismut AG in Saxony and in the general area of Aue. 540/

There is little definitive information on Schoenebeck's current rate of production of either TNT or DNT. [redacted] the first-quarter production plan for 1953 as 504 tons of TNT and 263 tons of DNT. 541/ [redacted] during August 1949, this plant actually made 152 tons of TNT and 68 tons of DNT. 542/ [redacted] 1952 production is estimated to have been 1,950 tons of TNT and 1,000 tons of DNT, together requiring a total of about 1,600 tons of toluol (commercial-grade basis). [redacted] the 1954 production plans for Schoenebeck include 2,040 tons of TNT and 1,420 tons of DNT.* 542a/

d. Exports.

Reported toluol exports in 1952 were 1,353 tons, an amount 6 times the 1951 total (224 tons). 543/ (See Table 11** for details on exports.) During both 1951 and 1952 Hungary appears to have been the largest recipient. Most, if not all, of the toluol going to Hungary probably was destined for the explosives manufacturing plants located north of Lake Balaton, especially the Fuzfogyartelep plant.

e. East German Plan Reserve.

An official East German statistical report advised that 25 tons of toluol were to be allocated to the Plan Reserve in 1952. 544/ This reserve is known to be regarded in East Germany as a "priority allocation." The exact purpose of the reserve is unknown, but, as a conjecture, the amount may be later transferred to a State Material Reserve as a strategic stockpile addition.

3. Xylol.

a. Chemical Uses.

Xylol may be the starting material in making dye intermediates (xylidines), sulfonamides, sulfonic acids, and other products. The dye-manufacturing plant, VEB Farbenfabrik Wolfen, is a known producer

* See p. 96, above.
** P. 50, above.

of xylidines and sulfonamides, but the plant's xylol requirements are not well known. In 1952 a considerable quantity of xylol (300 tons), having at least 40 percent meta-xylene content, was required by Wolfen for the extraction of pure meta-xylene from which a dye intermediate could be made. VEB Filmfabrik (Agfa) Wolfen needed this intermediate to manufacture color photographic film. 545/ There is no indication that the 300 tons were made available to the dye plant from import, but certainly the tar distillery at Erkner could not supply the amount.

Xylol is also a process material in making many organic chemicals. The pharmaceutical industry may employ xylol in manufacturing vitamins and in making compounds having therapeutic properties. The East German pharmaceutical industry was reported to have had a xylol requirement of about 21 tons in 1952. 546/ Lacking other information, an arbitrary 1952 consumption estimate of 100 tons of xylol for chemical uses is made.

Only within the past few years have the xylene isomers been recognized in the US as profitable chemical building blocks. Ortho-xylene was the first isomer to be so used. In 1945 it was oxidized on a commercial scale to form phthalic anhydride. The production of phthalic anhydride from ortho-xylene is now rapidly increasing in the US, and eventually it should relieve the demand on naphthalene, of which 80 percent now goes into the production of phthalic anhydride. In the US, para-xylene is also separated for use in the production of terephthalic acid. The latter is one of the raw materials for manufacturing a synthetic fiber (a polyester -- terephthalate) called "Dacron" (DuPont) in the US and "Terylene" in England, where it was developed. Later, a photographic film base and polyester film called "Mylar" were developed in the US; both are condensation products of terephthalic acid and ethylene glycol.

By the end of 1951, East Germany was in the experimental stage of producing terylene fiber. The experiments were conducted at the Institute for Synthetic Fiber Research, Berlin-Teltow-Seehof, and the VEB Thueringische Kunstfaserwerk "Wilhelm Pieck" at Schwarza. The large chemical plant at Bitterfeld was reported to have been the source of supply for the terephthalic acid. 547/ [redacted] 50X1
[redacted] terephthalic acid could be obtained from 50X1
VEB Deutsches Hydrierwerk Rodleben, Rodleben/Rosslau, but only in gram-size lots. 548/ Experiments also were being conducted in early 1953 within the film research department at VEB Filmfabrik (Agfa)

Wolfen to produce a nonflammable film material from terylene. A film was made, but it proved to be too dull. Photographic film specialists attached great importance to the work. 549/

Less spectacular in US markets than para-xylene is the meta-isomer. Meta-xylene is already in use in the US for the manufacture of isophthalic acid, which appears to have a large potential market. The acid is more reactive than terephthalic acid and shows good promise of becoming a replacement for phthalic anhydride in its surface-coating and plasticizer applications. To date, there has been no mention of the manufacture of isophthalic acid from meta-xylene in East Germany.

b. Solvent and Diluent Uses.

Undoubtedly, xylol is principally used by East Germany as a solvent and diluent, but data on the quantity consumed for these purposes are available. The chemical industry is expected to be the largest consumer. The aromatic is widely used as a solvent and diluent in the manufacture of protective coatings -- lacquers, enamels, and varnishes. Xylol is also a solvent for dyes, waxes, fats, oils,and resins, and for paint and varnish removers. Also as a solvent, it is used in making rubber cements and photographic film. VEB Filmfabrik (Agfa) Wolfen reportedly had a 1952 solvent requirement of 20 tons for color film, 550/ and the 1953 need was 40 tons. 551/ Perhaps more than 80 percent of the gross supply of xylol was utilized by East Germany in 1952 for solvent and diluent uses.

c. Export.

A small quantity (20 tons) of xylol was reported as an export item in 1952. Hungary received the entire amount,which was valued at 13,000 rubles. 552/

d. East German Plan Reserve.

A priority allocation of 20 tons of xylol was made to the East German Plan Reserve in 1952. 553/ The purpose of the reserve is unknown, but the allocation may have become an addition to a State Material Reserve -- that is, a strategic stockpile.

4. Naphthalene.

The problem of establishing a naphthalene consumption picture is a peculiar one because of the degree to which the physical volume of the salable product shrinks as it is reduced to greater purity and because certain important uses of the product require the refined grade. This situation is evidenced particularly in East Germany, as the country is largely dependent on imports of naphthalene. Thus, if a large proportion of the East German imports during 1952 had consisted of a crude grade of naphthalene (melting point below 79°C) rather than of a refined quality, the estimated total supply figure would be considerably higher than the net amount of naphthalene actually available. Unfortunately, definitive information is lacking on the relationship between crude and refined naphthalene imports into East Germany in 1952. It has been necessary in this report, therefore, to simplify the problem by assuming all naphthalene imported was of the crude grade and to make adjustments whenever uses for the refined product were noted.

a. Hydrogenated Naphthalenes (Decalin and Tetralin).

Decalin (decahydronaphthalene) and tetralin (tetrahydronaphthalene) are both made by hydrogenation of refined naphthalene (warm-pressed grade). Decalin and tetralin are excellent solvents for fats, oils, waxes, resins, and rubber. They may be used for the extraction of naphthalene from coal gas; in the manufacture of lacquers, paints, and varnishes (as substitutes for turpentine); and in solvent mixtures and lubricants. Despite their toxic nature, they are used as fumigants for moths because they are cheap, effective, and noninjurious to fabrics. Both may serve as cleaning agents and rust-dissolving solvents.

The sole producer of hydrogenated naphthalenes in East Germany is the VEB Deutches Hydrierwerk Rodleben, Rodleben/Rosslau. Formerly this plant supplied all Germany and in 1939 was reported to have produced 8,900 tons of decalin and 3,300 tons of tetralin. 554/ In comparison, the 1952 production plan called for a combined output of only 3,000 tons for the two compounds. 555/ [redacted] 50X1
[redacted] the plant would have an allocation of 3,350 tons of naphthalene 50X1
for 1952. 556/ This amount of naphthalene represents approximately 15 percent of the estimated gross supply in East Germany in 1952.
[redacted] the 1953 production quotas for 50X1
decalin and tetralin were 1,447 tons and 2,460 tons, respectively. 557/

Consumption of crude naphthalene in 1953 should total 4,150 tons (1,500 tons of naphthalene for decalin and 2,650 tons for tetralin). 558/ Production of hydrogenated naphthalenes would be greater if more naphthalene and metallic sodium, for refining tetralin, were made available to Rodleben. Currently (1954), the plant is understood to have maximum output capacity of 4,316 tons of decalin and 13,280 tons of tetralin. 559/

It is estimated that about 15 percent of the combined output of decalin and tetralin was exported in 1952. Decalin exports, however, were less than one-half of the 1951 figure, but tetralin exports were nearly three times greater than they had been in 1951. In 1952, Soviet Bloc countries imported about 29 percent of East Germany's exports of hydrogenated naphthalenes, but West Germany alone imported 47 percent of the total. (See Appendix B, Table 28.*)

b. Phthalic Anhydride.

Phthalic anhydride is a very important derivative of naphthalene. It currently is produced at only one East German chemical plant, VEB Chemische Werke Buna Schkopau. For its manufacture, Schkopau employs the process of catalytic oxidation of naphthalene vapors with air, using a vanadium pentoxide pelleted catalyst. The remarkable yield obtained by Schkopau is 102 kilograms of phthalic anhydride from 100 kilograms of naphthalene, 88 percent of the theoretical yield. In the US, the most widely quoted yield figure is 80 percent, although many producers are believed to be getting 75 percent or lower. The US, however, is now producing nearly 10 percent of its phthalic anhydride from ortho-xylene obtained from petroleum refineries.

Phthalic anhydride is principally used by East Germany for the manufacture of plasticizers (phthalates or "Palatinols" -- mostly for vinyl resins and plastics) and softeners ("ED 242"). A considerable amount of phthalic anhydride, one-half, or more, of the output, is probably shipped to the USSR. Some of the product is required for synthesizing dyestuffs. It is surprising that there are no indications that more than a negligible amount of phthalic anhydride is employed to produce alkyd-type resins. In the US, alkyd and vinyl resins require 85 percent of the total consumption, and dyes and miscellaneous uses require the remainder. In the pharmaceutical industry, phthalic anhydride is the starting product for the preparation of phenolphthalein and a number of phthalate esters.

* P. 160, below.

The East German pharmaceutical industry reportedly required 10 tons of phenolphthalein during 1952 to be supplied from indigenous production. 560/ It is believed likely that VEB Farbenfabrik Wolfen produces synthetic indigo blue, a dye that stems from intermediates derived from phthalic anhydride.

Production statistics from former I.G. Farbenindustrie AG files indicate that Schkopau's peak output was 6,350 tons of phthalic anhydride in 1943. 561/ Since 1949 there has been a rapid increase in output. Production in 1950 was reported as 5,988 tons, and the 1951 quota was 6,040 tons. 562/ Output in 1952 was 6,637 tons. 563/ The production plan for 1953 was 8,370 tons 564/ of which, 6,650 tons were to be delivered to outside consumers, including shipments to other countries. 565/ The 1954 production plan called for 8,480 tons which would require 8,650 tons of naphthalene (warm-pressed grade). The 1955 production goal under the Five Year Plan (1951-55) was reported to be 10,000 tons. 566/ During 1952 the production of phthalic anhydride in East Germany consumed an estimated 30 percent of the total naphthalene supply. By comparison, the US used perhaps 70 percent of its naphthalene in the same year for phthalic anhydride.

As mentioned above, considerable phthalic anhydride is shipped to the USSR, the only country that has been reported actually receiving the product since 1950. Total exports during 1950, including 40 tons to Czechoslovakia, represented about 36 percent of the East German production for that year. The export of 4,150 tons in 1951 567/ was in slight excess of plan and amounted to about two-thirds of the output. In respect to 1952 shipments, some confusion exists, for the reported plan was either 3,000 tons or 3,300 tons, 568/ but alleged actual shipments totalled only 119 tons. 569/ It is strongly suspected that much more than 119 tons of phthalic anhydride were sent to the USSR in 1952; perhaps nearly 4,000 tons in addition were shipped under a reparations account and/or plant profit deliveries (T-accounts). The 1954 export plan called for a delivery of 5,000 tons of phthalic anhydride. 570/ Under the East German Five Year Plan (1951-55) 5,300 tons of phthalic anhydride, about 53 percent of the planned output, are to be exported in 1955. 571/ (See Appendix B, Table 28,* for more details on phthalic anhydride exports.)

* P. 160, below.

(1) Palatinols.

VEB Chemische Werke Buna Schkopau employs phthalic anhydride principally for the manufacture of "Palatinols," which are phthalic anhydride esters (or phthalates). The following kinds of phthalates were produced during 1952 and are distinguished from one another by letter designations: Palatinol AH (dioctyl phthalate), Palatinol BH, Palatinol C (dibutyl phthalate), and Phthalic opal BU. Previously, other kinds were made, including Palatinol HS (diheptyl phthalate).

Phthalic anhydride esters are plasticizers and are used in vinyl resins, in plasticizing smokeless powder, and in manufacturing insect repellents. Dibutyl phthalate (Palatinol C) is an excellent plasticizer for surface coatings of nitrocellulose lacquers; it replaces odorous and volatile camphor and overcomes the characteristic brittleness and lack of adhesion of these lacquers.

An estimated 1,546 tons of phthalic anhydride were consumed for the manufacture of Palatinols in 1952. To produce the 1953 quotas, 1,720 tons of phthalic anhydride should have been consumed. East Germany used nearly 33 percent of its phthalic anhydride in 1952 for plasticizers (including Weichmacher ED 242 -- see below); the US used almost 30 percent.

Palatinols have been exported almost exclusively to Soviet Bloc countries, principally to Czechoslovakia, Poland, and the USSR. The original 1952 export plan called for 750 tons, 572/ but this apparently was reduced to 150 tons. 573/ Only 125 tons, however, were reported actually shipped by the end of the year. 574/ The Schkopau plant was scheduled to ship 220 tons of C and 450 tons of AH types to the USSR during 1953 under reparations and T-account deliveries. 575/ Schkopau's 1954 export plan includes 765 tons of Palatinols. 575a/

Given below are production data for each Palatinol type currently made at Schkopau and the most common uses of each:

	Production (Metric Tons)			
	1952 (Estimated)	1953 (Plan) 576/	1954 (Plan) 577/	Uses
Palatinol AH	1,929	2,300	3,100	Softener for Polyvinyl chloride (Igelit) and lacquers.
Palatinol BH	400	430	N.A.	Softener for polyvinyl chloride (Igelit foil and flooring material).
Palatinol C	610	600	720	Customary softener for nitrocellulose lacquers. Also suitable for Buna and Igetex mixtures.
Phthalic Opal BU	190	200	200	Binding agent for artificial resin lacquers and oil-free synthetic resin for nitro-lacquers.
Total	3,120 578/	3,530	4,020*	

(2) Weichmacher ED 242.

Another plasticizer (or softener) which consumes a considerable amount of phthalic anhydride is Weichmacher ED 242. It has been reported that during World War II various German cable works

* Phthalic anhydride requirement is 1,906 tons (1,352 tons for AH, 424 tons for C, and 130 tons for BU).

were supplied with "ED 242" (and "ED 356" - not believed made now) for the manufacture of insulating varnish for cables in aircraft. 579/ There is no evidence that the product is used today for this purpose. It is known that "ED 242" is a good softening agent for leather and polyvinyl chloride (Igelit) and may be used in Igetex, a Buna S3 latex. Great interest in the product has been shown by the USSR. The softener was quality inspected by Soviet officials at the plant and was shipped in metal drums (200-liter) inscribed with Soviet markings.

VEB Deutsches Hydrierwerk Rodleben, Rodleben/Rosslau, produced ED 242 at the rate of about 400 tons per year after the plant was restored in 1947. 580/ Reported actual production for 1950 was 624 tons, and the 1951 plan was 722 tons, which probably was exceeded, as 750 tons were exported. 581/ The production plan for 1952 was 905 tons, but actual output was alleged to have been 960 tons. 582/ The production goal for 1953 was 1,025 tons. 582a/ Maximum production possible is 1,244 tons. One ton of ED 242 requires 390 kilograms of phthalic anhydride. 583/ An estimated 10 percent of Schkopau's 1952 output of phthalic anhydride was consumed during 1952 in the manufacture of ED 242.

