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OUTLOOK FOR PROPYLENE IN WESTERN EUROPE, JAPAN AND UNITED STATES[1/]

by

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SUMMARY

OUTLOOK FOR [illegible] EUROPE,
[illegible] 1/

by

[illegible]
[illegible]
[illegible]

[illegible] Company
Philadelphia
United States of America

Strong growth in [illegible] propylene derivatives in Western Europe, [illegible] United States. [illegible] apparent deficit [illegible] United [illegible], [illegible] propylene [illegible] which [illegible] propylene derivatives [illegible] production of propylene. [illegible] import restrictions, and [illegible] substitutes for propylene [illegible].

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id.69-353

Recent articles in various trade publications have stated that propylene is short in Western Europe, Japan and in the United States. It, therefore, seems appropriate to examine the propylene picture, as it is at present and near term market conditions will be the case in the 1970's.

Before entering the main discussion today, the word/title of shortage must be examined briefly. Shortage is a relative term and should not be examined as absolute. With propylene derivatives growing at such a rapid rate, it is impossible to state future needs with great accuracy. In addition, since derivatives are produced by a great number of companies, variations in process conditions could lead to possible errors in deviation. Above all, propylene is produced as a co-product and as such is dependent upon production requirements of its co-products. Raw material and local economic considerations lead to other possible problems in absolute analysis.

Therefore, the word/title chosen must not be examined as absolute but look at them as reasonable trends which give an overall view of a market supply, demand picture, its problems and possible solutions.

This discussion will cover three major propylene consuming areas of the world: the United States, Western Europe and Japan. These areas are estimated to be producing approximately 90% of the free world's propylene.

United States' Market

The United States propylene market differs from both the Western European and Japan markets in that more propylene is consumed for gasoline than is used for chemicals. Also petroleum refineries are the major source for propylene (Figure 1).

Before looking at its future, let us first examine what has happened to propylene since 1960.

While Western Europe's demand for propylene will grow rapidly in the
'80's, supply would keep up with demand to yield an overall balanced but
tight market picture. However, areas of surplus or deficit could occur.
[illegible] demand forecast is inaccurate by
[illegible], [illegible] could [illegible] possible relief
for could [illegible].
[illegible]
[illegible] currently found in
[illegible] through the [illegible] 1979. Possible
[illegible] will be found in 1980 the U.S. [illegible] is expected to be
[illegible] in volume. Under [illegible] conservative conditions and stronger
[illegible] than the forecast, the 1979 surplus could be lowered and in 1980
shortages could occur.

In the area of propylene supply, let us look at the U.S. refineries. The major source of propylene is catalytic cracking with minor quantities (less than 5% of total) from other refinery processes. It and ? (U.S. catalytic cracking capacity since 1960 on a total feed basis) show a rapid growth in capacity in the early 1960's, a leveling off in installed capacity in the 1965-1969 period (the time period when the zeolite catalysts were being introduced), with capacity then increasing at a slow rate through 1970. The adoption of the zeolite catalyst thus allowed the U.S. refiner to increase conversion levels and increase production, therefore eliminating the near term need to increase cracking capacity.

Because use of zeolite catalyst permits higher conversion levels, additional propylene is now produced in U.S. refineries from catalytic cracking in spite of little additional capacity increases.

Of interest is the dotted line in Figure 2 which represents (on a total feed basis) the Oil and Gas Journal's estimate of capacity which might have been installed if zeolite catalysts had not been utilized.

The other source of propylene - that from ethylene units - has not lived up to earlier expectations. Postponement of heavier feedstock utilization coupled with lower propane usage resulted in less propylene production from ethylene units than had been anticipated.

Let us now examine propylene demand 1960-1970. In the chemical area, we now see that earlier U.S. forecasts were quite conservative. This was due to more rapid growth than anticipated in such major propylene derivatives as polypropylene, acrylonitrile and propylene oxide. In the refinery area, there has been a strong demand for propylene for motor alkylate. As earlier anticipated, propylene use for polymer gasoline continues to drop yearly. Table I

... tabulation of polymer gasoline capacity (only those units which ...
...ated to produce gasoline blending stocks, namely, alkylate and ...) ... is ...
...-1970. Since 1960, new U.S. [illegible] type units have been placed ...
...rational 16,000 B/SD type units by 1970. A number of new units ...
... production ...
... commence.

Propylene supply-demand for the years 1965-1970 is given in Table II.

During the 1965-1970 period chemical demand for propylene (used mainly ...
... gasoline products such as polymer, trimer and tetramer) is seen to rise ...
... 2.0 MM tons to about 3.4 MM tons, a 70% overall growth in ...
...-/year.

Refinery use of propylene will rise from 1.2 MM tons in 1965 to ...
... in 1970. This small increase is primarily a result of the ...
... shortcomings of propylene which in turn will result in part ...
... by increased hydrotreating.

In total, propylene demand is seen to grow from some 3.2 MM tons in 1965 to ...
... 5.0 MM tons in 1970, an increase of almost 56% from 1965 to 1970.

Propylene supply for refinery use is shown in Table II. It is ...
... that supply will rise from 4.3 MM tons in 1965 to 6.4 MM tons ...
... 1970 and is anticipated to increase to 9.6 MM tons in 1975.

A range is used because it is impossible to know exact conversion levels ...
... operating conditions in refineries.

Propylene from ethylene units is shown as increasing from 1 MM tons in ...
... to 1.6 MM tons by 1970.

Total propylene supply, optimistically adjusted for production losses, ...
... 5.8 MM tons in 1965, 8.4 MM tons in 1970 and may reach some 9.6 MM

...e in 1970.

Overall, Table II shows that there had been a tight market ...
... with a possible deficit of propylene occurring in 1970, ...
... possible conditions will affect the ... to meet ...
... (which is a responsibility) the market will be in ...