[redacted] ED 242 is exported regularly to the USSR. In fact, the USSR is the only known importer. East Germany was reported to have shipped 150 tons in 1950, 583a/ 750 tons in 1951, 584/ 700 tons in 1952, 585/ and 1,100 tons were planned for 1954. 586/ Of the 1952 production (960 tons), 73 percent was exported to the USSR, and about 21 percent went to "government orders." 587/ 50X1

(3) Alkydal P and Alkyd Resins.

"Alkydal P" is understood to be a type of alkyd coating resin and is produced by Schkopau. It is reported to be a condensation product of butylaldehyde, crotonaldehyde, and phthalic anhydride.

VEB Lack- und Lackkunstharzfabrik Zwickau (formerly Louis Blumer plant) is a known producer of alkyd resins ("Duxalkyd") from phthalic anhydride supplied by Schkopau. The Zwickau resin plant is believed currently to consume about 300 tons of phthalic anhydride a year. The resins are distributed to various industries requiring them for coating purposes, especially the automotive industry for body finishes and the tin preserving can manufacturers. 588/

Prewar Germany made large quantities of alkyd resins (various Alkydals), of which the ingredients were mainly phthalic anhydride, glycerin, and the fatty acids from linseed oil or castor oil. In the US today, almost 60 percent of the phthalic anhydride goes into alkyd resins. End uses for alkyds in the US are primarily for automotive and other metal finishes, particularly for consumer goods, but large amounts are used in surface coatings for military vehicles, equipment, and ammunition. Other uses include artificial leather coatings and house and marine paints.

"Alkydal P" output at Schkopau in 1952 is estimated at about 60 tons. The 1953 plan was 70 tons. 588a/ About 100 kilograms of phthalic anhydride are required to produce 350 kilograms of the product. There are no exports reported for Alkydal P, nor have any imports of alkyd resins been reported.

c. Beta-Naphthol.

Beta-naphthol is a primary derivative of naphthalene. It is the starting material for the manufacture of a large group of naphthol dye intermediates and is used in the production of azo dyes. A particular strategic use is in the rubber industry, where beta-naphthol becomes a raw material to produce an essential rubber antioxidant, phenyl-beta-naphthylamine. (See the following subsection, Phenyl-Beta-Naphthylamine.)

In the US the second largest use of naphthalene is in the manufacture of beta-naphthol. Perhaps over 60 percent of the US output of beta-naphthol goes into dyestuff intermediates, and the remainder is used to make a rubber antioxidant. Because of the need for naphthols (alpha and beta isomers) by the dye industry, the commercial production of refined naphthalene, heretofore required only for the preparation of moth balls, was begun in 1873. Consumption was small at first, and it increased slowly. At that time its use was confined to Germany and England. Beta-naphthol is produced by alkali (caustic soda) fusion of sodium naphthalene-beta-sulfonate, which, in turn, is obtained by neutralizing the sulfonation product of refined naphthalene.

The only known producer of beta-naphthol in East Germany is VEB Farbenfabrik Wolfen. There have been no source references to indicate that alpha-naphthol is produced at Wolfen or at any other East German chemical plant. Alpha-naphthylamine, the principal dye intermediate from alpha-naphthol, is normally imported from the USSR and West Germany. The 1952 import plan was 190 tons. 589/

There are no production data available for any one year on Wolfen's output of beta-naphthol. It is known, however, that SAG plants (Soviet-owned corporations) had a combined planned requirement for 1952 of 1,665 tons of beta-naphthol. 590/ Inasmuch as Farbenfabrik Wolfen was an SAG firm during the early part of 1952, and because there are no other plants in the SAG category which are believed to have required the chemical, it is assumed that the 1,665 tons represents Wolfen's own needs. [redacted] 50X1
[redacted] Wolfen was experiencing "an acute shortage of beta-naphthol" but that this situation had been "partially overcome by imports from the West." 591/ It is quite possible Wolfen failed to produce its 1952 requirement. Thus, an arbitrary output estimate, but one believed to represent a maximum, for beta-naphthol during 1952 is 1,650 tons (about 15 percent of the 1952 US output). This amount of beta-naphthol would require about 2,000 tons of refined naphthalene, an equivalent 2,500 tons of the crude grade. 50X1

No beta-naphthol was reported actually exported in 1952, although 100 tons (destined for Hungary) were mentioned in the export plan. 592/ This may confirm the belief that Wolfen failed to produce sufficiently to cover all requirements for the chemical. The 1951 export plan was reported as 165 tons, but only 115 tons apparently were shipped (50 tons to China, 65 tons to Hungary). 593/

Phenyl-Beta-Naphthylamine (PBN).

Undoubtedly, the most important use put to beta-naphthol in East Germany is for the manufacture of phenyl-beta-naphthylamine (PBN) by way of beta-naphthylamine. PBN is a necessary general-purpose antioxidant in all rubbers. This rubber chemical retards aging of rubber resulting from oxidation, flex-cracking, atmospheric cracking, and heat deterioration. PBN may be referred to also as an age resister, for when such a material is incorporated in a rubber mix, it helps to protect the vulcanizate against certain kinds of aging. Natural rubber oxidizes when exposed to sunlight and air, whereas Buna-type rubbers, under similar conditions, tend to polymerize further and also to cyclicize. This action is prevented by adding a stabilizer, usually PBN. PBN is used in natural rubber on a basis of 1 to 1.5 percent of the rubber in tire treads, inner tubes, wire insulation, mechanicals, and footwear. Synthetic rubber requires about twice as much antioxidant as natural rubber. Chemische Werke Buna Schkopau is reported to use PBN at the rate of 2.9 percent per ton of Buna rubber produced. 594/

VEB Farbenfabrik Wolfen is the only known producer of PBN in East Germany. Production at Wolfen in 1950 was reported as 1,120 tons and, based on output in the first quarter of 1951, the estimated 1951 production was 1,500 tons. 595/ Assuming about 55,000 tons of buna rubber were made in 1952, an estimated 1,600 tons of PBN would be required. It is possible that PBN output in 1952 may have been close to 1,700 tons, for which about 1,250 tons of beta-naphthol would have been used. East Germany used possibly three-fourths of its beta-naphthol production to make PBN. There are indications that PBN output in 1952 ran close to synthetic rubber production. Schkopau was reported to have been, on one occasion at least, within 48 hours of a complete stoppage, but a shipment of PBN from the USSR arrived in time. 596/ Schkopau's 1954 PBN requirement has been reported as 1,874 tons. 596a/

Prior to 1951, East Germany was apparently unable to produce sufficient PBN to cover requirements for its Buna manufacture. Wolfen's PBN plant was reported destroyed in World War II and not rebuilt until 1949. 597/ Imports planned for 1950 were reportedly from the USSR and Poland, the latter to supply 90 tons and the USSR 200 tons. 598/ Still earlier, the large chemical plant at Ludwigshafen in West Germany occasionally shipped PBN by truck to Schkopau. Output was sufficient by the end of 1951 to permit exports totalling 132 tons, 599/ but in 1952 only 50 tons could be exported, and that amount went only to China. 600/ East Germany's selling price to China was about $1,050 per ton, practically equivalent to the US market price. (PBN is also mentioned under aniline consumption, p. 71, above.)

d. Emulgator 1,000.

"Emulgator 1,000" is an emulsifier for buna-type rubbers, including Perbunan and Igetex types. It is used for making "kalunit" (the sodium salt of dibutyl naphthalene sulfonic acid). The latter is a degreasing agent and is employed by the soap industry for the preparation of washing and cleansing agents of all types. Emulgator 1,000 has frequently been used for the preparation of "Nekal BX," a wetting agent for the textile industry or a dispersing medium for dyestuffs.

The most strategic use for Emulgator 1,000 is as a rubber chemical, an emulsifier. It is considered to be the best emulsifier used in Germany for the manufacture of Buna rubber. Reportedly, its use gives a higher tensile strength to rubber than do fatty acid soaps used in the US. For every ton of Buna rubber made by Schkopau, about 60 kilograms of the emulsifier are required.

The chemical was first made at Ludwigshafen in 1917, and new plants for its manufacture were installed during the war at Schkopau, at Huels (West Germany), and at Auschwitz (now Poland). From the files of the former I.G. Farbenindustrie A.G. it is learned that Schkopau produced 2,966 tons of Emulgator 1,000 in 1943. 601/ Today, Schkopau remains the only East German plant to produce the emulsifier. Schkopau's production in 1952 is estimated at 3,490 tons. 602/ The production goal for 1953 was 3,855 tons, and the 1954 plan is 4,145 tons (requiring 1,687 tons of warm-pressed grade naphthalene). 603/ In order to have produced 3,490 tons in 1952, it is estimated that Schkopau consumed 1,430 tons of refined naphthalene, an equivalent 1,800 tons of crude naphthalene.

The product was exported in 1951; the USSR was reported as receiving 88 tons of the total 91 tons exported, and China received the rest. 604/ There is no definite indication that any of the chemical was exported during 1952.

e. Carbon Black.

The term carbon black identifies an important group of industrial carbons used chiefly as reinforcing agents in the rubber industry for such commodities as tires and for coloring pigments in the ink (printers' ink), paint, and plastics industries. Carbon blacks differ from other carbonaceous materials such as charcoals and bone chars in their unique chemical and physical characteristics. Chemically, they are nearly pure elemental carbon; physically, they are composed of essentially spherical particles of graphitic-crystalline structure. The variation in properties displayed by different types of carbon blacks is due, in large part, to differences in average particle size.

The process of making carbon blacks from aromatic hydrocarbons (anthracene and naphthalene) was developed before World War II by Degussa (Deutsche Gold und Silbersheide Anstalt) at Frankfurt/Main in West Germany. East Germany now has one carbon black manufacturing plant utilizing crude naphthalene. This plant is the VEB Russwerk Oranienburg, which reportedly employs the Dusek Process to produce a carbon black comparable in quality to the "channel-black" type. [redacted] the plant also uses anthracene, but this 50X1 has not been confirmed and it will be assumed that only naphthalene is used. About mid-1952, Oranienburg had additional facilities installed to increase its capacity and to assure the tire industry of an adequate supply of carbon blacks. 605/ A second type of carbon black is made in East Germany from acetylene gas and is produced by VEB Stickstoffwerk Piesteritz.

Production of carbon blacks at the Oranienburg plant has usually been short of annual quotas. Apparently only 894 tons were produced in 1950, whereas the plan was 2,000 tons. 606/ Output in 1951 was 1,130 tons, against a plan for 1,800 tons. 607/ Reported 1952 production was 1,842 tons, 608/ but the year's quota was 2,000 tons. 609/ The 1953 goal has been given as 2,399 tons. 610/

To manufacture carbon blacks from crude naphthalene, a considerable quantity of naphthalene is consumed. It is estimated that about 3,840 tons of crude naphthalene were required in 1952 to produce 1,842 tons of carbon blacks. Inasmuch as the need for reinforcing black for rubber tires is critical in East Germany, the expenditure of precious naphthalene must be considered a worthy purpose. No exports of carbon blacks have been noted.

f. Miscellaneous Uses.

Naphthalene uses included as "miscellaneous" are: (1) those products known to be produced in East Germany but for which there is little production information available and (2) products that may possibly be made in East Germany but of which there is no positive evidence. Admittedly, any amount of naphthalene declared consumed for miscellaneous uses actually represents unaccountable naphthalene consumption. Unfortunately, nearly 20 percent of East Germany's 1952 estimated naphthalene gross supply must be entered under a miscellaneous category at this time.

One class of naphthalene derivatives, the chlorinated napthalenes, possibly consumes appreciable quantities of naphthalene. Two German trade names are associated with chlorinated naphthalenes, "Xylamon" and "Paraflow." Xylamon, possibly pentachloronaphthalene, is principally a wood preservative for protecting telephone poles, wooden

houses, and the like. The production of Xylamon was intended to be resumed at Treuhandbetrieb (THB) Werk Westeregeln sometime in 1951 after equipment was repaired. 611/ [redacted] 50X1
1,000 tons of crude naphthalene were shipped to Westeregeln during July 1951, and most likely this was for Xylamon production. 612/ No further naphthalene imports destined for Westeregeln have been noted, but during 1952 the plant received raw material from the Erkner tar distillery. 613/

Paraflow is a viscous, oily material usually made by condensation of a chlorinated paraffin wax with an aromatic hydrocarbon (naphthalene). The product is useful to improve low-temperature flow characteristics of lubricating oils -- that is, a pour-point depressor. The luboil additive prevents large crystals of paraffin (left in oil after solvent extraction) from forming at low temperatures. Paraflow was used by the Germans in their automobile oils during World War II. During that time the commodity was obtainable only from the Ludwigshafen plant (West Germany). The cold-weather luboil additive was imported by East Germany from Ludwigshafen at least until 1950. On orders from Moscow, a product was developed during 1949 at SAG Hydrierwerk Zeitz, Zeitz/Troeglitz which was composed of 90 percent chlorinated paraffin and 10 percent chlorinated naphthalene and which allegedly compared favorably with the Ludwigshafen product and that made by Standard Oil (US). 614/ The East German requirement for Paraflow in 1949 was 60 tons, and in 1952 it had risen to 150 tons. 615/ East Germany was even capable of exporting the commodity in 1951 and sent 4 tons to Poland, 616/ but a planned export of 10 tons to Poland in 1952 failed to be realized. 617/

Available information has not been sufficiently detailed to report quantitatively how much naphthalene is required or used by East Germany for dyestuffs and intermediates manufacture. Various azo dyes are made by VEB Farbenfabrik Wolfen which stem from naphthalene, but also certain intermediates for their preparation are imported (alpha-naphthylamine, for example), making it impossible to resolve the situation. Wolfen very likely produces some sulfonated naphthalenes and similar compounds for its own use.
[redacted] Wolfen is capable of producing H- 50X1
acid but "is at present unable to offer any to the West" because sulfuric acid is short. 618/ H-acid was formerly imported from the USSR and West Germany. Wolfen also produces alpha-nitronaphthalene, a commodity presumably used in East Germany for manufacturing

dyestuffs rather than for "deblooming" (decolorizing) petroleum oils. 619/ In 1950, Wolfen shipped out 57 tons of the product of which 23 tons went to West Germany. 620/ During 1952, East Germany exported 130 tons of alpha-nitronaphthalene, all to West Germany. 621/

Refined naphthalene is used in making moth repellents. There is no information to indicate the extent, if any, to which napthalene is used for this purpose in East Germany. Naphthalene may be used to manufacture synthetic organic tanning agents ("Syntans"). These are made in East Germany, but which agents require naphthalene and how much is consumed are unknown at this time.

5. Refined Phenol.

a. Caprolactam.

Caprolactam (E-amino-capronic acid lactam) is the intermediate substance from which is manufactured a synthetic plastic of the polyamide type, in East Germany an "Igamide" (Perlon Luran). During World War II, Germany used polyamides of the Perlon type for the manufacture of parachute fabrics, cord filaments for airplane tires, bristles for industrial brushes, and foils (0.1-mm thickness) for airplane gasoline tanks. Other uses under development included protective coverings for aircraft cables, connecting belts for motor-driven equipment, glider tow-ropes, harness, and belts for military and civilian use. Currently, East Germany is producing the following from caprolactam: hosiery and tie silk, parachute material, dress and raincoat materials, fibers, bristles for brushes, "wire" for industrial filters and coiled brush coverings for polishing nonferrous and light metal surfaces, electrical wire insulation, cord for automobile and airplane (MIG-15) tires, technical foil ("Perfol"), and transparent film for food bags. 622/

The generic term for polyamides is "Nylon," but Perlon L differs from nylon in manufacture and, somewhat, in characteristics and uses. Nylon results from the reaction of a dibasic acid, such as adipic acid (from cyclohexanol via phenol), with a diamine, such as hexamethylene diamine. Perlon L, on the other hand, is made from the condensation of amino-carboxylic acids, their lactams or derivatives. Briefly, the production steps for making Perlon L are: Phenol to cyclohexanol to cyclohexanone to cyclohexanone oxime to caprolactam to Perlon L. Caprolactam is shipped from producer to consumer as a solid (yellowish-white scales) and is usually called "lactam salt."

East Germany has only one caprolactam producer, VEB Leunawerke "Walter Ulbricht." This plant makes caprolactam from its own production of pure phenol. The product is shipped to VEB Filmfabrik (Agfa) Wolfen (about one-half); VEB Thueringische Kunstfaserwerk "Wilhelm Pieck," Schwarza; VEB Kunstseidenwerk "Friederich Engels," Premnitz; and VEB Kunststoffwerk Aceta, Berlin/Rummelsburg. In those plants it is consumed in the manufacture of Perlon materials. Leuna's caprolactam production record, including annual plans, is as follows:

Year	Metric Tons
1942	914 623/
1943	1,140 624/
1944	731 625/
1946	159 626/
1947	569 627/
1948	600 (Estimated), 500 (Plan) 628/
1949	750 (Estimated), 650 (Plan) 629/
1950	1,160 (Estimated), 930 (Plan) 630/
1951	1,671 631/ 1,400 (Plan) 632/
1952	2,092 633/ 2,000 (Plan) 634/
1953	2,600 (Plan) 635/
1954	2,750 (Plan) 636/
1955	10,000 (Original Plan) 637/

Considerable phenol is required to manufacture caprolactam, about 2 tons of phenol for 1 ton of caprolactam. It is estimated that during 1952 Leuna consumed about 4,200 tons of phenol for caprolactam. This amount of phenol constituted about 84 percent of Leuna's output and about 46 percent of the total East German phenol production. The following caprolactam consumption factors for Perlon L materials are available 638/: for 1 ton of cord-silk, 1.23 tons of caprolactam; 1 ton of fine-silk, 1.26 tons of caprolactam; 1 ton of bristles, 1.33 tons of caprolactam; 1,000 square meters of foil (Perfol), 0.062 ton of caprolactam. For general purposes, it is customary to use a factor of 1.3 tons of caprolactam for every ton of Perlon L produced. The 1953 production plan for Leuna called for an output of 2,600 tons of caprolactam requiring 5,230 tons of phenol, 83 percent of the plant's phenol quota. 639/

b. Plastics and Resins Based on Phenol.

In the US the largest single peacetime outlet for phenol is in phenol-formaldehyde plastics. The second largest is in phenol-formaldehyde resins for surface coatings and as a bonding agent in laminated products. Together, these consume 60 to 75 percent of the total US phenol production. In comparison, East Germany is estimated to have consumed in 1952 only about one-third of its phenol output. If more phenol had been available, the proportion allocated for plastics and resins manufacture might have been greater. The production of plastics in East Germany is totally inadequate; production had only attained about 20 percent of prewar output in 1951. Raw materials, as well as fabricating machinery, have been lacking. Supplies of phenol have been too short to permit the manufacture of phenol plastics ("Phenoplasts"). 640/

A production of 10,000 tons of molded plastics with a phenol resin base was desired for 1951. The lack of phenol and woodpowder (for filler purposes), however, limited production to only 5,900 tons. 641/ Moreover, available molding equipment capacity was incapable of handling more production. It was then foreseen that in 1952 9,000 tons, corresponding to the available equipment capacity on hand in East Germany would be possible. 642/ The final 1952 production plan was 9,132 tons, 643/ but actual production was 8,272 tons. 644/ The 1953 East German production capacity for phenol-based plastics was reported as 8,500 tons. 645/ Since molded articles are expected to play an important role as a substitute for nonferrous metals in the East German Five Year Plan, it is anticipated that phenol plastics will find an even larger use. The original 1955 Plan goal of moldable plastics for the plastics industry was 12,000 tons, containing approximately 6,000 tons of resin. 646/

The molded plastics industry is understood to be shifting away from preferred phenol and has started utilizing cresol and xylenol as raw materials. Also, the acute shortage of phenol has made it necessary to develop good molding powders for plastics from low-grade but abundantly available phenolic compounds. Investigations were conducted in 1951 on the "middle-oil phenol" (R-III), produced at VEB Teerverarbeitungswerk Rositz, as a potential phenolic raw material for plastics, even though the material contains only about 15 percent phenol. The problem entails the preparation from R-III of a suitable product which is free of bases, acids, and neutral oils. Similar experiments, utilizing crude phenol mixtures for manufacturing synthetic resins, were also conducted with products obtained from plants at Hirschfelde and Espenhain.

There is no available information relating to the amount of phenol consumed in 1952 to produce phenol plastics and resins. It is necessary to assume that production of nearly 8,300 tons of molded plastics was based entirely on phenol and did not include cresol and xylenol. A further assumption must be made that total output represented molding compound (including filler, and the like) with an actual resin content of about 55 percent of this total. Since a typical phenol-formaldehyde resin may contain about 60 percent phenol, it is estimated that 2,700 tons of phenol were consumed for phenol molded plastics during 1952. The production of bonding agents, surface coatings, Haveg acid cements (for acid-proof bricks and coating iron), grinding wheel resins, and the like, very probably consumed an additional 300 tons of phenol. Also included is the manufacture of "Kramitoel," believed to be a phenol-formaldehyde adhesive, by VEB Filmfabrik (Agfa) Wolfen, which, in 1952 was expected to require 90 tons of phenol for 120 tons of the product. 647/ In summary, it is estimated that 3,000 tons of phenol were used during 1952 by East Germany to produce various phenol-based plastics and resins. Not included are the ion-exchange resins, "Wofatits" and synthetic organic tanning agents (based on phenol-formaldehyde resins), which have been considered separately and are discussed later.

Several known phenol plastics and resins manufacturing plants in East Germany are:

VEB Kunstharz- und Pressmassefabrik Erkner, Erkner/Berlin
VEB Lackkunstharzfabrik Zwickau, Zwickau
VEB Lackfabrik Moelkau, Moelkau/Leipzig
VEB Kunstharz- und Pressmassefabrik Espenhain, Espenhain/Leipzig
VEB Lackkunstharzfabrik Schoenebeck, Schoenebeck/Elbe

c. Refining Lubricating Oils.

The principal East German producer of natural lubricating oils is VEB Mineraloelwerk Luetzkendorf at Krumpa. This plant employs phenol as a selective solvent for refining lubricating oils by removing aromatics and naphthenic hydrocarbons. If a sufficient amount of anhydrous phenol is used, the aromatic and naphthenic hydrocarbons can be completely extracted, leaving a purely paraffinic oil behind. The quality of the raffinate is best when anhydrous phenol is used, but the yield is small. The effect from solvent extraction on a luboil is to produce a product with a high viscosity index -- that is, to maintain good lubrication characteristics even at elevated temperatures.

The Luetzkendorf plant is the only natural luboil producer in East Germany known to use phenol to refine its products. This plant requires phenol from year to year to replenish losses in process and to cover expanding production. Luetzkendorf was scheduled to receive 270 tons of phenol from Leunawerke for its 1948 requirement. 648/ The 1949 requirement was reported to have been 330 tons. 649/ Luboil production quotas for Luetzkendorf for 1948 and 1949 were 33,000 tons and 40,000 tons, respectively. 650/ A recent estimate on Luetzkendorf's 1952 luboil production was 55,000 tons. For this quantity of production, it is estimated that about 450 tons of phenol were required.

d. Pharmaceuticals.

The announced 1952 requirements of the East German pharmaceutical industry included 400 tons of pure phenol. All of the phenol was to be consigned to the industrial portion of the industry for manufacturing medicinals. 651/ It is not known, however, whether or not the industry actually received its full allocation during the year. At present, there is some question about the inclusion of phenol requirements for manufacturing salicylic acid (see f, below) in the allocation to the pharmaceutical industry. This report has assumed that phenol for the production of salicylic is not included in the pharmaceutical allocation, for salicylic acid has uses other than medical and also may be a starting material to produce other medicinals.

e. Ion Exchange Resins (Wofatits).

On a comparative basis, the US and German ion exchange industries had reached approximately the same level of development by the end of World War II. Work on synthetic resins preceding the development of Wofatit began in 1936. Among other uses, the Germans were utilizing the process to recover copper from cuprammonium (rayon) process waste waters and silver from photographic waste waters. At the present time the process may be used to recover valuable metals from wastes, for purification of streptomycin, for recovery and separation of radioactive isotopes from atomic fission, and for the catalysis of organic reactions. Another important use is in the beet-sugar industry, where the final impurities are removed from the sugar juices, increasing sugar and decreasing molasses yields and making it possible to produce an edible liquid sugar directly. Probably the main use today for ion exchange resins in East Germany is for softening water. Many industrial waters in the area are very hard and, therefore, numerous softening installations are required. The resins are used by thermal power plants as a boiler water additive.

VEB Farbenfabrik Wolfen was the principal German producer of ion exchange resins of the Wofatit type before the end of the war and is now the only known producer in East Germany. The Wolfen plant makes several types of Wofatits, only one of which, the "P" type, is known to be prepared from phenol. The P type is prepared by reacting phenol, formaldehyde, and sodium bisulfite to produce the methylene sulfonic salt of phenol. This compound is then condensed with additional phenol and formaldehyde, and a solid resin results. After further treatment, the final product is a moist resin containing about 40 percent water. Various Wofatits understood to be produced by VEB Farbenfabrik Wolfen are as follows:

Type	Characteristics
Wofatit P	A cation exchanger for water softening. Resistant to temperatures up to 95°C.
Wofatit F	Same as P but resistant to temperatures up to 50°C.
Wofatit C	For partial salt removal of water rich in carbonates.
Wofatit MD	An anion exchanger for removal of salts from water, used together with P and F types.
Wofatit L	An anion exchanger for salts and silicates.
Wofatit E and ED	Both types are used for decolorizing of solutions, such as clarified juices, sugar clearing liquors, molasses, starch solutions, glucose, dextrose, sorbite-plant and other extracts.

No current production data on production of Wofatit at Wolfen are available. [redacted] in early 1952 50 tons of phenol per month (600 tons per year) were being consumed by the Wolfen plant to produce Wofatits. 652/ This amount, however, appears to be too high in relation to other phenol requirements of East Germany. Production of Wofatit of all types was about 410 tons in 1950. 653/ Perhaps 100 to 150 tons of phenol were used in 1950 to produce Wofatits based on phenol. Allowing for a possible doubling in output by the end of 1952, the phenol consumption would amount to 300 tons as a maximum for production of Wofatit. East Germany is an exporter of Wofatit resins, largely to other Soviet Bloc countries. Poland has been the principal importer, with Czechoslovakia, Hungary, and the USSR following in decreasing order. [redacted] Wolfen's productive capacity for Wofatit was fully utilized in 1953 and exports were scheduled to take 54 percent of the total output. 654/ (See Appendix B for further details.)

50X1

50X1

f. Salicylic Acid.

Salicylic acid is considered a fine chemical and is used as a medicinal and an intermediate in the manufacture of other medicinals and pharmaceuticals. In the US, approximately 65 percent of the salicylic acid produced is employed to prepare aspirin, 25 percent for making other medicinals, and 10 percent for miscellaneous uses, including the manufacture of dyes. Aspirin (acetyl salicylic acid) is prepared by acylating salicylic acid with acetic anhydride. Salicylic acid is a starting material in making various salicylates, methyl salicylate (oil of wintergreen), phenyl salicylate (Salol), and the like. The chemical is used in making dyes, including azo colors, and may be employed as a preservative and for manufacturing organic intermediates and perfumes.

Salicylic acid produced in East Germany probably is not used principally to make aspirin, for production of the latter was expected to begin only by mid-1952, upon import of acetic anhydride. Commercial quantities of acetic anhydride have not been made in East Germany. Aspirin has been available, however, through imports from "capitalistic countries," from Hungary, and from the USSR. Aspirin requirements by the pharmaceutical industry amounted to 75 tons in 1952, and salicylic acid requirements by this industry totaled 205 tons. 655/ The large dyestuffs manufacturing plant, VEB Farbenfabrik Wolfen, requires salicylic acid, presumably only for making azo dyes. In 1950 the Wolfen plant received about 75 tons, some of which was imported from Denmark and West Germany (Leverkusen). 656/ It is believed that Wolfen's needs in 1952 would not have been much higher than in 1950. East Germany also exported some 20 tons of salicylic acid in 1952, although the plan called for 30 tons. 657/ The 1954 export plan provided for shipment of 60 tons of salicylic acid (technical grade). 657a/

Only two known producers of salicylic acid exist in East Germany. These plants are VEB Pharmaceutisches Werk Oranienburg and Leunawerke "Walter Ulbricht." A third plant, utilizing a new process which is about 50 percent cheaper, was reported to have been established at VEB Chemische Fabrik von Heyden, Dresden/Radebeul. 658/ Available data on salicylic acid production in East Germany for 1949-55 are given below:

Year	Metric Tons
1949	60 (Plan) 659/
1950	112 660/
1951	240 (Plan) 661/
1952	294 662/, 280 (Plan) 663/
1953	320 (Plan) 664/
1954	350 (Plan) 665/
1955	350 (Plan) 666/

It is estimated that to have produced 294 tons of salicylic acid in 1952, about 235 tons of phenol were required. It is interesting to note that salicylic acid is one of the production target items listed within the framework of the East German Five Year Plan (1951-55). The production of salicylic acid by oxidation of ortho-cresol has been considered by East Germany and was included among the 1951 research projects assigned to the tar distillery at Erkner. 667/

g. Triphenyl Phosphate.

Triphenyl phosphate is mainly a plasticizer and a softener. As a plasticizer, it increases the flexibility and extensibility of synthetic resins and similar compounds. It is an excellent softener in making photographic films from cellulose acetate, a gelatinizing and softening agent in making compositions containing nitrocellulose, and a substitute for camphor in making celluloid. The chemical is a solid nonvolatile, incombustible softener widely used for manufacturing lacquers, varnishes, and plastics in combination with nitrocellulose and acetyl cellulose. It may also serve as a softener for film foils and in natural and synthetic rubber (Buna) mixtures. It is understood that East Germany employs triphenyl phosphate mainly in the lacquer and cable industries.

VEB Elektrochemisches Kombinat Bitterfeld is the only producer of triphenyl phosphate in East Germany. According to I.G. Farbenindustrie statistics, the Bitterfeld plant produced 298 tons of the chemical in 1937 and 284 tons in 1943. Output in 1951 was 291 tons. 668/ Only 135 tons were produced in 1952, of which 49 tons were used by Bitterfeld itself. The original 1953 quota was 240 tons, 669/ but this was later revised to only 50 tons, although 114 tons were produced. 670/ An estimated 125 tons of phenol were consumed in 1952 to produce the 135 tons of triphenyl phosphate. The plasticizer has been an export item but has been exported only to Western countries. Nearly one-half of the 1952 output was exported. (For details, see Appendix B, Table 29.*)

h. Miscellaneous.

East Germany requires phenol to produce various other chemical intermediates and end products important to the area's economy. Individual outputs of these phenol-based products demand little of the available phenol supply, but collectively the amount of phenol consumed for their preparation has some significance.