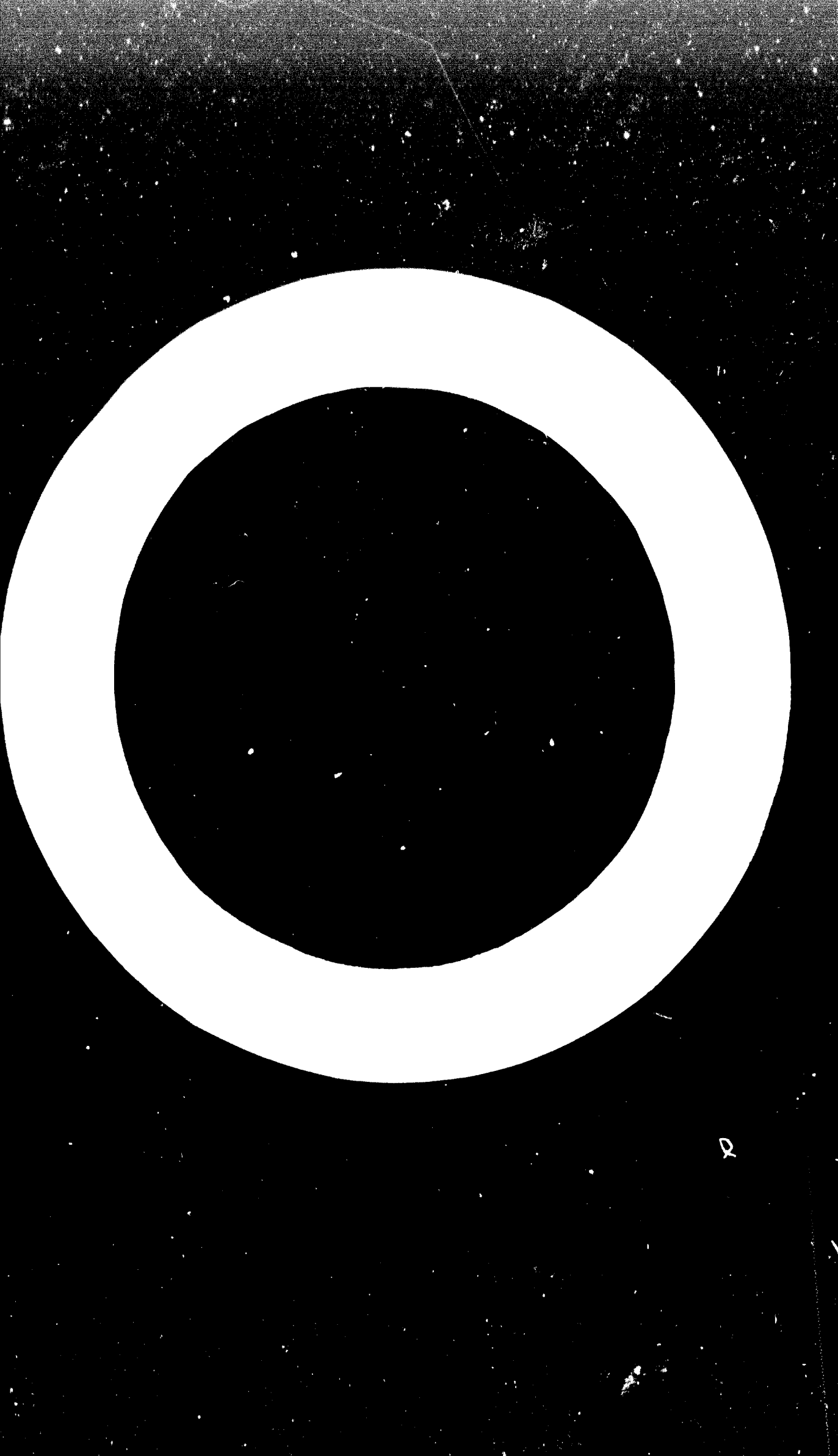
Let us now look forward to 1970 to see what the 1970's have ...
... propylene supply-demand.

An estimate of propylene ... for ... is shown in ...
... the propylene ... which will be ... about ...
... 1965 and 1970 will increase 4 ½ times between 1960 and 1970, ...
... growth rate ... with ... major propylene ... ...
... propylene, cumene, acrylonitrile and propylene oxide are major ...
... forecast to ...

Propylene from the refinery ..., which has been ... by ...
... 40,000 tons in the 1965-1970 period, and expected to increase ...
... 5 tons is possible, but judged by most as improbable, ...
... since the new polymerization capacity dropping as alkylation ...

Overall, we anticipate that propylene ... for chemicals ...
... will increase ... tons in 1965 to 11.5-12.5 tons by ...
...-2.5 million tons by 1970. The lower ... figure ... as the ...

Let us now examine propylene ... in the 1970-1975 period. ...
... the foreseeable future, refinery catalytic cracking ... ...
... the major source of propylene. Currently 6% of ... catalytic ...
... is made ... fluid catalytic cracking. Moving bed type ...
... ... planned ... and would ... virtually ... all by the ...
...'s. Fluid catalytic cracking capacity is once again increasing ...



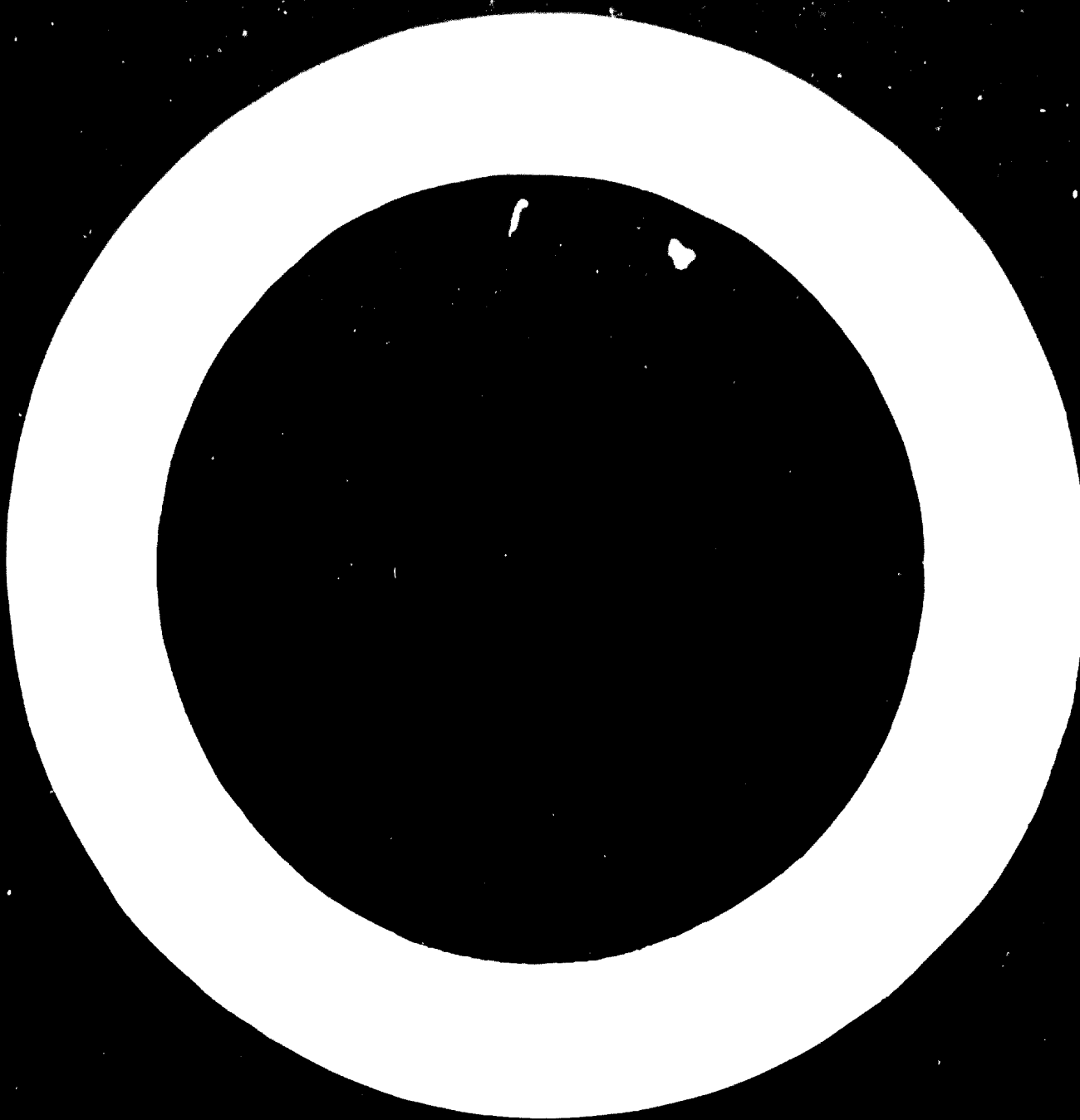
is a wide divergence of opinion as to how much it will increase in the 1970's. Some industrial sources expect that growth in catalytic cracking will be limited by hydrocracking in the 1975-1980 period while others expect catalytic cracking to remain the work horse of the refinery.

Because of these two widely diverging outlooks we have made two projections in order to bracket both possibilities; as such, refinery propylene production would be expected to increase 1.6 to a maximum of 2.7 M tons in the 1970-1980 period. Of course, not all of this propylene is economically recoverable so a significant quantity is lost to the marketplace.