The large photographic materials manufacturing plant, VEB Filmfabrik (Agfa) Wolfen, expected to require a total of 30 tons of pure phenol during 1952. Anticipated requirements to manufacture photographic film, paper, plates, and color film components amounted to about 20 tons. An additional 10 tons of pure phenol were to be used for a softener for Perfol, a technical foil from caprolactam. 671/

The extensive hydrogenation plant, VEB Deutsches Hydrierwerk Rodleben, Rodleben/Rosslau, is a producer of cyclohexanol ("Hexalin") through phenol reduction. Hexalin and the ketone cyclohexanone are important solvents, similar in purpose to Methylhexalin and methylcyclohexanone derived from cresol. (See Hydrogenated Cresols, p. 140, below.) These hydrogenated materials, either alone or mixed with each other, are valuable solvents for camphor, fats, oils, waxes, natural and synthetic resins, and rubber. They also find application in a variety of special soaps and detergents, for they are emulsifying and solubilizing agents for soaps and oils. The production of solvents by

* P. 163, below.

pressure hydrogenation could not be fully realized at VEB Deutsches Hydrierwerk Rodleben in 1951, and, although the 1952 program was probably more optimistic, it is probable that little phenol was used, for cresol was more readily available. The only production information available is Rodleben's 1953 quota of 50 tons of Hexalin. One ton (1,000 kilograms) of Hexalin requires 1,175 kilograms of phenol. 672/

Phenol is the starting material for the manufacture of the hormonetype weedkiller 2,4-D (2,4-dichlorophenoxy acetic acid). This chemical has particular value to farming because of its selective power to kill broad-leaved plants without harming grasslike crops -- wheat, barley, oats,and rye, for example -- thus making possible higher average crop yields. The VEB Elektrochemisches Kombinat Bitterfeld is the most important producer and may be the only producer of 2,4-D in East Germany. The Bitterfeld plant formulates a spray with a 2,4-D base called "Hormit (H 11)" and a powdered preparation (dust) called "Hormin (H 22)." Two other plants produce preparations with a 2,4-D base, the VEB Asid-Werk' Bernburg (product: D 24) and VEB Leunawerk Merseburg (products: L 1 and L 2). Nothing is known of production rates at these two plants. Bitterfeld's production record and plans are as follows:

	Metric Tons	
Year	Hormit (Spray)	Hormin (Dust)
1951	17	58 673/
1952	38 (Plan)	360 (Plan) 674/
	84 (Actual)	265 (Actual) 675/
1953	158*	962** 678/
1954	200 (Plan)	500 (Plan) 679/

Bitterfeld sells all of the Hormin it produces and more than half of the Hormit product, but the purchasers are unknown. The remainder of the Hormit product is used by the plant itself as an ingredient in making up the powdered form, Hormin. Pure phenol input in 1952 was 84 tons, and 153 tons are anticipated for 1953. 679a/

* Actual output. Original 1953 quota was 180 tons but the quota was later revised to 141 tons. 676/

** Actual output. Original 1953 quota was 1,100 tons but the quota was later revised to 868 tons. 677/

The dyestuffs plant, VEB Farbenfabrik Wolfen, is understood to produce a limited amount of picric acid (trinitrophenol). This product results from nitration of phenolsulfonic acid, which is obtained by heating phenol with concentrated sulfuric acid. Picric acid is the starting point in making indulin and nigrosin dyes. Wolfen's output of picric acid is not known. Dinitrophenol is also made at Wolfen, but output is unknown.

VEB Farbenfabrik Wolfen is also the only East German producer of "Metol," a very important photographic developer. This chemical (methyl-para-aminophenol sulfate) is believed to be made by Wolfen by the method involving the reduction of para-nitrophenol and then reducing the resulting para-aminophenol compound. Wolfen produces various nitrophenol isomers. Output of Metol in 1950 was reported as 52 tons, 680/ but no later annual outputs are known. Metol was exported to both Soviet Bloc countries and the Free World in 1951, but apparently the only exports were made to Soviet countries in 1952. (See Appendix B, Table 29.*)

All synthetic organic tanning agents (Syntans) made in East Germany are based on phenol and formaldehyde (or urea), or on cresol (see Synthetic Organic Tanning Agents, p. 141, below) and naphthol. In view of the small availability in plant-derived tanning agents, the production of Syntans in East Germany is under heavy demand, with no prospects for exports. 681/ The 1952 production plan (3,240 tons 682/) was only 78 percent fulfilled, principally because of the "lack of phenol." The quality of these synthetic substances did not measure up to the requirements of the leather industry, and the addition of fine vegetable tanning agents was necessary. VEB Farbenfabrik Wolfen currently produces one synthetic tanning agent, "Wofagan M" (for sole leather), but there is no evidence that phenol is actually used in the manufacture. Wolfen was scheduled to produce 1,560 tons of organic tanning agents in 1954. 683/ Other Syntans known to be produced in East Germany are: "Novaltan" (by VEB Chemiewerk Doelau, Greiz/Doelau) and "Boemotan" (by VEB Fettchemie- und Fewawerk Chemnitz). Again, no details and information are available relating to the proportionate use of phenol against cresol in manufacture of these Syntans. It is impractical to estimate how much phenol was consumed in 1952 to manufacture Syntans. Currently, considerably more cresol than phenol is probably being used.

* P. 163, below.

Other products and intermediates based on phenol are unquestionably produced in East Germany, but information concerning them is lacking. The quantity of phenol consumed in 1952 for miscellaneous uses and products, of course, is unknown. An arbitrary consumption figure of 365 tons merely represents the difference between the sum of better known phenol uses already discussed (and export) and the estimated gross supply of phenol in 1952.

i. Exports.

Both pure and crude phenol are exported by East Germany. Soviet Bloc countries appear to have been favored in actual exports. Reported 1952 exports of pure phenol total 175 tons (252 tons were planned), of which Communist China received 55 percent. 684/ Apparently no pure phenol was exported to the USSR in 1952, a striking contrast to 1951, when the USSR received 650 tons, 62.5 percent of the total East German export. 685/ Crude phenol exports were nearly all destined for Poland in 1952 (1,030 tons). 686/ (See Table 11, p. 50, above, for additional details.)

j. Stockpile (Strategic Reserve).

There is no available information indicating that a phenol stockpile, that is, an allocation of phenol to the East German State Reserve, was established in 1952. It is assumed that no phenol was placed in strategic reserve during that year. A recent report has indicated, however, that 40 tons of "liquefied phenol" were included in the 1954 plan for medical and pharmaceutical supplies of the State Reserve. 687/

6. Cresols.

a. Tricresyl Phosphate (TCP).

Tricresyl phosphate (TCP) is principally used as a plasticizer. It is compatible with vinyl, polystyrene, and cellulose-derived plastics, but its greatest demand is in plasticizing polyvinyl chloride and nitrocellulose. TCP contributes nonflammability, which is especially valuable for nitrate lacquers and films. It is employed as a softener for collodion body colors, for adhesives and binders, and as a substitute for camphor in the manufacture of celluloid. TCP is used for the extraction of phenol from waste waters (effluents) of coal hydrogenation plants. The phosphate may go into oil additives.

Because it increases the strength of oil film, it is valuable for heavy duty oils, and its flame-resisting characteristics make it desirable in hydraulic fluids used in hot-running equipment. A new use for TCP as an additive for premium motor fuels, little known as yet outside the US, may eventually develop into the largest US use. During World War II the Shell Oil Company discovered that when TCP is added to leaded motor fuels, any lead oxide deposits in the engine are converted to lead phosphates or other nonconductive products whereby spark-plug fouling is prevented, thus prolonging spark plug life and improving performance of the leaded fuels.

In the US the use of tricresyl phosphate as a plasticizer probably accounts for about 90 percent of sales. No comparable end-use pattern is available for East Germany, but unquestionably most of the product serves as a plasticizer in polyvinyl chloride materials, and the greatest demand is in the lacquer and cable industries. Total annual output of TCP in the US from the 4 producing plants was about 7,900 metric tons and 8,200 metric tons for 1951 and 1952, respectively. On the other hand, East Germany has but one producer, VEB Elektrochemisches Kombinat Bitterfeld. Reported annual outputs of TCP at this plant are as follows:

Year	Metric Tons
1937	254 688/
1943	3,342 689/
1944	4,053 690/
1946	845 691/
1947	1,700 (As reported) 692/
1948	1,703 693/ (Plan, 1,500 694/)
1949	1,800 (Plan) 695/
1950	3,569 696/ (Plan, 3,240 697/)
1951	3,766 698/ (Plan, 4,200 699/)
1952	3,951 700/ (Plan, 4,200 701/)
1953	3,830 702/ (Original plan, 6,000 703/; revised plan, 3,880 704/)
1954	4,000 (Plan) 705/

The Bitterfeld plant employs cresol DAB IV, a cresols mixture but low (less than 2 percent) in ortho-cresol isomer content. An estimated 4,150 tons of the raw material were used by Bitterfeld in 1952 to produce TCP. 706/ It was expected that about 6,300 tons of cresol DAB IV would be required in 1953, and VEB Leunawerke "Walter

Ulbricht" was to supply 1,300 tons of this amount. 707/ This ortho-cresol isomer imparts toxic characteristics to TCP when the latter is used as a plasticizer. East Germany has found it necessary to ban the use of plastic articles of polyvinyl chloride, and the like, which have been plasticized with TCP containing more than 6 percent ortho-tricresyl phosphate, when these items are used in connection with food, drugs, cosmetics, toys, and wearing apparel.

The Bitterfeld plant itself is a reasonably large consumer of the product for plasticizing purposes; the plant used 37 percent (1,462 tons) of its 1952 TCP output. The remainder of the 1952 production was exported (19 percent) (see Appendix B) or was sold to other East German consumers, including VEB Farbenfabrik Wolfen. Bitterfeld anticipated in 1953 a consumption of 1,686 tons of TCP, about 28 percent of its output. 708/ Wolfen expected to use 60 tons in 1953. 709/ The VEB Hydrierwerk Zeitz, Zeitz/Troeglitz, is known to employ TCP by the Otto process to recover crude phenol from the plant's waste process waters to prevent stream pollution. 710/

b. Synthetic Resins and Plastics.

Like phenol, cresol also is used in the formation of synthetic resins upon treatment with formaldehyde. Soft, fusible, and soluble thermal-setting resins, which are used in varnishes as well as in molding and laminating compounds, can be formed. In manufacturing resinous materials, the meta-cresol isomer exhibits closer analogy to phenol than do the other cresol isomers, ortho and para. A meta-cresol-para-cresol mixture is most generally used in the preparation of resins. The ortho form can be removed from industrial cresol, which contains all three cresol forms, by simple distillation, but meta and para isomers can be separated from one another only by chemical means. Ortho-cresol and ortho-cresol fraction may be used in making resins, particularly with phenol, to control the reaction and the final hardening of the resin.

In East Germany, cresol is used in the manufacture of synthetic resins for lacquers, pressed resins, molding preparations, cast and hardened resins for turning and carving purposes, acid and liquid-proof substances for putties and cements, hard-paper manufacture, and the like. Synthetic organic tanning agents based on condensation products formed from cresol with formaldehyde or urea are also produced. These are discussed later. Much research effort in East Germany has gone into developing many resins and plastics from more plentiful cresol that will exhibit comparable qualities and applications to phenol-based products. In the meantime, cresol has been employed but often at a sacrifice resulting in inferior products. Some success is apparent from a 1951 report advising that the molded plastics industry was moving away from the preferred phenol base compounds and was already utilizing cresol (and xylenol) as raw material. 711/

There is little information about the amount or extent to which cresol is employed in the manufacture of resins and plastics in East Germany. It has been necessary to assume arbitrarily for 1952 that the amount of cresol used was equivalent to the estimated amount of phenol consumed, 3,000 tons. There have been no reports of exports of resins and plastics derived from cresol. Presumably, the largest manufacturer of cresol-based resinous products in East Germany is VEB Kunstharz-und Pressmassefabrik Erkner.

c. Hydrogenated Cresols.

Cresol yields valuable solvents when hydrogenated. Methylcyclohexane and methylcyclohexanol are the best known. The latter, also known as "Methylhexalin," is perhaps the most important and may be employed as a solvent for cellulose esters for lacquers, as an antioxidant for lubricants, and as a blending agent for special textile soaps and detergents.

The VEB Deutsches Hydrierwerk Rodleben, Rodleben/Rosslau is a known producer of organic solvents by hydrogenation, and both methylcyclohexane and Methylhexalin are made there. It is understood that VEB Leunawerke "Walter Ulbricht" also hydrogenates cresol. The Rodleben plant produced 487 tons of Methylhexalin in 1939. 712/

Very little postwar production data are available for either solvent. [redacted] The manufacture of one ton (1,000 kilograms) of Methylhexalin requires 1,175 kilograms of cresol. 714/ Since there is no production information available for any hydrogenated cresols in 1952, it is assumed that total East German output of these solvents may have been about 1,000 tons. The cresol consumption then conceivably could have been about 1,200 tons.

50X1

The tar-distillation plant at Erkner is known to have supplied the Rodleben installation with ortho-cresol during 1952. 715/ An export plan of 100 tons of Methylhexalin was reported for 1952, 716/ but only 60 tons were shipped, apparently, and that was all sent to France. 717/

d. Synthetic Organic Tanning Agents.

Synthetic organic tannins (Syntans) are based principally upon phenol, cresol, and naphthol. Because natural or vegetable tannins were not in sufficient supply, synthetic organic substitutes for tanning principles were developed in Germany before World War II. East Germany now has shortages both in plant-derived tanning agents and in synthetic organic substitutes. The quality of Syntans during 1952 did not meet the requirements of the leather industry, and it was necessary to add vegetable tanning agents. 718/

No information is available relating to the quantities or the extent to which either cresol or phenol are used currently in the manufacture of substitute tanning materials. Moreover, data are lacking on recent outputs of various individual Syntans. Three chemical plants are known to be producers: VEB Farbenfabrik Wolfen; VEB Chemiewerk Doelau, Greiz/Doelau; and VEB Fettchemie- und Fewawerk Chemnitz (now Karl Marx Stadt).

Wolfen currently produces a Syntan under the trade name "Wofagan M." This tannin may be used for bottom leather and sleek and russet upper leather, both in the pit-tanning and drum-tanning process, and for the tanning of sole leather. If Wofagan M is mixed with vegetable tanning extracts, it produces a mild leather from calf, sheep, and goat skin. The product was first mentioned in production at Wolfen in 1950, and the output that year was reported as 700 tons. 719/ During the first 6 months of 1951, Wolfen produced 582 tons, 720/ and output in the first 7 months of 1952 amounted to 619 tons toward the annual plan of 1,440 tons. 721/

The Doelau plant manufactures condensation products on a phenol (and cresol) formaldehyde basis for the leather industry. Products made here are called "Novaltans" (Novaltan F, Novaltan extra W, etc.). Starting materials employed to synthesize tanning agent fixation materials include phenol and/or cresol- formaldehyde condensation products, urea, sulfite spent liquor, and sulfones from cresol. During 1950, research was being undertaken at Doelau to develop more economically feasible tanning agents from cresol, of which some could also be used in the Perlon fiber industry. 722/

The plant at Chemnitz produces a tanning agent called "Boemotan." This substitute is reported to give best tanning results with bottom leather, belting, and sleek and russet upper leather. The tar distillation works at Erkner supplied Chemnitz with cresol during 1952, presumably for manufacturing Syntans.

Synthetic organic tanning agents produced in East Germany during 1950 amounted to 1,410 tons. 723/ Output in 1952 was reported as 2,548 tons 724/; the 1952 annual plan was 3,240 tons. 725/ Information and data available do not permit a firm estimate on the amount of cresol consumed in 1952 to manufacture Syntans, so an arbitrary quantity of 750 tons has been selected.

e. Miscellaneous Uses.

There are a number of other possible uses for cresol, including the manufacture of disinfectants, medicinals, insecticides, health soaps, perfumes, textile compounds, dye intermediates, and inks. Still other probable applications include selective solvents for refining lubricating oils, agents for the flotation of ores, grease detergents for industry, and use in the preparation of sheep-dips.

Ortho-cresol is the starting material for VEB Farbenfabrik Wolfen to prepare dinitro-ortho-cresol, from which Wolfen produces two salable products, "Hedolit Powder" and "Selinon." The Hedolit Powder becomes a spraying agent for pest control in grain seeds, particularly against charlock and other wild varieties of field mustard. Selinon is a winter spraying agent for combating the principal fruit tree parasites, which are dormant during the winter in the egg or larvae stages. Selinon also kills shield lice types and destroys mosses and lichens. The Spring worm larvae and various lice and mites found in vineyards are controlled with Selinon. According to the records of I.G. Farbenindustrie AG, the Wolfen plant produced 457 tons of dinitro-ortho-cresol in 1943, but later output data are not available. 726/

There is no positive indication that East Germany is currently using cresol as a selective solvent for refining lubricating oils. The matter was given consideration in 1951, when ortho-cresol was found to be difficult to market. Ortho-cresol was suggested for lowering the solidification point of diesel fuel and to replace phenol as the selective solvent at VEB Mineraloelwerk Luetzkendorf. 727/ VEB Teerdestillation- und Chemische Fabrik Erkner is known to have made delivery of ortho-cresol to Luetzkendorf during 1952. 728/ When mixed with phenol, cresol can be used as a selective solvent which extracts cyclic hydrocarbons, sulfur compounds, and asphaltic bodies, leaving behind a more paraffinic raffinate in petroleum refining. Cresol is also an effective antioxidant in the prevention of gum formation in gasoline and acts similarly in inhibiting harmful oxidizing reactions in petroleum lubricants.

Pure ortho-cresol is used in the manufacture of perfume materials and coumarin (for flavoring substances), of a perfumery fixative, and of pharmaceutical preparations. The Erkner plant shipped ortho-cresol to VEB Schimmel, Miltitz/Leipzig in 1952. 729/ The Miltitz plant is a flavor extract and perfume manufacturer.

Ortho-cresol, when treated with caustic soda and carbon dioxide under pressure, produces ortho-cresotic acid, a dye intermediate. There is no indication, however, that the Wolfen dye factory or any other East German plant produces ortho-cresotic acid.

Cresol is used extensively in general disinfectants such as cresol soaps and lysol. Cresol has greater germicidal properties than has phenol and is safer to the skin. The meta isomer exhibits more powerful antiseptic action than phenol or the other cresols. Undoubtedly, East Germany consumes an appreciable quantity of cresol for disinfectant purposes, but there are no data on the magnitude of this quantity.

Cresol consumed by East Germany during 1952 for miscellaneous uses may have totaled about 1,900 tons. Sufficient information is unavailable to permit a smaller figure for "miscellaneous uses," and it is impossible to make further breakdowns into specific demands for included end-uses.

f. Export.

East Germany exports between 10 and 20 percent of its cresol output. Total cresol exports apparently declined in 1952, when approximately 1,700 tons were shipped, in contrast to about 1,900 tons in 1951. (See Table 11, p. 50, above.) It is of interest to note that nearly 90 percent of the cresol exports in 1951 (over 95 percent in 1952) were made to non-Soviet Bloc countries. Also, no actual deliveries of cresol (in any grade) to the USSR were reported for 1952.

g. Stockpile (Strategic Reserve).

[redacted] 50X1

[redacted] 5 tons of crude 50X1
cresol were allocated in 1953 to the State Reserve for pharmaceutical supplies (disinfecting drugs). 729a/

7. Aniline.

a. Phenyl-Beta-Naphthylamine (PBN).

Discussion concerning the production and use of phenyl-beta-naphthylamine (PBN) in East Germany has already been given.*

It was also stated previously that the only East German producer of PBN is VEB Farbenfabrik Wolfen. The estimated output of this rubber antioxidant in 1952 was 1,700 tons. In order to produce this amount of PBN, 750 tons of aniline were probably consumed. There is little doubt that the bulk of the aniline used in East Germany during 1952 went into the manufacture of PBN. Perhaps nearly 60 percent of the total aniline supply was used for this purpose. Another derivative of aniline, diphenylamine, is used as a rubber antioxidant by VEB Chemische Werke Buna, Schkopau (see Miscellaneous, p. 148, below).

b. Vulkazit.

Vulkazit is a German trade name for a series of special-purpose rubber accelerators. They are indispensable to the processing of both natural and synthetic rubber to the finished fabricated products. The only plant in East Germany producing this line of rubber chemicals is VEB Farbenfabrik Wolfen. This plant is understood to have started Vulkazit production in early 1949. Wolfen is reported to produce the following types of Vulkazit at the present time:

* P. 121, above.

(1) Vulkazit AZ (liquid) (Benzothiazolyl-2-sulfendiethylamide). This type is preferred as a vulcanizer accelerator in a mixture for rubber goods of heavily detailed profiles (forms) because a retarded start of vulcanization insures a good filling out of the molds.

(2) Vulkazit DM (Bis-mercaptobenzothiazole). This type is preferred as a vulcanization accelerator for light-colored rubber goods because no discoloration results.

(3) Vulkazit M (Mercaptobenzothiazole). The M type has wide application as a vulcanization accelerator, except for articles which come in contact with foodstuffs.

(4) Vulkazit P extra N (Zinc salt of methylphenylthiocarbamate). This vulcanization accelerator is used for transparent, thin-walled rubber articles.

(5) Vulkazit 1,000 (2-tolyl-biguanide). This type is suitable as an activator for strong accelerators (mercapto, thiuram, and the like).

(6) Vulkazit Thiuram (Tetramethylthiuram disulfide). A vulcanization accelerator particularly for rubber mixtures of low sulfur content and high heat resistance.

Wolfen was reported to have produced about 460 tons of Vulkazit (all types) in 1950. Of this quantity the plant specifically reported the production of about 19 tons of type M, 14 tons of DM, and 21 tons of AZ. 730/ The DM and AZ types require amounts of type M for their manufacture, and the latter is based on aniline. For the quantities of types M, DM, and AZ reported produced in 1950, it is estimated that about 40 tons of aniline were consumed. There is much uncertainty whether additional amounts of Vulkazit were produced which required aniline; some may have been listed under an unspecified category. There are no available data for any succeeding years on production of Vulkazit at Wolfen. An estimate of 60 tons of aniline consumed by Wolfen in 1952 to prepare these rubber chemicals is entirely arbitrary and may be low. East Germany supplies Vulkazits to the Satellites, especially to Hungary (see Appendix B, Table 31*). In 1953, East German exports of vulcanization accelerators were reported to amount to 11 percent of the production capacity. 731/

* P. 166, below.

c. Hydroquinone.

Hydroquinone is produced from aniline, through quinone, and is a strong reducing agent. This is the property that makes it valuable as a photographic developer; it is used in larger amounts than any other chemical for this purpose, including Metol.

The plant producing hydroquinone is VEB Farbenfabrik Wolfen. What is known of Wolfen's production record for hydroquinone is as follows:

Year	Metric Tons
1937	211 732/
1938	199 733/
1939	178 734/
1940	179 735/
1941	217 736/
1942	304 737/
1943	284 738/
1950	140 739/
1951	170 (estimated; output in first quarter of 1951 was 47 tons) 740/
1952	200 (estimated)

An estimated output of 200 tons of hydroquinone in 1952 would require approximately 200 tons of aniline.

An appreciable portion of the hydroquinone output is sent to VEB Filmfabrik (Agfa) Wolfen. Approximately 45 tons were supplied to the film plant in 1950, 741/ and the plant's requirement for 1953 was reported as 92 tons. 742/ Hydroquinone exports in 1951 amounted to nearly 30 percent of the estimated output, but to only 20 percent in 1952. Exports were about equally divided between Soviet Bloc countries and Western countries in 1951 but most of the product went to Soviet countries in 1952. (See Appendix B, Table 31.*)

d. Centralite (Carbanilides).

In the preparation of nitrocellulose, the principal ingredient in most smokeless powder, great care is exerted to produce a highly purified product that has a high degree of chemical stability. In spite of these precautions, it is found necessary to add stabilizing

* P. 166, below.

chemicals to all modern explosive powder compositions to insure an acceptable stability life of the finished powder. The two principal stabilizers employed are centralite and diphenylamine (see f, below). Centralite is actually two chemicals -- Centralite I (dimethyl-diphenyl-urea) and Centralite II (diethyl-diphenyl-urea). Centralite may also be used as a solvent for cellulose esters and ethers and shellac or as the starting material for intermediates and pharmaceuticals. The dye factory, VEB Farbenfabrik Wolfen, is the only definitely known producer of centralite. 743/ Unfortunately there are no output data available.

An export of 76 tons of centralite to Hungary in 1952 was reported. 744/ If an arbitrary estimate of 90 tons of centralite is established as the 1952 output in East Germany, this quantity of product would consume about 100 tons of aniline.

e. Sulfonamides.

Aniline is the starting material for the manufacture of a whole series of sulfa drugs, including sulfanilamide, sulfaquanidine, and sulfathiazol. The sulfonamides are a group of medicinal chemicals used internally in combating infections and externally as bacteriostatic agents.

Two significant sulfonamide producers in East Germany are VEB Farbenfabrik Wolfen and VEB Deutsches Hydrierwerk Rodleben. Another plant reported producing sulfa drugs is VEB Chemische Fabrik Gruenau, Berlin/Gruenau. A new installation was installed in 1953 at VEB Schering, Berlin/Adlershof. 745/

There are little factual data on individual plant outputs. The Wolfen plant was reported to have produced only 2.5 tons in the first half of 1950 and 2.8 tons in the corresponding period of 1951. 746/ The plant at Rodleben had a 1953 plan of 8 tons but had produced 6.7 tons by the end of June. 747/ Rodleben prepares sulfanilamide and has a maximum capacity output of 23 tons. 748/ [redacted] the entire East German production plan for sulfa drugs in 1953 was 60 tons. 749/ An output of about 45 tons in 1952 is perhaps a reasonable estimate, and this amount would have consumed about 60 tons of aniline. 50X1

f. Miscellaneous,

A great number of other aniline-derived products are probably prepared in East Germany. One chemical apparently produced in significant quantity is diethylaniline, which is used for making dyes. Where the product is produced is not known, but it is probably made at VEB Farbenfabrik Wolfen. East Germany was to export 230 tons of diethylaniline to the USSR in 1952, but only 110 tons had been shipped by the end of 10 months. 750/ SAG plant requirements in the same year were 11 tons. 751/

The Wolfen plant does prepare sulfanilic acid, which is largely used as an intermediate in manufacturing azo dyes, including methyl orange. Requirements for sulfanilic acid in 1952 amounted to 15 tons, 752/ and 3 additional tons were shipped to Bulgaria. 753/

Wolfen also produces para-nitroaniline, but it is not known whether the chemical is made from nitrochlorobenzene or acetanilide (from aniline). Current output of para-nitroaniline is unknown, but Wolfen produced 945 tons in 1938 and 338 tons in 1943. 754/ East German exports of the chemical in 1952 totaled 40 tons, and all went to Soviet countries. (See Appendix B, Table 31.*) Para-nitroaniline is used to some extent as an intermediate in the preparation of azo and azoic dyes and also for the production of para-phenylenediamine, a rather important intermediate and dye.

The Wolfen plant probably produces para-chloroaniline, but there is no positive evidence. This chemical is chiefly used as an intermediate in the preparation of azo and azoic dyes. An export of 10 tons to the USSR was reported in 1952. 755/

East Germany's production level of azo dyes in 1953 was 200 tons per month. 756/ In 1954, the Wolfen plant was scheduled to produce the following organic dyestuffs: 6,051 tons for textiles and leather industries, 244 tons for lacquers and pigments, and 414 tons of miscellaneous types. An additional 4,877 tons of organic dyestuffs and pigments are to be made in 1954 by other chemical plants. 757/

Prior to 1952, East Germany imported diphenylamine from the USSR. In 1952, however, the SAG plants were reported to have an annual requirement of 56 tons, and 30 tons were expected to be available from East German manufacture, the remainder from stocks. 758/

* P. 166, below.

To produce 30 tons of diphenylamine, about 39 tons of aniline would be needed. Diphenylamine, like centralite, is an important stabilizer for nitrocellulose propellants and celluloid but may be used as a synthetic rubber antioxidant, as an intermediate for dyes, or for the preparation of the insecticide phenothiazine.

A plant named Anilinfarbenfabriken, Wilhelm Brauns, KG,* located at Quedlinburg, requires aniline for the manufacture of dyes for clothing, food, leather, and printing inks. This plant is believed to be the second largest consumer of aniline in East Germany and its 1953 plan requirement was 120 tons. 758a/

A third aniline consumer is Laborchemie Apolda but the nature of this plant's products is unknown. Apolda probably consumes only a few tons of aniline each year.

An antihistamine called "Thiantan" is made by VEB Deutsches Hydrierwerk Rodleben. The 1953 production plan called for 572 kilograms, and 334 kilograms were produced in the first half of the year. 759/ Thiantan is prepared from aniline hydrochloride, and 1 kilogram of product requires 2.5 kilograms of aniline hydrochloride. 760/

* KG is the abbreviation for Kommanditgesellschaft, a joint stock company.

APPENDIX B

EAST GERMAN FOREIGN TRADE IN DERIVED AROMATIC CHEMICALS AND PRODUCTS

1. Imports.

East Germany imports aromatic chemicals which are not produced domestically or are not produced in sufficient quantity. A considerable variety of these chemicals are imported. A single shipment may amount to only a few kilograms or to several tons but the import may cover a year's requirement for East Germany. A high proportion of these chemicals have a limited use and are destined for VEB Farbenfabrik Wolfen.

A study of the import pattern for other aromatics and chemicals derived from benzol, toluol, naphthalene, and the like, reveals an apparent decline in imports which may indicate that East Germany is becoming more independent. At the present time, East Germany is certainly less dependent upon Western countries, especially West Germany, than it was prior to 1951. Several chemicals now seemingly in sufficient production so that imports are no longer necessary are nitrobenzene and benzidine (from benzol), salicylic acid (from phenol), and diphenylamine (from aniline). In addition, beta-naphthol and phenyl-beta-naphthylamine (PBN) -- both from naphthalene -- were continually imported prior to 1951, but after that, except for sporadic shortages in 1953, domestic production surpassed demand and even permitted export of both items.

Table 25* lists some chemicals that have been reported in recent import statistics and are not produced in East Germany or are produced in inadequate quantities, and gives countries of origin and possible uses.**

* Table 25 follows on p. 152.
** Continued on p. 154.