Propylene supply from ethylene plants is expected to increase from 1.6 M tons in 1970 to 3.3 M in 1975, to a 5 M level by 1980. This increase will be due to increased use of heavy feed (butane and heavier) as pyrolysis stocks. By 1975, heavy charge stocks are expected to be the major source of propylene in ethylene units.

Let us now bring the 1970-1980 propylene supply-demand picture into focus.

Table IV balances the propylene supply-demand picture for 1970-1980. Demand is shown increasing some 5 M tons to a possible (but judged improbable by some industry sources due to alternate methods to obtain gasoline octane quality) maximum level of some 12+ M tons by 1980. Supply is seen increasing from an average 6.4 M tons in 1970 to a range of 14.1 to 17.1 M tons, the latter number is that which will be found if catalytic cracking growth continues, (however, this is disputed by some industry experts) we have assumed that supply will increase 6 M tons in the 1970-1980 period (which is the middle of the above range). Thus, based upon estimated demands a propylene oversupply in 1970 of as little as 210,000 tons to as much as 960,000 tons



...ket. This could increase to an undersupply of 1.4 MM tons or possibly ... to 5 MM tons by 1980 depending upon lead restrictions in motor gasoline ...oods utilized to obtain gasoline octane quality.

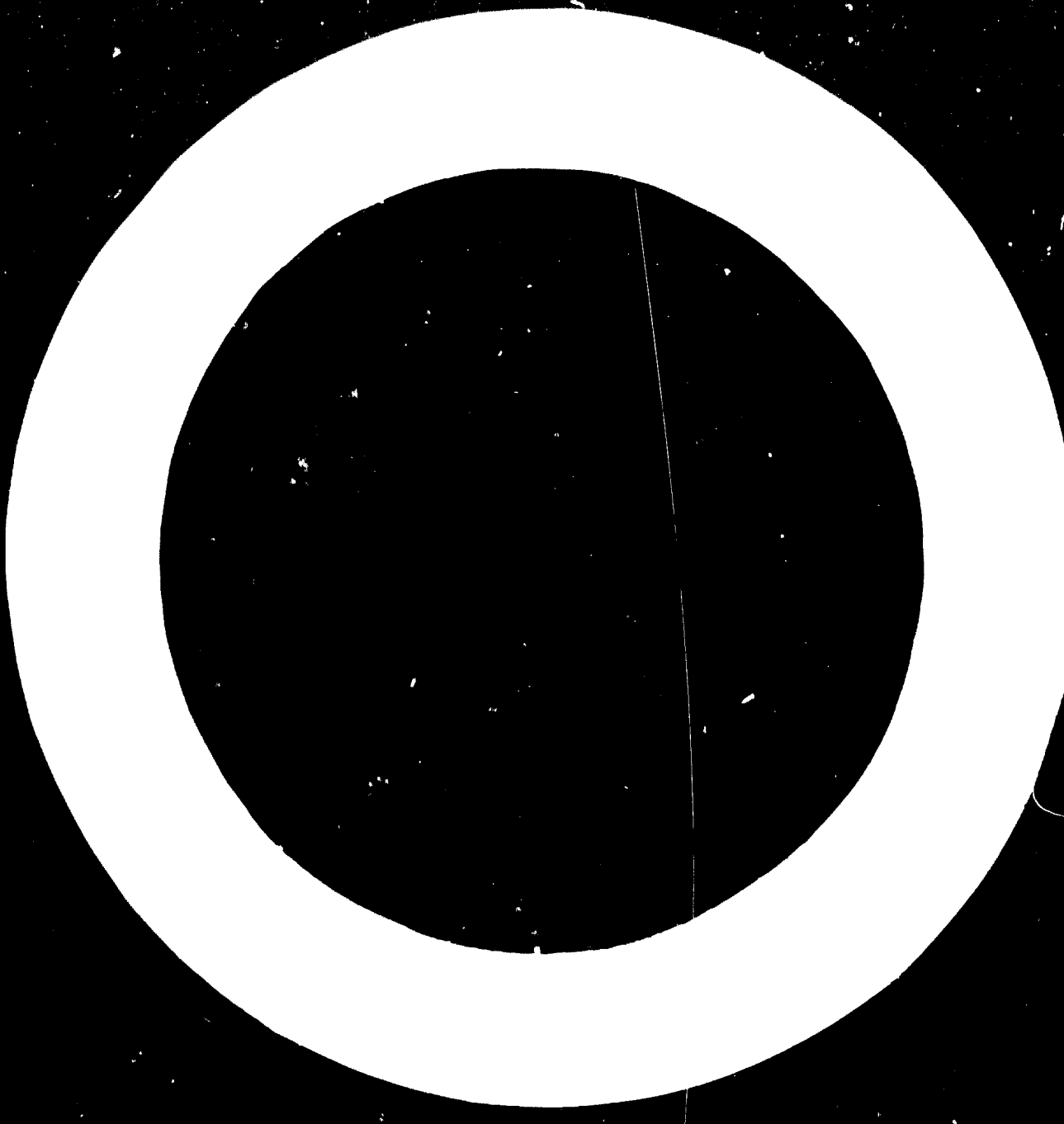
...efore, more light is to be seen in the tight propylene market situation ... the year 1980 if current propylene prices ...

A number of things could happen to help ease the short situation:

- Chemical users could outbid refinery users to obtain the propylene necessary for their continued growth. Refineries could then utilize aromatics (reformate) to obtain necessary octanes.
- Deliberate production of propylene by propane dehydrogenation and/or by isobutane cracking. The former route would yield chemical propylene while the latter could yield chemical propylene but more likely would be primarily used to supply a major refinery alkylation feedstock.
- Importation of propylene derivatives from overseas, such as cumene.
- Import restrictions could be removed on further refined LPG, propane, propylene and heavy charge stocks for chemical use.
- Refiners might use other alkylation feedstocks such as ethylene and amylenes.
- Routes from charge stocks other than propylene may become more for some of the chemicals which are today based on propylene.
- Modifications might be made to cracking catalysts to increase olefin yields without an uneconomical loss in gasoline production.

Two major factors which could cause the 1980 propylene demand projection to be low are:

- Growth of propylene derivatives faster than that forecast.
- Limitations on use of lead alkyls in motor gasoline.



In summary, United States propylene is seen in tight supply today, with

[illegible] in the 1970's.

[illegible]