Table 25

Reported Imports or Requirements of Aromatic Chemicals by East Germany, Countries of Origin, and Possible Uses 1950-54

Item	Import Plan a/* or Requirement b/ (Metric Tons)	Year of Import	Country of Origin	Possible Uses for Item
From Benzol				
Maleic Anhydride	3 to 5 (R) 761/ c/	1952	N.A.	Dyestuffs
Maleic Anhydride	2 (R) 762/	1952	West Germany	Dyestuffs
Diphenyl, pure	3 (R) 763/ d/	1952	West Germany	Organic synthesis
Diphenyl, pure	0.4 (R) 764/	1952	West Germany	Organic synthesis
From Toluol				
Para-nitrotoluene	450 (R) 765/	1952	USSR	Dyestuffs and Explosives
Nitrotoluene	500 (P) 766/	1953	USSR	
Dinitrotoluene	150 (P) 767/	1950	USSR	Dyestuffs and Organic synthesis
Dinitrotoluene	88 (P) 768/	1951	USSR	
Dinitrotoluene	57 (R) 769/	1952	USSR	
Ortho-toluidine	6 (R) 770/	1951	USSR (?)	Dyestuffs
Meta-toluidine	9 (R) 771/	1951	USSR (?)	Dyestuffs
Para-toluidine	0.5 (R) 772/	1952	West Germany	Dyestuffs
From Naphthalene				
Phenyl-beta-naphthylamine	200 (P) 773/	1950	USSR	Rubber antioxidant
Beta-naphthol	50 (P) 774/	1950	USSR	Dyestuffs
Alpha-naphthol	8 (R) 775/	1951	USSR (?)	Dyestuffs
Alpha-naphthol	12 (R) 776/ e/	1952	N.A.	Dyestuffs
Alpha-naphthol	15 (P) 777/	1954	N.A.	Dyestuffs
Alpha-naphthylamine	170 (P) 778/	1950	USSR	Dyestuffs
Alpha-naphthylamine	97 (R) 779/	1951	USSR	Dyestuffs

* Footnotes for Table 25 follow on p. 153.

Table 25

Reported Imports or Requirements of Aromatic Chemicals by East Germany, Countries of Origin, and Possible Uses 1950-54 (Continued)

Item	Import Plan a/ or Requirement b/ (Metric Tons)	Year of Import	Country of Origin	Possible Uses for Item
From Naphthalene (Continued)				
Alpha-naphthylamine	190 (P) 780/	1952	USSR	Dyestuffs
H-Acid	14 (P) 781/	1951	USSR	Dyestuffs
I-Acid	22 (R) 782/	1951	N.A.	Dyestuffs
From Aniline				
Dimethylaniline	33.5 (P) 783/	1950	USSR	Dyestuffs
Dimethylaniline	16 (P) 784/	1951	USSR	Dyestuffs
Diphenylamine	71 (R) 785/	1951	USSR (?)	Dyestuffs
Miscellaneous				
Pyrocatechol	40 (P) 786/	1951	Czechoslovakia	Synthetic tannins
Pyrocatechol	20 (P) 787/	1952	Czechoslovakia	Synthetic tannins
Pyrocatechol	60 (P) 788/	1953	Czechoslovakia	Synthetic tannins
Pyrocatechol	60 (P) 789/	1954	Czechoslovakia	Synthetic tannins
Pyridine, Pure	500 (P) 790/	1952	Poland	Pharmaceuticals, color film dyes, and export
Resorcinol	6 (R) 791/ f/	1952	N.A.	Various

a. Import plan figures are identified by the symbol (P).
b. Requirement figures are identified by the symbol (R).
c. VEB Chemische Werke Buna, Schkopau, was capable of producing only about 1 ton a year (1952).
d. VEB Farbenfabrik Wolfen was able to produce only enough for research purposes (1952).
e. VEB Farbenfabrik Wolfen does not produce alpha-naphthol (1952).
f. VEB Farbenfabrik Wolfen was capable of producing about 3 tons per year (1952).

2. Exports.

East Germany exports a considerable number and variety of chemicals and products derived from coal chemicals. Broadly speaking, the exported products can be grouped according to their probable uses. Such general use categories would include the following: insecticides and pesticides, synthetic rubber manufacture and rubber chemicals, plasticizers and softeners for plastics and resins manufacture, photographic chemicals, dyestuffs and dye intermediates, solvents, explosives manufacture, and pharmaceuticals and medicinals.

The exported products mentioned in Tables 26 through 31* are presented under the particular aromatic (benzol, toluol, naphthalene, phenol, cresols, or aniline) from which they were probably derived. All available export data for the years 1951 and 1952 for each product are given along with the respective countries receiving the exports. Exports of final or semifinished end products like synthetic rubber, plastics and fibers, and photographic films are not given, although many chemicals considered in this report entered into their manufacture.

No mention has been made in any of the tables regarding export of finished organic dyes. These dyes are often referred to as "aniline dyes," a term which popularly includes not only dyes derived from aniline and its derivatives but the entire field of synthetic organic dyes. During 1952 the export of organic dyes by East Germany was valued at 6,179,000 rubles, and of that amount, dyes valued at 5,782,000 rubles were shipped to the Soviet Bloc countries, including Communist China. 792/ Unfortunately, no comparable figures are available for 1951 or 1953. Also, no quantities for derived chemicals and products are knowingly included in the tables which represent "bonus" deliveries -- that is, reparations or "T-account" deliveries -- to the USSR. Several commodities reported to be involved in these shipments during 1952 were ethylbenzene, phthalic anhydride, and the Palatinols (C and AH types), which are phthalate plasticizers. Other items suspected of being sent to the USSR under supplemental accounts are saccharin and a softener called "ED 242." Actual annual shipments of the above commodities under special accounts are not available for any year. However, planned deliveries reported for 5 months (February through June) of 1953 were 2,500 tons of ethylbenzene, 3,300 tons of phthalic anhydride, and 530 tons of Palatinols (290 tons of C type). 793/ The East German press announced on 22 August 1953

* Tables 26 through 31 follow on pp. 156-166.

that the USSR had made an agreement with East Germany which called for the cessation of reparations beginning 1 January 1954, as well as the transfer to German ownership of the Soviet corporations (SAG) formerly controlled by the Administration of Soviet Property (USIG).

East German exports of certain chemicals and products obtained from the basic aromatic chemicals are shown in Tables 26, 27, 28, 29, 30, and 31.

Table 26

East German Exports of Chemicals and Products Derived from Benzol, by Importing Countries 1951-54

Metric Tons

Commodity	Importing Country	Amount 1951 794/	1952 795/	1953 796/	1954 797/
Benzene Hexachloride (BHC) ("Hexa" products)	Bulgaria	40	300	N.A.	N.A.
	Czechoslovakia	540	560	N.A.	N.A.
	Total	580	860	N.A.	N.A.
DDT (100 Percent Basis)	Albania	0	78	N.A.	N.A.
	Bulgaria	58	173	N.A.	N.A.
	China	0	50	N.A.	N.A.
	Czechoslovakia	992	800	N.A.	N.A.
	Hungary	0	213	N.A.	N.A.
	Poland	240 (Plan)	765	N.A.	N.A.
	North Korea	0	32	N.A.	N.A.
	USSR	N.A.	860	N.A.	N.A.
	Total	1,210 (Plan)	2,971	3,149 (Plan)	4,725 (Plan)
Dichlorobenzene, Ortho	Switzerland	0	50	N.A.	N.A.
	Total	0	50	N.A.	N.A.
Dichlorobenzene, Para	Hungary	0	16	N.A.	N.A.
	USSR	100	50	N.A.	N.A.
	Total	100	66	N.A.	N.A.
Dinitrobenzene, Meta	Czechoslovakia	0	80	N.A.	N.A.
	Total	0	80	N.A.	N.A.

Table 26

East German Exports of Chemicals and Products Derived from Benzol, by Importing Countries
1951-54
(Continued)

Metric Tons

Commodity	Importing Country	Amount 1951 [794]	1952 [795]	1953 [796]	1954 [797]
Dinitrochlorobenzene (DNCB)	China	187	812	N.A.	N.A.
	Hungary	11	0	N.A.	N.A.
	Netherlands	33	20	N.A.	N.A.
	Total	231	832	500 (Plan)	N.A.
Diphenyl Oxide	Poland	0	13	N.A.	N.A.
	Total	0	13	N.A.	N.A.
Ethylbenzene	Hungary	0	7	N.A.	0
	Poland	0	5	N.A.	0
	USSR	9,000	6,000 (Plan)	N.A.	0
	Total	9,000	6,012	2,000 (Plan)	0
Monochlorobenzene (MCB)	Bulgaria	4	5	N.A.	N.A.
	USSR	N.A.	1,000	N.A.	N.A.
	Total	4	1,005	500 (Plan)	1,000 (Plan)
Nitrochlorobenze, Ortho	Hungary	22	0	N.A.	N.A.
	USSR	200	200	N.A.	N.A.
	Total	222	200	50 (Plan)	N.A.

Table 26

East German Exports of Chemicals and Products Derived from Benzol, by Importing Countries
1951-54
(Continued)

Metric Tons

Commodity	Importing Country	Amount 1951 794/	1952 795/	1953 796/	1954 797/
Nitrochlorobenzene, Para	Hungary	0	16	N.A.	N.A.
	USSR	100	50	N.A.	N.A.
	Total	100	66	100 (Plan)	N.A.
Polystyrol	Bulgaria	1	0	N.A.	N.A.
	Czechoslovakia	1	0	N.A.	N.A.
	Hungary	6	0	N.A.	N.A.
	Poland	15	0	N.A.	N.A.
	Total	23	0 (Plan)	50 (Plan)	120 (Plan)

Table 27

East German Exports of Chemicals and Products Derived from Toluol, by Importing Countries 1951-54

Metric Tons

Commodity	Importing Country	Amount 1951 798/	1952 799/	1953 800/	1954 801/
Benzoic Acid	Poland	55	25	N.A.	N.A.
	France	0	30	N.A.	N.A.
	Total	55	55	180 (Plan)	50 (Plan)
Saccharin	Albania	2	0	N.A.	N.A.
	Bulgaria	16	12	N.A.	N.A.
	China	2	0	N.A.	N.A.
	Poland	0	9	N.A.	N.A.
	USSR	60	0	N.A.	N.A.
	Belgium	10	9	N.A.	N.A.
	England	147	24	N.A.	N.A.
	Netherlands	5	4	N.A.	N.A.
	Switzerland	2	0	N.A.	N.A.
	Sweden and Turkey	0	Negligible	N.A.	N.A.
	Total	244	58	100 (Plan)	100 (Plan)

Table 28

East German Exports of Chemicals and Products Derived from Naphthalene, by Importing Countries
1951-54

Metric Tons

Commodity	Importing Country	Amount 1951 [802]	1952 [803]	1953 [804]	1954 [805]
Alpha-nitronaphthalene	West Germany	N.A.	130	N.A.	N.A.
	Total	N.A.	130	N.A.	N.A.
Beta-naphthol	China	50	0	N.A.	N.A.
	Hungary	65	0	N.A.	N.A.
	Total	115	0	N.A.	N.A.
Decalin	Czechoslovakia	15 (Plan)	0	N.A.	N.A.
	Poland	10 (10 months)	0	N.A.	N.A.
	USSR	50 (Plan)	5	N.A.	N.A.
	Australia	10 (10 months)	0	N.A.	N.A.
	Denmark	15 (10 months)	0	N.A.	N.A.
	England	0	5	N.A.	N.A.
	France	0	60	N.A.	N.A.
	Italy		20	N.A.	N.A.
	Sweden	13 (10 months)	0	N.A.	N.A.
	West Germany	30 (Plan)	35	N.A.	N.A.
	Total	130 (as reported)	125 (as reported)	250 (Plan)	N.A.
Palatinols					
	Czechoslovakia	90	90	N.A.	N.A.
	Poland	140	10	N.A.	N.A.
	USSR	200	N.A.	N.A.	N.A.
	Austria	15 (10 months)	0	N.A.	N.A.
	Total	445	125	670 (Plan)	615 (Plan)

Table 28

East German Exports of Chemicals and Products Derived from Naphthalene, by Importing Countries 1951-54 (Continued)

Metric Tons

Commodity	Importing Country	Amount 1951 802/	1952 803/	1953 804/	1954 805/
Paraflow (Chloro-naphthalene)	Poland	4 (10 months)	10 (Plan)	N.A.	N.A.
	Total	4	0	N.A.	N.A.
Phenyl-beta-naphthylamine (PBN)	China	80	50	0	0
	England	2	0	0	0
	Switzerland	50	0	0	0
	Total	132	50	0 (Plan)	0 (Plan)
Phthalic Anhydride	Czechoslovakia	N.A.	N.A.	40 (Plan)	N.A.
	USSR	4,150 (Actual)	100 (sic) (Actual)	N.A.	N.A.
		4,000 (Plan)	3,300 (Plan)	4,000 (Plan)	N.A.
	Total	4,150	119 (sic)	4,040 (Plan)	5,000 (Plan)
Tetralin	China	10	0	N.A.	N.A.
	Hungary	21	0	N.A.	N.A.
	Poland	10	125	N.A.	N.A.
	Australia	20	0	N.A.	N.A.
	Denmark	15	10	N.A.	N.A.
	France	0	45	N.A.	N.A.

Table 28

East German Exports of Chemicals and Products
Derived from Naphthalene, by Importing Countries
1951-54
(Continued)

Metric Tons

Commodity	Importing Country	Amount 1951 802/	1952 803/	1953 804/	1954 805/
Tetralin (Continued)	Italy	0	14	N.A.	N.A.
	Sweden	13	0	N.A.	N.A.
	Switzerland	0	12	N.A.	N.A.
	West Germany	42 (Plan)	176	N.A.	N.A.
	Total	131	382	300 (Plan)	200 (Plan)
Weichmacher (Softener) ED 242	USSR	750	700	975	1,100
	Total	750	700	975 (Plan)	1,100 (Plan)

Table 29

East German Exports of Chemicals and Products
Derived from Phenol, by Importing Countries
1951-54

Metric Tons

Commodity	Importing Country	Amount 1951 806/	1952 807/	1953 808/	1954 809/
Cyclohexanol (Hexalin)	Belgium	0	9	N.A.	N.A.
	France	0	9	N.A.	N.A.
	Sweden	34	0	N.A.	N.A.
	Switzerland	5	11	N.A.	N.A.
	Total	39	29	50 (Plan)	N.A.
Cyclohexanone	Austria	15	0	N.A.	N.A.
	Switzerland	20	50	N.A.	N.A.
	Total	35	50	100 (Plan)	100 (Plan)
Metol (methyl para-aminophenol sulfate)	China	1	1	N.A.	N.A.
	Czechoslovakia	3	0	N.A.	N.A.
	Hungary	3	0	N.A.	N.A.
	Poland	2	1	N.A.	N.A.
	USSR	10	N.A.	N.A.	N.A.
	Austria	3	0	N.A.	N.A.
	Belgium	10	0	N.A.	N.A.
	Denmark	1	0	N.A.	N.A.
	England	2	0	N.A.	N.A.
	Sweden	1 (10 months)	0	N.A.	N.A.
	Switzerland	10	0	N.A.	N.A.
	Total	46	2	16 (Plan)	35 (Plan)

Table 29

East German Exports of Chemicals and Products Derived from Phenol, by Importing Countries 1951-54 (Continued)

Metric Tons

Commodity	Importing Country	Amount			
		1951 806/	1952 807/	1953 808/	1954 809/
Salicylic Acid	Bulgaria	4	0	N.A.	N.A.
	China	20	0	N.A.	N.A.
	Poland	0	12 (8 months)	N.A.	N.A.
	Switzerland	20 (10 months)	0	N.A.	N.A.
	Total	44	20(as reported)	30 (Plan)	70 (Plan)
Selinon	Total	0	0	20 (Plan)	190 (Plan)
Triphenyl Phosphate	Netherlands	0	50	N.A.	N.A.
	Switzerland	50	0	N.A.	N.A.
	Tangier	0	8	N.A.	N.A.
	US	0	1	N.A.	N.A.
	West Germany	0	1	N.A.	N.A.
	Total	50	60	100 (Plan)	N.A.
Wofatit	Czechoslovakia	97	89	N.A.	N.A.
	Hungary	33	59	N.A.	N.A.
	Poland	200	200	N.A.	N.A.
	Rumania	0	1	N.A.	N.A.
	USSR	0	40	N.A.	N.A.
	Austria	0	11	N.A.	N.A.
	Netherlands	0	25	N.A.	N.A.
	Switzerland	1	0	N.A.	N.A.
	Total	331	425	600,000 liters (Plan) a/	850,000 liters (Plan) a/

50X1

Table 30

East German Exports of Chemicals and Products Derived from Cresols, by Importing Countries 1951-54

Metric Tons

Commodity	Importing Country	Amount			
		1951 810/	1952 811/	1953 812/	1954 813/
Methylcyclohexanol (Methyl Hexalin)	Poland	0	8	N.A.	N.A.
	France	0	60	N.A.	N.A.
	Switzerland	15 (10 months)	116	N.A.	N.A.
	Total	15	184	N.A.	N.A.
Tricresyl Phosphate	Bulgaria	0	1	N.A.	N.A.
	Czechoslovakia	20	100	N.A.	N.A.
	Hungary	0	150	N.A.	N.A.
	Poland	139	108	N.A.	N.A.
	Austria	42	78	N.A.	N.A.
	Denmark	30	15	N.A.	N.A.
	England	0	30	N.A.	N.A.
	Netherlands	88	79	N.A.	N.A.
	Switzerland	209	135	N.A.	N.A.
	US	5	0	N.A.	N.A.
	West Germany	0	250 (Plan)	N.A.	N.A.
	Liechtenstein	50 (10 months)	0	N.A.	N.A.
	Total	583	754 (as reported)	1,500 (Plan)	1,500 (Plan)

Table 31

East German Exports of Chemicals and Products Derived from Aniline, by Importing Countries 1951-54

Metric Tons

Commodity	Importing Country	Amount: 1951 814/	1952 815/	1953 816/	1954 817/
Chloroaniline, Para (or from Benzol)	USSR	N.A.	10	N.A.	N.A.
	Total	N.A.	10	N.A.	N.A.
Centralite	Hungary	N.A.	76	N.A.	N.A.
	Total	N.A.	76	N.A.	N.A.
Diethylaniline	USSR	N.A.	110 (10 months)	N.A.	N.A.
	Total	N.A.	230 (Plan)	N.A.	N.A.
Hydroquinone	China	6	0	N.A.	N.A.
	Czechoslovakia	3	8	N.A.	N.A.
	Hungary	3	13	N.A.	N.A.
	Poland	2	13	N.A.	N.A.
	USSR	10	N.A.	N.A.	N.A.
	Austria	3	0	N.A.	N.A.
	Belgium	10	0	N.A.	N.A.
	Denmark	1	0	N.A.	N.A.
	England	2	0	N.A.	N.A.
	Switzerland	10	0	N.A.	N.A.
	West Germany	0	7	N.A.	N.A.
	Total	50	41	20 (Plan)	100 (Plan)

Table 31

East German Exports of Chemicals and Products Derived from Aniline, by Importing Countries
1951-54
(Continued)

Metric Tons

Commodity	Importing Country	Amount 1951 814/	1952 815/	1953 816/	1954 817/
Nitroaniline, Para (or from Benzol)	China	12	13	N.A.	N.A.
	Czechoslovakia	0	17	N.A.	N.A.
	Hungary	0	10	N.A.	N.A.
	Total	12	40	60 (Plan)	N.A.
Phenylenediamine, Meta	China	5 (Plan)	0	N.A.	N.A.
	Hungary	N.A.	3	N.A.	N.A.
	Total	N.A.	3	N.A.	N.A.
Sulfanilic Acid	Bulgaria	N.A.	3	N.A.	N.A.
	Total	N.A.	3	N.A.	N.A.
Vulkazite	Bulgaria	5	0	N.A.	N.A.
	China	0	4	N.A.	N.A.
	Czechoslovakia	0	8	N.A.	N.A.
	Hungary	0	33	N.A.	N.A.
	Poland	1	0	N.A.	N.A.
	Rumania	0	1	N.A.	N.A.
	Italy	0	1	N.A.	N.A.
	Netherlands	3	0	N.A.	N.A.
	Switzerland	0	11	N.A.	N.A.
	Total	9	65 (as reported)	N.A.	45 (Plan)

APPENDIX C

STATISTICAL TABLES

Table 32

Production of Coke, Raw Tar, and Crude Benzol by Cokeries and Gas Plants in East Germany 1936 and 1938-55

Metric Tons

Year	Coke		Raw Tar			Crude Benzol		
	Cokeries	Gas Plants	Cokeries	Gas Plants	Total	Cokeries	Gas Plants	Total
1936 818/	285,000	1,056,000	12,000	62,000	74,000	4,000	7,300	11,300
1938 819/	279,000	1,440,000	13,000	70,000	83,000	6,000	10,800	16,800
1939 820/	249,834	N.A.	11,181	N.A.	N.A.	N.A.	N.A.	N.A.
1940 821/	239,320	N.A.	10,883	N.A.	N.A.	N.A.	N.A.	N.A.
1941 822/	228,835	N.A.	10,436	N.A.	N.A.	4,415	N.A.	N.A.
1942 823/	224,614	N.A.	10,034	N.A.	N.A.	4,118	N.A.	N.A.
1943 824/	226,881	1,684,000	9,433	83,000	93,000	4,050	9,200	13,200
1944 825/	227,007	N.A.	9,030	N.A.	N.A.	3,877	N.A.	N.A.
1945 826/	142,738	N.A.	5,363	N.A.	N.A.	2,145	N.A.	N.A.
1946 827/	175,404	N.A.	5,802	N.A.	N.A.	1,532	N.A.	N.A.
1947 828/	224,492	600,000	7,486	26,700	42,957	2,850	2,789	5,639
	(213,000) a/*		(9,440)		(55,500)	(2,700)		
1948 829/	226,798	970,000 b/	7,928	50,400 b/	58,300 b/	3,083	9,450 b/	12,631
	(220,000)		(6,938)			(2,480)		

* Footnotes for Table 32 follow on p. 170.

Table 32

Production of Coke, Raw Tar, and Crude Benzol by Cokeries and Gas Plants in East Germany
1936 and 1938-55
(Continued)

Metric Tons

	Coke		Raw Tar			Crude Benzol		
Year	Cokeries	Gas Plants	Cokeries	Gas Plants	Total	Cokeries	Gas Plants	Total
1949 830/	240,691 (230,000) a/	1,111,800	8,731 (7,800)	55,786	64,500 b/	3,449 (2,850)	8,734	12,200 b/ (10,000)
1950 831/	254,400 (240,000)	1,365,000	9,200 b/ (8,500)	57,826	67,000 b/ (64,000)	3,800 b/ (3,200)	9,700 b/	13,500 b/ (12,000)
1951 832/	262,000 b/ (250,000)	1,440,000 b/ (1,481,000)	9,500 b/ (8,770)	75,400 b/	84,900 (85,150)	3,950 b/ (3,340)	12,618 b/	16,600 b/ (16,384)
1952 833/	264,000 b/ (245,500)	1,700,000 b/ (1,708,000)	9,650 b/ (9,686)	84,000 b/ (90,067)	93,650 b/ (99,854)	4,000 b/ (3,325)	14,600 b/ (14,413)	18,600 b/ (18,482)
1953 834/	265,000 b/ (268,000) c/	1,800,000 b/ (1,896,000)	9,700 b/ (10,425)	95,500 b/ (99,753)	105,200 b/ (110,178) (114,000) d/	4,000 b/ (3,670)	15,600 b/	19,600 b/ (12,400) d/
1954 836/	266,000 b/ (292,000)	1,890,000 b/ (1,850,000) e/	9,850 b/ (10,450)	100,000 b/	109,850 b/ (124,500) d/	4,050 b/ (3,990)	16,650 b/	20,700 b/ (13,500) d/
1955 837/	268,000 b/ (299,000)	2,000,000 b/ (2,000,000) e/	9,920 b/ (10,650)	104,000 b/	114,000 b/ (140,500) d/	4,100 b/ (4,070)	17,600 b/	21,700 b/ (15,100) d/

a. All figures in parentheses are reported production plans.
b. Estimated production.

d. Plan as given in Final Draft to the East German Five Year Plan (1951-55).
e. Plan as given in the Preliminary Draft to the East German Five Year Plan (1951-55).

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Table 33

Production Quotas for Hard-Coal Tar and Crude Benzol
for Gas Plants in East Germany 838/ a/*
1952

Metric Tons

Saxony-Anhalt	Hard-Coal	Crude Benzol
Allstedt	27 (L)	
Annaburg	23 (D)	
Bernburg	240 (E)	
Bismark	35 (L)	
Calbe/Milde	35 (L)	
Dueben	39 (D)	
Eilenburg	110 (D)	
Elsterwerda	70 (D)	
Gardelegen	80 (V)	
Halberstadt	570 (E)	75
Halle	2,350 (E)	330
Helldrungen	29 (L)	
Kloetze	36 (L)	
Koelleda	58 (L)	
Magdeburg	14,200 (E)	3,060
Osterburg	50 (L)	
Quedlinburg	360 (E)	
Salzwedel	190 (V)	
Sangershausen	240 (V)	27
Stendal	360 (E)	44
Tangerhuette	48 (V)	
Torgau	140 (E)	19
Wittenberg	480 (E)	75
Total	19,770	3,630

Saxony	Hard-Coal	Crude Benzol
Annaberg	560 (E)	
Aue	285 (D)	42
Bautzen	520 (E)	44
Bernsdorf	16 (L)	
Chemnitz	4,200 (E)	770
Crimmitschau	248 (D)	
Dahlen	25 (L)	
Doebeln	302 (D)	55
Dresden	8,480 (E)	1,060
Ebersbach	65 (D)	
Eibenstock	80 (D)	
Eppendorf	20 (D)	
Geithaim	40 (L)	
Grossenhain	130 (D)	
Grossschoenau	65 (D)	7
Hainichen	41 (L)	
Heidenau	1,860 (E)	344
Herrnhut	28 (L)	
Hohenstein-Ernsthal	164 (D)	12
Hoyerswerda	38 (L)	
Kamenz	87 (D)	
Lammatsch	45 (D)	
Langebrueck	40 (L)	
Lauenstein	15 (L)	

Saxony (Continued)	Hard-Coal	Crude Benzol
Lausik	40 (L)	
Leipzig	6,740 (E)	1,650
Leisnig	456 (D)	22.8
Loebau	132 (D)	
Marienburg	45 (D)	
Markneukirchen	184 (E)	17.6
Meissen	600 (E)	103
Mittweida	230 (D)	10
Neugersdorf	210 (D)	29
Neustadt	64 (D)	
Niesky	46 (L)	
Oberwiesenthal	11 (L)	
Oederan	70 (D)	
Oelsnitz	75 (D)	
Olbernhau	43 (L)	
Ottendorf Okrilla	27 (L)	
Plauen	900 (E)	143
Radeberg	69 (D)	
Radeburg	28 (D)	
Riesa	250 (D)	40
Rietschen	12 (L)	
Rochlitz	174 (D)	21.6
Rosswein	120 (D)	
Rothenkirch	20 (L)	
Sebnitz	110 (D)	20
Seitenhennersdorf	64 (D)	
Weisswasser	150 (D)	
Zoeblitz	30 (L)	
Total	28,254	4,391

* Footnote for Table 33 follows on p. 174.

Table 33

Production Quotas for Hard-Coal Tar and Crude Benzol for Gas Plants in East Germany 838/ a/
1952
(Continued)

Metric Tons

Thueringen	Hard-Coal	Crude Benzol
Arnstadt	570 (E)	
Dingelstedt	32 (L)	
Eisenach	1,350 (E)	120
Eisenberg	91 (D)	
Erfurt	2,222 (E)	390
Ernsthal	17 (L)	
Frankenhausen	60 (L)	
Freiz	276 (D)	
Gera	838 (E)	87
Haselbach	90 (D)	
Hildburghausen	70 (D)	
Jena	515 (E)	
Kahla	27 (L)	
Meiningen	170 (D)	
Muelhausen	535 (E)	50
Neustadt/Orla	60 (D)	
Nordhausen	480 (E)	50
Poessneck	240 (D)	
Ronneburg	92 (D)	
Rudolstadt	528 (E)	
Schalkau	10 (L)	
Schleiz	32 (L)	
Schlotheim	55 (L)	
Schmalkalden	140 (D)	
Schmoelln	128 (D)	

Thueringen (Continued)	Hard-Coal	Crude Benzol
Schott Jena	400 (D)	
Tennstedt	26 (L)	
Triptis	25 (L)	
Weimar	426 (E)	82
Zeulenroda	84 (L)	
Total	9,589	779
Berlin-East		
Lichtenberg and Dimitroffstrasse	17,600 (E)	4,420
Mecklenburg		
Anklam	183 (L)	21.6
Barth	95 (L)	
Buetzow	70 (L)	
Crivitz	36 (L)	
Dargun	29 (L)	
Demmin	198 (L)	
Doberan	90 (L)	
Friedland	48 (L)	
Gnoien	50 (L)	
Grabow	64 (L)	
Greifswald	278 (L)	24.4
Grevesmuehlen	58 (L)	

Mecklenburg (Continued)	Hard-Coal	Crude Benzol
Guestrow	317 (L)	36
Hagenow	118 (L)	
Kroepelin	29 (L)	
Ludwigslust	151 (L)	10
Luebtheen	40 (L)	
Malchin	65 (L)	
Neubrandenburg	161 (L)	
Neukalen	29 (L)	
Neukloster	48 (L)	
Neustrelitz	184 (L)	
Parchim	143 (L)	15
Pasewalk	53 (L)	
Riebnitz	43 (L)	
Roebel	34 (L)	
Rostock	1,327 (E)	222
Schwaan	34 (L)	
Schwerin	755 (L)	131
Sternberg	38 (L)	
Strahlsund	517 (L)	36
Tessin	26 (L)	
Teterow	69 (L)	
Torgelow	60 (L)	
Uckermuende	67 (L)	
Waaren	118 (L)	
Wismar	495 (L)	38
Wittenburg	24 (L)	
Woldegk	24 (L)	
Wolgast	60 (L)	
Total	6,228	534

Table 33

Production Quotas for Hard-Coal Tar and Crude Benzol for Gas Plants in East Germany 838/ a/
1952
(Continued)

Metric Tons

Brandenburg	Hard-Coal	Crude Benzol	Brandenburg (Continued)	Hard-Coal	Crude Benzol
Angermuende	96 (V)		Luebben	48 (L)	
Beeskow	46 (L)		Muellrose	16 (L)	
Bernau	164 (V)		Neupetershagen	40 (L)	
Brandenburg	690 (V)		Neuruppin	344 (V)	
Cottbus	720 (E)	120	Neustadt/Dosse	15 (L)	
Eberswalde	500 (V)	66	Niemegk	16 (L)	
Finsterwalde	225 (E)		Peitz	20 (L)	
Forst	240 (L)	36	Perleberg	124 (V)	
Frankfurt	528 (V)	56	Potsdam	1,790 (E)	344
Freienwalde	90 (V)		Prenzlau	90 (V)	
Friesack	39 (L)		Pritzwalk	66 (V)	
Fuerstenberg	32 (L)		Rathenow	230 (V)	
Fuerstenwalde	140 (V)		Rheinsberg	76 (V)	
Grossraeschen	50 (L)		Schwedt	40 (L)	
Guben	204 (E)	37	Senftenberg	60 (V)	
Havelberg	42 (L)		Spremberg	172 (V)	
Henningsdorf	100 (V)		Vetschau	25 (L)	
Jueterbog	92 (V)		Werder	60 (V)	
Ketzin	18 (L)		Wilsnack	27 (L)	
Kirchhain	35 (L)		Wittenberge	670 (V)	
Koenigs Wüsterhausen	150 (V)		Wittstock	63 (V)	
Lenzen	26 (L)		Wriezen	45 (L)	
Luckau	42 (L)		Zehdenick	55 (L)	
Luckenwalde	276 (V)				
			Total	8,626	659

Table 33

Production Quotas for Hard Coal Tar and Crude Benzol
for Gas Plants in East Germany 838/ a/
1952
(Continued)

a. Coal tar allocations to consuming plants are designated by letters: (E) VEB Teerdestillation- und Chemische Fabrik Erkner; (D) VEB Oswald Greiner, Doebeln (now VEB Chemischer Fabrik Doebeln); (V) VEB Schwieck and Company, Velten (now VEB Chemische Fabrik Velten); and (L) Land Governments.