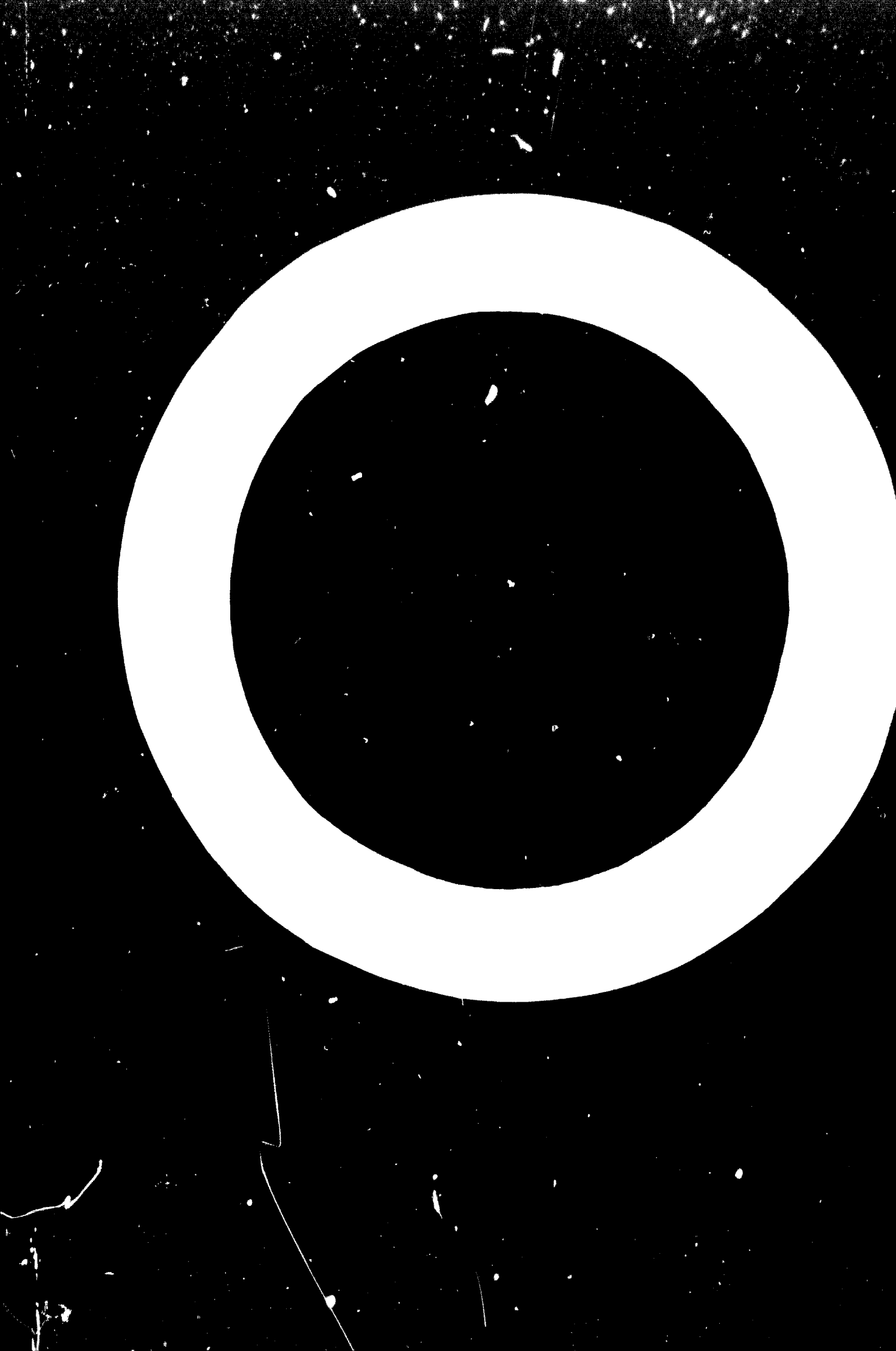
[illegible], supply of United States, relies upon ethylene manufac-
[illegible] major source of propylene. In fact, it is estimated that some
[illegible] propylene used for chemical manufacture will come as an ethylene co-
[illegible] on cost the outlook for ethylene, its major manufacturing route
[illegible] materials are factors which will determine propylene's supply situation.

Overall ethylene demand for Western Europe is shown below:

Ethylene Demand - Western Europe 000 Tons/Year	
1965	5,665
1970	9,500
1975	9,000
1980	12,575

The forecast is based upon a country by country analysis, but only the total
[illegible] European picture is presented here. Ethylene is shown growing some
[illegible] in the 1965-1970 period and some dropping to a 5.5% overall rate in
[illegible]. Somewhere a good basis ethylene demand is seen increasing so-
[illegible],000 tons/year in the 1970-1980 period.

[illegible] on a by country analysis of capacity, manufacturing pro-
[illegible], raw material and anticipated propylene-ethylene production ratio's, a
[illegible] of propylene available from ethylene units was obtained. As avai-
[illegible] propylene supply we only include that co-produced with ethylene but
[illegible] obtained from refineries (either as separated propylene or as poly-
[illegible]), this amount was estimated and included in the total propylene



Based upon these calculations, propylene supply for chemicals in Western Europe is seen increasing as follows:

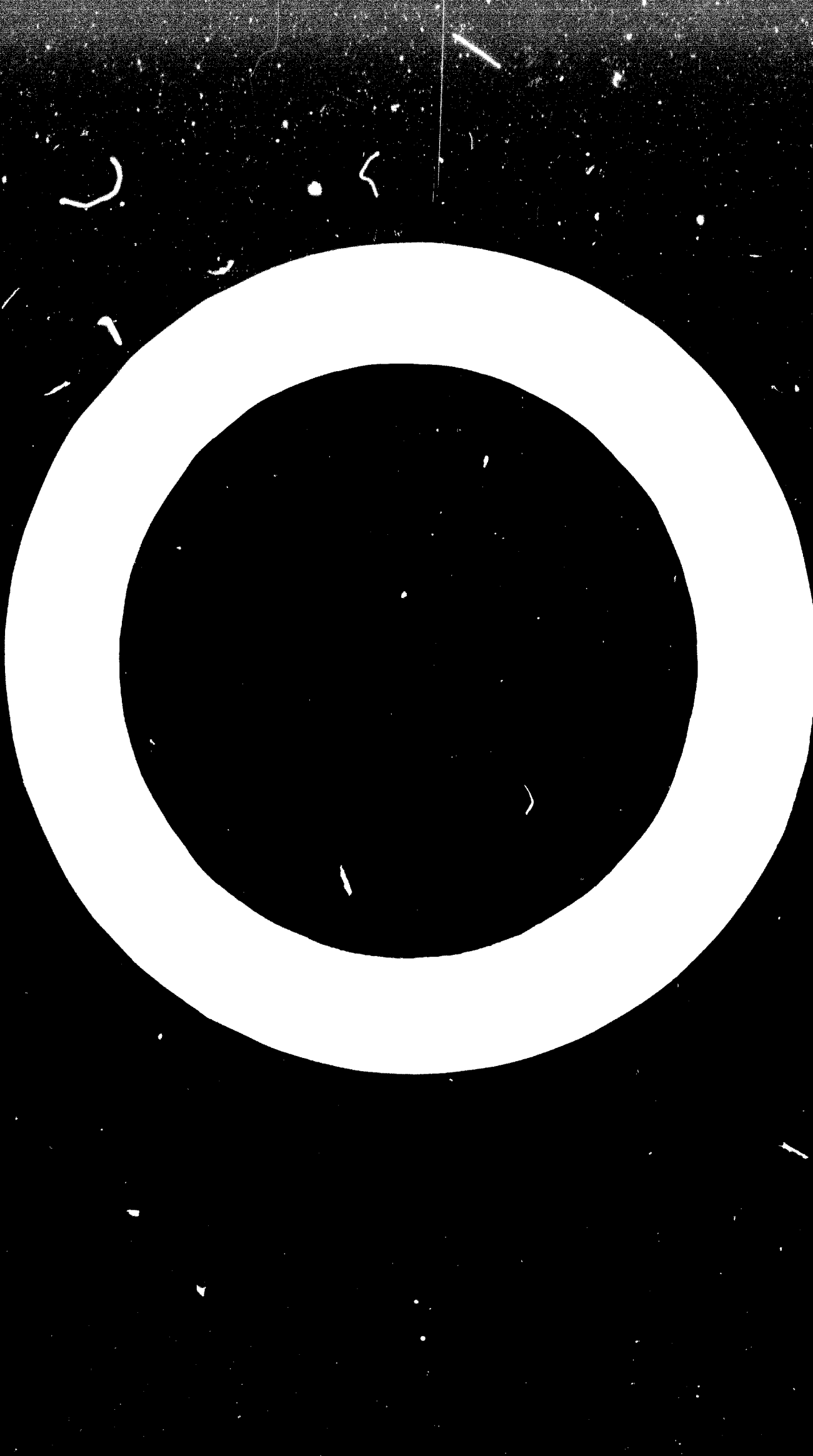
Available Chemical Propylene Supply - Western Europe	
	'000 Tons/Year
1970	5,385
1975	5,145
1980	7,760

In addition to the estimated propylene production noted above, it is highly possible that additional propylene will be obtained from refinery and petrochemical expansions in Western Europe. This may well serve as the key to correcting possible imbalances in parts of Western Europe.

The major outlet for propylene production in Western Europe is the manufacture of polypropylene. In 1970, an estimated total 4.1 MM tons of propylene could be consumed in polypropylene and styrene plants, of which 3.3 MM tons is available from refinery sources (as noted above). Of this, 2.1 MM tons will be consumed for polypropylene manufacture.

Propylene consumption for chemical production has grown very rapidly in Western Europe since 1960 with demand increasing some 14-20%/year. Approximately two-thirds of this demand is found in the EEC with the remainder in the EFTA countries and others.

Based upon an analysis of past major propylene derivative capacity additions (Table V) propylene demand for chemicals is forecast to grow some 11%/year 1965-1975, (9+%/year 1970-1975), before dropping to some 6.5%/year 1975-1980. As previously noted, the per year rates are conservative, as they are based on 5 year periods. The results show that in the overall propylene demand will increase some 5,000 tons/year in the 1965-1970 period. It can be noted that this demand incorporates estimated exports of derivatives



..., which would ease the propylene shortage in the U.S.

Currently (1970) six main end uses account for 80% of Western Europe's propylene consumption: acrylonitrile, cumene, isopropanol, propylene oxide, oxo-alcohols and polypropylene (Table VI). By 1975-1980, they are projected to account for approximately 90%. The two major growth-volume outlets remain acrylonitrile and polypropylene.

Major consuming nations (in order of their propylene demand) in 1975-80 are seen as follows:

Western Germany

United Kingdom

Italy

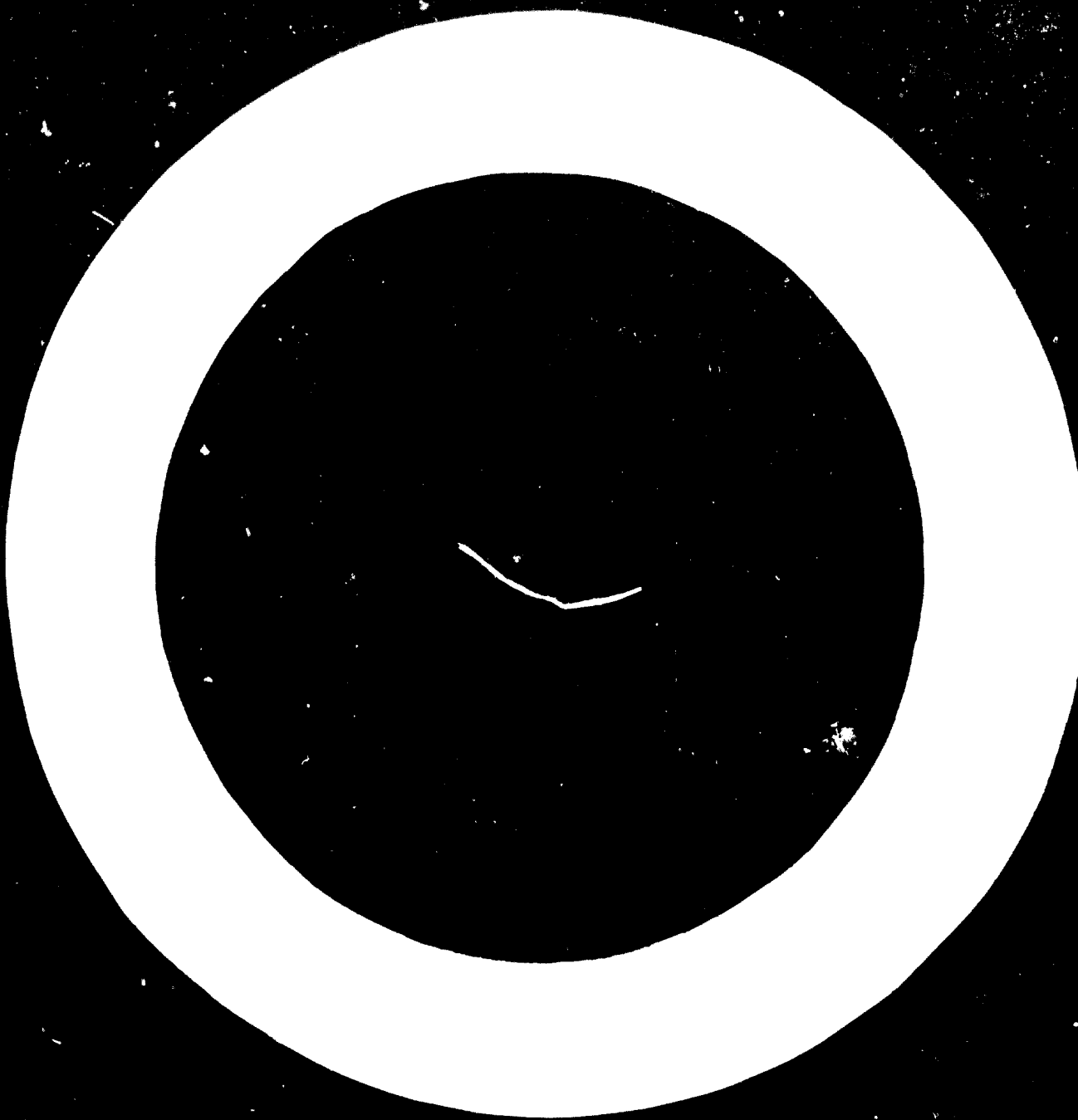
France

Benelux

These nations will account for some 90% of propylene demand in Western Europe in the 1975-1980 period. It is in these nations where future propylene supply will be most important.

Based upon our analysis, country by country, of supply-demand an overall Western European balance was developed. The balance (Table VIII) shows that complications there will be an overall surplus of some 3,0-3,000 tons of propylene in Western Europe during the 1970-1980 period, some 8-10% of anticipated demand. An examination, however, of the balances of individual countries shows some to be in surplus while others to have deficits.

...Europe's propylene balance may not be as bright as shown in this ...currently there are start up problems at many of the naphtha crackers in Western Europe that produce ethylene and propylene. ...initiation of these ...other new units in the early 1970's could curtail ethylene and