Summary:

Number of Producing Plants: Coal Tar, 194; Crude Benzol, 48.
Total Quantities of Coal Tar to Consuming Plants:

VEB Teerdestillation- und Chemische Fabrik Erkner	72,072 metric tons
VEB Oswald Greiner, Doebeln	5,737 metric tons
VEB Schwieck and Company, Velten	5,339 metric tons
Land Governments	6,919 metric tons
Total	90,067 metric tons

Table 34

Raw Hard-Coal Tar Processed by Tar Distilleries in East Germany a/ 1941-53

Metric Tons

Year	Tar Distilleries			
	VEB Teerdestillation- und Chemische Fabrik Erkner	Former Ruetgerswerke AG Niederau	VEB Chemische Fabrik Velten	VEB Chemische Fabrik Doebeln
1941 839/	58,545	52,117	9,820	8,398
1942 840/	59,804	47,601	10,550	8,282
1943 841/	66,892	42,943	9,670	8,424
1944	N.A.	72,000 842/ b/	N.A.	N.A.
1945	N.A.	Dismantled	N.A.	N.A.
1946 843/	21,657		2,846	2,650
1947 844/	32,416 c/		4,264 c/	6,000 c/
1948	N.A.		N.A.	N.A.
1949	N.A.		N.A.	N.A.
1950 845/	62,471		N.A.	N.A.
1951	76,116 846/		4,000 847/ d/	5,000 848/ d/
1952	83,799 849/		5,339 850/ c/	5,737 851/ c/
1953	87,500 852/ c/ e/		N.A.	N.A.

a. Tar distilleries do not include cokeries or roofing-board manufacturing plants.
b. Reported annual processing capacity.
c. Annual plan.
d. Reported operating capacity.
e. Reported annual processing capacity is 110,000 tons. 853/

Table 35

Plants Producing Crude Phenols in East Germany 854/
1954

Plant and Location	Raw Materials Used	Source of Phenols	Phenols Recovery Process Used
Crude Phenol Oil			
VEB Kombinat Espenhain, Espenhain (near Borna)	Brown-coal briquettes	LTC a/* waste waters and heavy benzine (naphtha)	Absorption with caustic soda
VEB Hydrierwerk Zeitz, Zeitz/Weissenfels	Brown-coal tar and light oil	Waste waters from hydrogenation (Bergius process)	Tricresyl phosphate (Otto) process
VEB Leunawerk "Walter Ulbricht," Leuna (near Merseburg)	Brown-coal tar, light oil and hydrogenation of brown coal	Hydrogenation waste waters and heavy benzine (naphtha) (Bergius process)	Absorption with caustic soda
VEB Teerverarbeitungswerk Rositz (near Altenburg)	Brown coal in generators and brown-coal tar processing	Heavy oils from distillation of brown-coal tar	Absorption with caustic soda
VEB Kombinat "Otto Grotewohl," Boehlen (near Leipzig)	Brown-coal tar and light oil	Waste waters from hydrogenation (Bergius process)	Phenosolvan (Lurgi) process
VEB Teerverarbeitungswerk Goelzau, Goelzau/Weissandt	Crude brown coal	N.A.	N.A.
VEB Grosskokerei "Matyas Rakosi," Lauchhammer (near Ruhland)	Brown-coal briquettes	HTC b/ waste waters	Phenosolvan process

* Footnotes for Table 35 follow on p. 177.

Table 35

Plants Producing Crude Phenols in East Germany 85/
1954
(Continued)

Plant and Location	Raw Materials Used	Source of Phenols	Phenols Recovery Process Used
Phenolate Liquor			
VEB Elektrochemie Hirschfelde (near Zittau)	Brown-coal briquettes	LTC waste waters and heavy benzine (naphtha)	Absorption with caustic soda
VEB Kombinat "Otto Grotewohl," Boehlen (near Leipzig)	Brown-coal briquettes	LTC waste waters and heavy benzine (naphtha)	Absorption with caustic soda
VEB Teerverarbeitungswerk Goelzau, Goelzau/Weissandt	Brown-coal, crude and predried	Heavy benzine from LTC unit	Absorption with caustic soda
VEB Mineraloelwerk Klaffenbach, Klaffenbach/Erzgebirge	Crude Austrian petroleum	Heavy benzine (?)	Absorption with caustic soda

a. LTC -- low-temperature carbonization (500 to 600°C).
b. HTC -- high-temperature carbonization (900 to 1,200°C).

Table 36

East German Production Costs and Sales Prices for Aromatic Coal Chemicals 855/ a/
1951-52

East German Marks (DME)

Product	Cost per Ton 1951	Cost per Ton 1952	Sales Price per Ton 1952
Benzol (commercial grade, "90er")	390.90	414.90	456.50
Toluol (refined)	457.60	487.80	538.0
Toluol (pure)	506.60	540.0	596.50
Xylol	476.80	508.80	561.50
Naphthalene (warm-pressed grade)	134.70	135.10	235.0
Phenol (pure)	1,083.30	1,047.90	980.0
Cresol (DAB 4) b/	418.80	415.50	340.0
Cresol (ortho)	655.40	709.10	592.0
Xylenol fraction	385.90	382.70	313.0

a. Actual reported costs for 1951 and 1952 (without turnover tax) and sales price for 1952 per ton of product produced by VEB Teerdestillation- und Chemische Fabrik Erkner.
b. DAB (Deutsche Arzneibuch) is the German pharmacopoeia.

APPENDIX D

INDICATIONS OF TRENDS IN RESEARCH AND DEVELOPMENT

The shortage of indigenous hard coal makes the problems in the field of basic organic chemistry in East Germany both important and critical, as it limits the supply of many of the required aromatic chemicals. It is logical, therefore, that the greatest attention should be shown to the chemistry of brown coal, a potentially valuable source of similar raw materials. It was reported that the primary use of brown coal in the future will be as a basic raw material for the organic chemical industry rather than in direct burning as a household and industrial fuel. Research currently is under way to create methods of utilizing brown coal not only for the production of synthetic fuels and crude phenols but also for other aromatics -- benzol, toluol, and the like.

Aromatics are present in small quantities in low-temperature carbonization tar. At present, the complex extraction of such products is justified only in the case of phenols. Refining operations presently do not permit the attainment of the most valuable components of the light oils from brown-coal tar -- benzol, toluol, and xylol. Researchers at the synthetic fuel plants VEB Leunawerk "Walter Ulbricht" and VEB Kombinat "Otto Grotewohl" at Boehlen have proposed dehydrogenation methods as the means for obtaining considerable amounts of aromatics (ranging up to ethyl benzene) from the light oil distillate of tar, which contains hydrogenated aromatics, naphthenes, obtained by hydrogenation refining and from the gasoline fraction (contains from 55 to 60 percent aromatic compounds -- mostly homologs of cyclohexane) which is obtained by hydrogenation. 856/ The submission of the coal to hydrogenation is similar to the US hydroforming process. The end result is the same, and experimentally this work has already been done at Boehlen in the so-called DHD units (dehydrogenation high-pressure units).

As a result of the research and development work carried on thus far in East Germany, it was proposed that in the future further attention should be given to the following methods of brown-coal tar treatment: (1) a combined treatment by distillation and hydrogenation at combine-size plants equipped with sufficient hydrogenation capacity and (2) a separate coking of pitch under conditions similar to the high-temperature coking of hard coal, for in the hydrogenation step the bulk of the hydrogen is consumed by the pitch fraction. The adoption of these methods appears to present the greatest possibility for complete utilization of brown-coal tar to obtain the following products: carburetor fuel, benzol, toluol, xylol, diesel fuel, hard paraffin, phenol and its homologs, pyridine and higher bases, other fine chemicals (particularly for the dye industry -- naphthalene, anthracene, and carbazole), electrode coke, sulfur and sulfuric acid, synthesis gas for the basic chemistry of plastics (ethane, ethylene), fuel gas, methane, and others. 857/ Alternate plans for commercial production have been drawn up. One plan shows a throughput of 690,000 tons per year of tar and light oil to produce 132,000 tons of DHD gasoline (aviation) or produce 5,000 tons of benzol, 22,000 tons of toluol, 22,000 tons of xylol, and 56,000 tons of motor gasoline. The second plan requires an input of 900,000 tons of tar and light oil per year to produce 128,000 tons of DHD gasoline or to produce 4,000 tons of benzol, 21,000 tons of toluol, 21,000 tons of xylol, and 55,000 tons of motor gasoline. The two plans were proposed for realization in 1960. 858/

[redacted] the 1953 research program at 50X1
Boehlen included research on obtaining naphthalene from hydrogenation products. The naphthalene was to be gained by distillation and dehydrogenation of various raw and intermediate materials and byproducts. Boehlen also was to attempt the oxidation of DHD residue, primarily to produce phthalic acid. The residue obtained during the dehydrogenation of gasoline to yield DHD gasoline was to be oxidized with potassium permanganate and air, thus giving oxygenated products, such as phthalic acid. 859/

The solution for the aromatic chemicals problem of East Germany is not to be expected at once. Considerable research is still necessary, and much outlay in capital investments will be required to build the installations. Also, it should be stated that the extraction of aromatics considerably increases the "knocking" properties of gasoline, and in addition, higher homologs rather than benzol are likewise usually formed.

Further research is being conducted in East Germany for more complete recovery of crude phenols from the low-temperature water fractions (Schwelwasser), not only to increase the supply of phenol and its homologs, but to attain complete recovery of all the products contained in these effluents, because this is an urgent necessity from the point of view of the East German water economy. It is considered that further development of the chemical industry in "Central Germany" is directly dependent upon total recovery of chemicals in the waters. 860/

In the meantime, because of the limited supply of refined (including the pure grade) phenol, particularly essential to the plastics industry, research efforts are to continue and are to be aimed at the establishment of new types of resins with partial to exclusive use of xylenols and medium-oil phenols from brown-coal tar. The technology of the production of protective coatings and moldable plastic materials is hoped to be converted to the phenol-cresol (mixture) basis and standard specifications established therefor. Uses of these materials in the form of moldable plastics and fluid resins are being developed, as substitutes for metals, as basic materials in the construction of bearings, fittings, and apparatuses. 861/

Inasmuch as a large proportion of the total phenol supply enters into the manufacture of the synthetic fiber (and plastic), Perlon, research is being carried on endeavoring to produce new synthetic fibers not based on phenol. Recently, it was reported that there has been developed a fiber called "Trelon," which originates from lignite and agricultural waste products such as husks of oats. Trelon is claimed to be superior to Perlon in many of its characteristics. 862/

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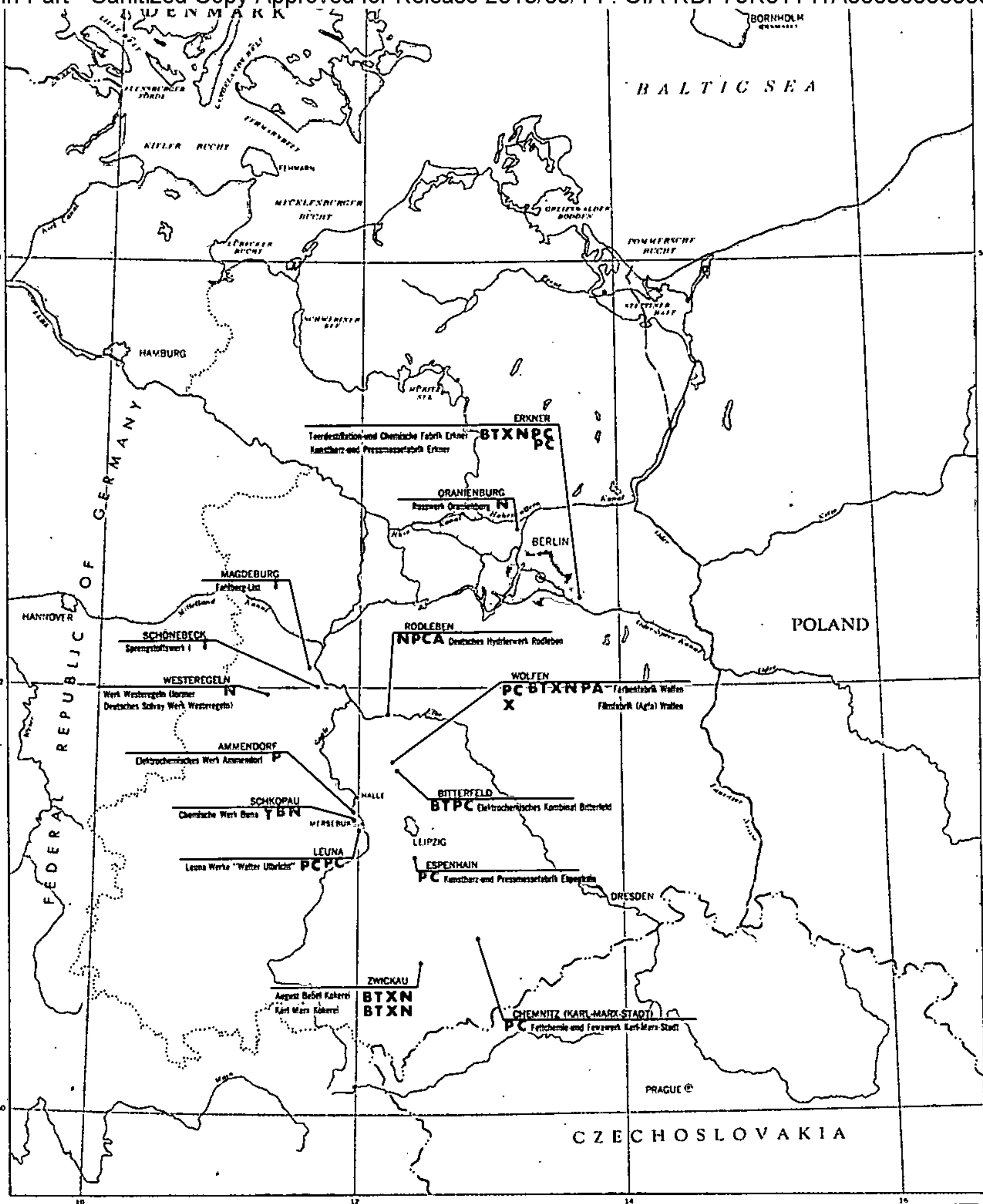

EAST GERMANY
(SOVIET ZONE)

Basic Aromatic Chemical Plants: Major Producers and Consumers

	Refined Benzol	Toluol	Xylol	Naphthalene	Refined Phenol	Cresols	Aniline
CHEMICAL PRODUCED	B	T	X	N	P	C	—
CHEMICAL CONSUMED	B	T	X	N	P	C	A

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