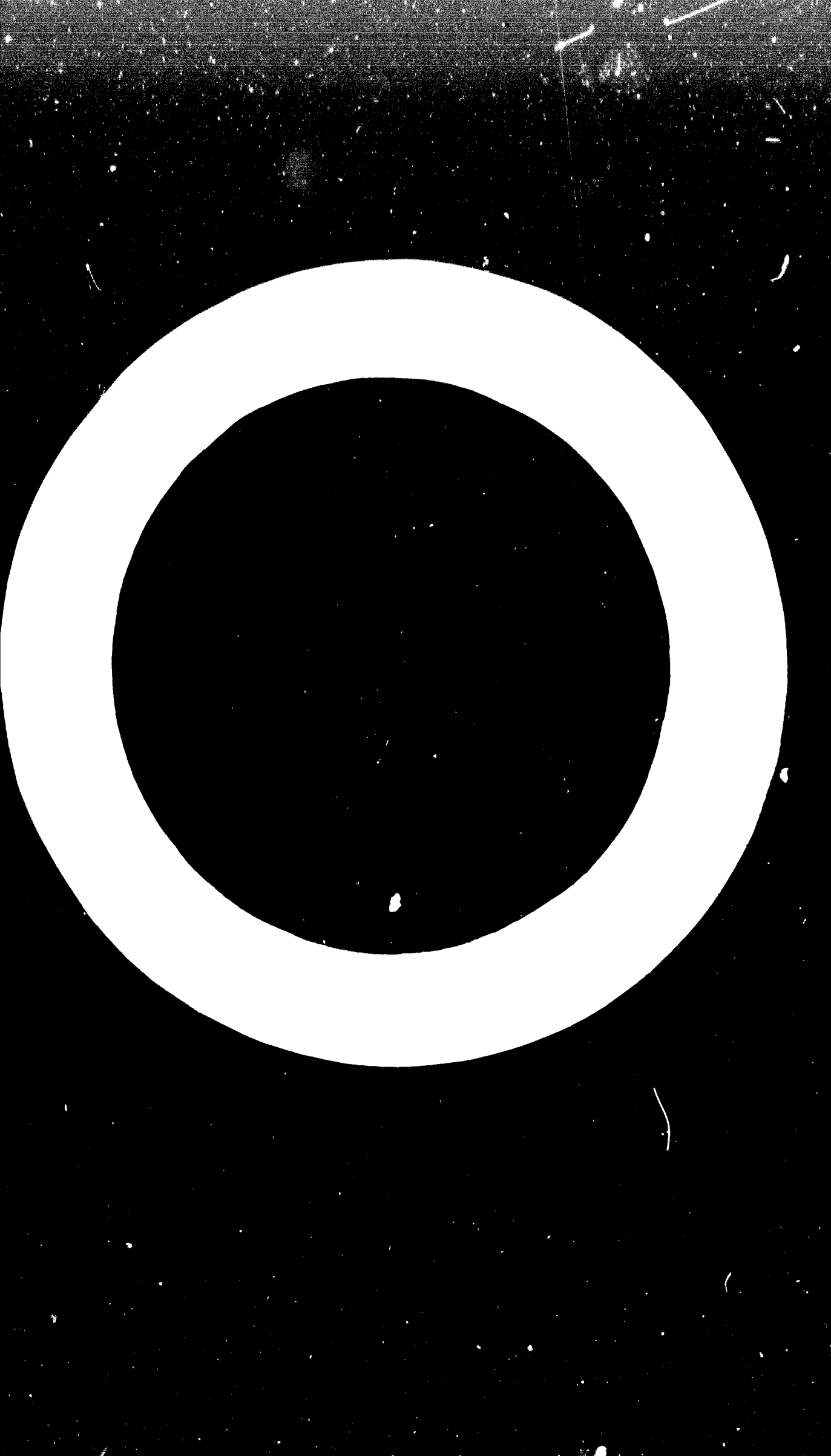
propylene output. Also, as noted in Table VII, 5% drop in [illegible] would reduce the surplus to less than 300,000 tons or [illegible] and a tight market situation would occur [illegible] propylene demand grew faster than expected, a drop of [illegible] to 1.7%, slightly less than a 300,000 ton surplus [illegible] of Western Europe. Once again, a 5% lower ethylene or propylene demand could bring a tight market situation [illegible] during the mid 1970's LPG would be available to [illegible] ethylene manufacture. Should it be utilized as [illegible] source, a lower propylene output would be expected.

Overall by 1980 a 500,000 ton propylene surplus is seen [illegible] However, long term forecasts must be utilized with care. In retrospect they turn out to be conservative (low) but, of course, a [illegible] occur in a 10 year period for which a forecast is made. Once again a test a 5% error in propylene demand could create very tight [illegible] Europe.

(Eastern Europe's balance is shown graphically in Figure [illegible]

A possible relief factor may be refinery propylene. If [illegible] in some areas of Eastern Europe catalytic cracking capacity [illegible] and the resulting propylene used for chemical manufacture [illegible] whether or not major additional volumes of propylene are [illegible] source in Eastern Europe.

In summary, while Western Europe's demand for propylene [illegible] now replaces in the 1970's, supply could keep up with it and [illegible] demand but tight market picture. However, [illegible] surplus [illegible] ever. Should ethylene demand or propylene demand be off by [illegible]



light market picture could develop. A possible relief factor could be [illegible] of refinery propylene.

[illegible] our discussion of propylene, let us now look at the Japanese [illegible].

[illegible]

Propylene demand continues to soar in Japan as does the demand for ethylene (Figure 5). Propylene demand for chemicals which was negligible [illegible] 12 years ago grew to some 453,000 tons by 1969 and is projected to some 1,525,000 tons by 1970, a 25% yearly growth in the 1965-1970 period. [illegible] outlets and their oriented propylene consumption are shown in Table [illegible] strong demand for such derivatives as polypropylene, acrylonitrile, [illegible] propylene oxide and oxo alcohols are pushing the propylene chemical [illegible] anticipated to grow to some 2,400,000 tons by 1975 and to 3,750,000 tons by 1980, a 9% growth/year in the 1970's. Also, as with Western Europe, exports are anticipated.

Propylene for chemical production in Japan is obtained primarily as a co-[illegible] in the production of ethylene by naphtha cracking. A very small [illegible] is obtained from fluid catalytic cracking. As in Western Europe, [illegible] supply is dependent upon ethylene demand, raw materials and their [illegible], and crackers' economy.

[illegible] production began in Japan in 1958 when 14,300 tons of product [illegible]. Some 10 years later production has increased to some 1,700,000 [illegible] ylene demand is projected as follows:

Ethylene Demand - Japan
000 Tons/Year

1965	777
1970	[illegible]
1975	[illegible],300
1980	[illegible],100

(A growth equivalent to 25%/year in the 1965-1970 period dropping to .04%/year in the 1970's.) In terms of absolute demand, however, ethylene demand will grow some 365,000 tons/year in the 1970-1980 period as compared to 436,000 tons/year between 1965-1970.

The Japanese ethylene industry is dependent upon naphtha, both domestic and imported, as the chemical stock for ethylene manufacture. Currently, domestic production of naphtha is forecast to be inadequate, thus increasing dependence upon world naphtha, which in turn is tightening the supply situation of naphtha production, producers are being required to optimize ethylene output to conserve naphtha which means higher severity cracking. Due to this higher severity, propylene production will suffer. Also, firms are reported looking at naphtha substitutes for pyrolysis feed, which would shift the relative ratio's of propylene and ethylene production.

Based upon analysis of the factors involved, we have forecast Japanese propylene availability to increase as follows:

Propylene Supply - Japan
000 Tons

1965	540
1970	1330-1575
1975	2525-2630
1980	3625-3965

...ages are used due to possible variances in ethylene cracking severity. ...ased upon the analysis of propylene supply and demand a propylene balance ...been developed (Table 1X).

...rily, the following is seen for 1965-1970 and 1975-1980.

...The 1965 period propylene obtained from naphtha cracking was in surplus ...Japan and reportedly entered the LPG marketplace. Since then chemical ...has more than utilized available propylene yielding the current tight ...ture. By 1970, as naphtha cost rein,-higher severity cracking for ..., propylene is anticipated to be tight and shortages continue. By 1975 ...the lower severity condition anticipated, propylene will be back in ...and possible slight surplus exist.

The 1980 market outlook depends upon the severity of cracking taking place ...now. It is anticipated that a balanced situation will be found.

..., to restate, expect the current tight propylene-supply-demand situation ...(Figure 9) to exist in Japan through the early 1970's, by 1975 ...slight surplus will exist and by 1980 the market to be back in balance. ...Again, under naphtha conserving conditions and ...stron... propylene demand ...could the 1975 surplus could be lowered and in fact a short... could

In conclusion, strong growth is forecast for propylene and propylene ...derivatives in Western Europe, Japan and the United States. While an apparent deficit situation could occur in the United States, adequate propylene is ...available for chemical growth providing it is bid away from refineries. ...Efforts are expected to help offset the shortage include imports ...of propylene derivatives from overseas or the liberal production of ...LPG. Other possibilities include easing of petroleum import restrictions,

use of other alkylation feedstocks, and possible new routes to propylene based chemicals.

While Western Europe's demand for propylene will grow rapidly in the 1970's, supply could keep up with demand to yield an overall balanced but tight market picture. However, areas of surplus or deficit could occur.

Should ethylene or propylene demand be off by as little as 5% a very tight market picture could develop. A possible relief factor could be the utilization of refinery propylene.

The present tight propylene supply demand situation currently found in Japan is expected to exist through the early 1970's. By 1975 a possible surplus will be found and by 1980 the Japanese market is expected to be back in balance. Under naphtha conserving conditions and a stronger propylene demand than forecast, the 1975 surplus could be lower and in 1980 a shortage could exist.

TABLE I

U.S. CAPACITY OF REFIT BY PROCESSES CONSUMING PROPYLENE
1,000 Barrels/Stream Day

	Polymerization	Alkylation
1960	[illegible]	407
1965	126	530
1966	118	560
1967	96	595
1968	96	646
1970	80	720

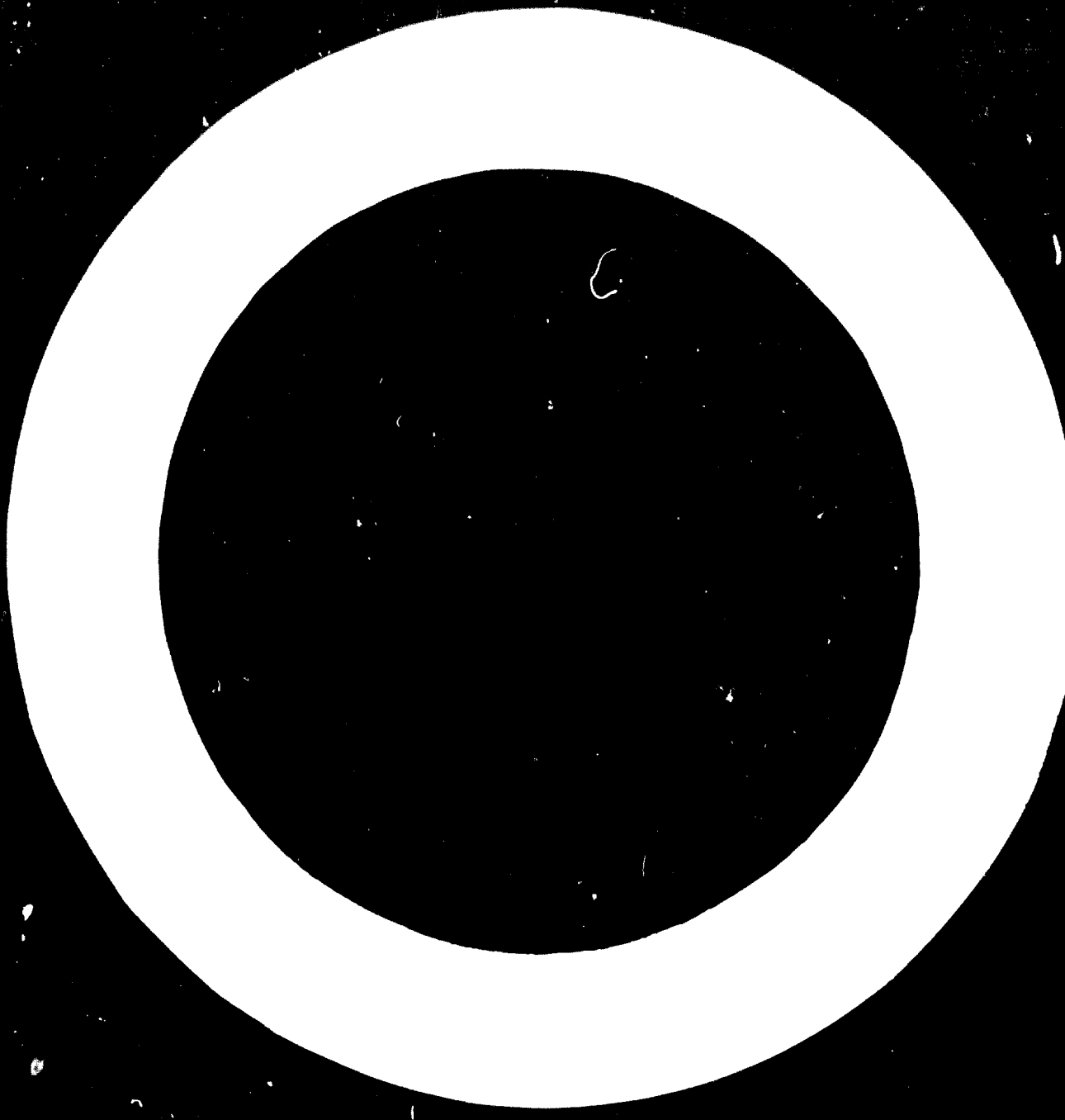


TABLE II

U.S. PROPYLENE SUPPLY-DEMAND
1966-1970
000 Metric Tons/Year

	1966	1970	
Demand			
Chemicals[1]	2060	2780	
Refinery	6350	6150	
Total Demand	8350	8930	
Supply			
Refinery Production	8280	7900-8750	
Ethylene Units	1000	1230	
Total Available	9280	9130-9980	10,[illegible]
Economically Available	8350	8200-[illegible]980	[illegible]
Propylene Balance[2]	0	(730)-50	([illegible]

[1]Excludes polymer gasoline products such as heptene, [illegible] tetramer which are produced in refinery polymerization [illegible]

[2]Figures in brackets indicate deficiency.

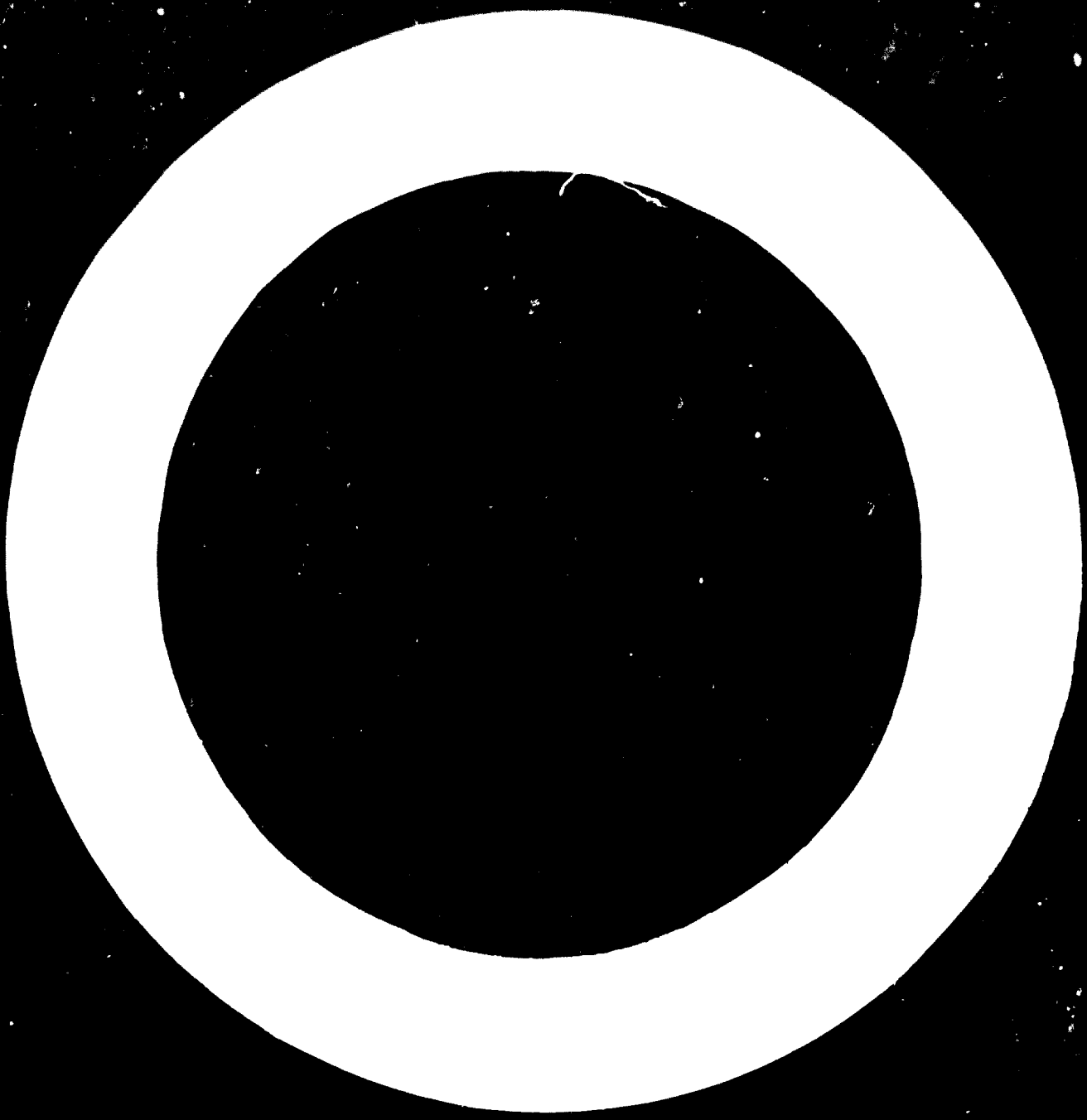


TABLE III

TOTAL U.S. PROPYLENE DEMAND FOR CHEMICALS[1]
000 Metric Tons/Year

	1965	1970	1975	1980
Polypropylene	190	710	1320	2280
Acrylonitrile	195	590	935	1100
Propylene Oxide	260	455	705	1100
Isopropanol	595	680	835	1050
Oxo Alcohols[2]	550	680	730	870
Cumene	105	240	545	690
Others[3]	445	745	830	1110
	2340	4100 ± 200	5900 ± 200	8200 ± 300

[1]Mean demand given for each end use. Data rounded off to nearest 5,000 tons.

[2]Includes heptenes.

[3]Tetramer, trimer, isoprene, glycerine, epichlorohydrin, ethylene-propylene rubber and acrylates.

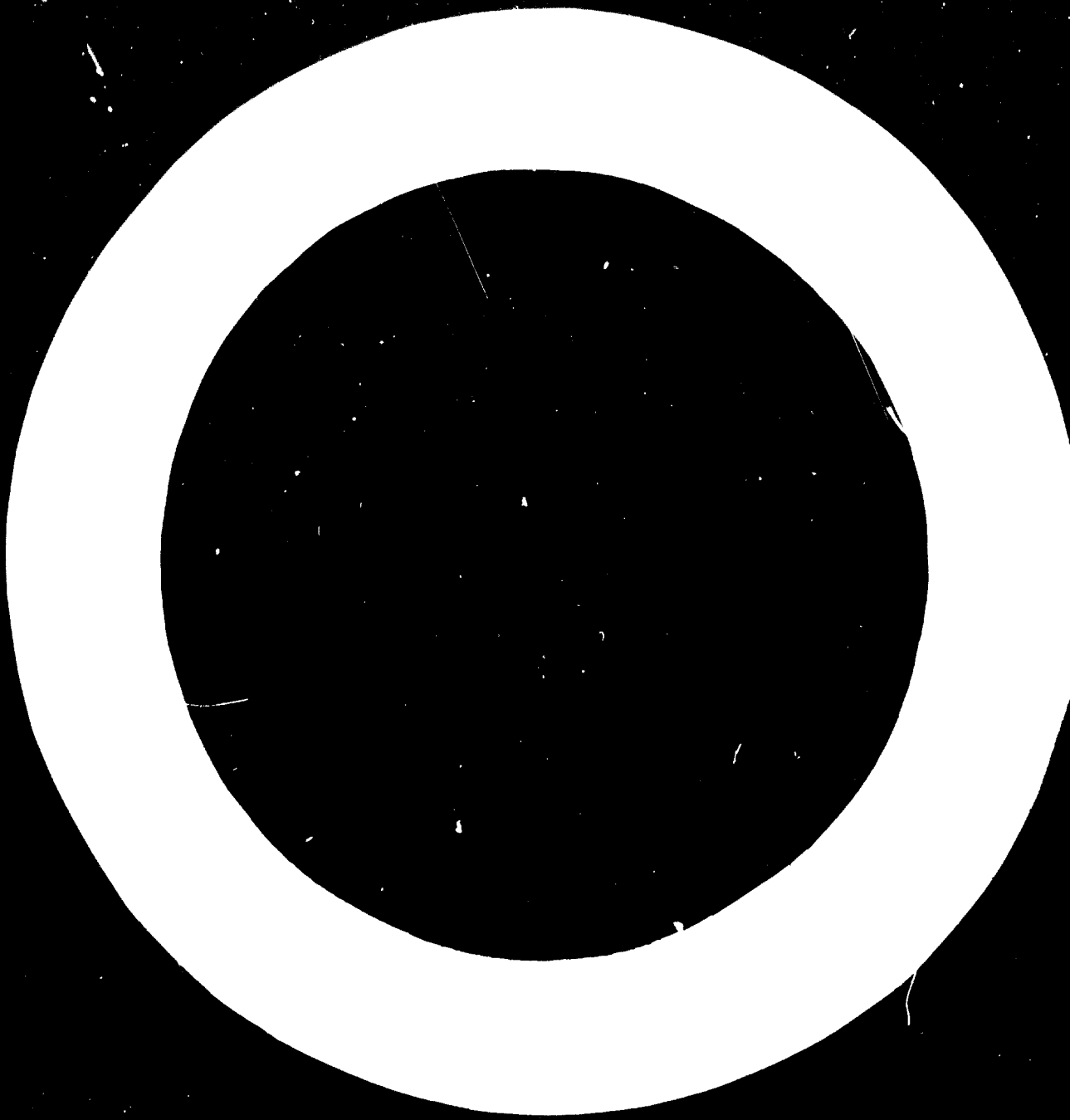


TABLE IV

U.S. PROPYLENE SUPPLY-DEMAND
1970-1980
000 Metric Tons/Year

	1970	1975	1980
Demand			
Chemical[1]	3360	5240	7650
Refinery	6600	7230	7,550–14,600
Total Demand	9960	12,450	15,200–22,250
Supply			
Refinery Production	9,410–9,450	9,350–12,150	10,300–13,300
Ethylene Units	1500	3320	5000
Total Available	10,900–10,940	12,670–15,470	15,300–18,300
Economically Available	9,000–9,750	11,400–13,200	13,600–17,100
Production Balance[2]	(960)–(210)	(1050)–1450	(1600)–(5150)

[1] Projected for polymer gasoline products such as heptene, trimer and tetramer, which are produced in refinery polymerization units.

[2] Numbers in brackets indicate insufficient supply.

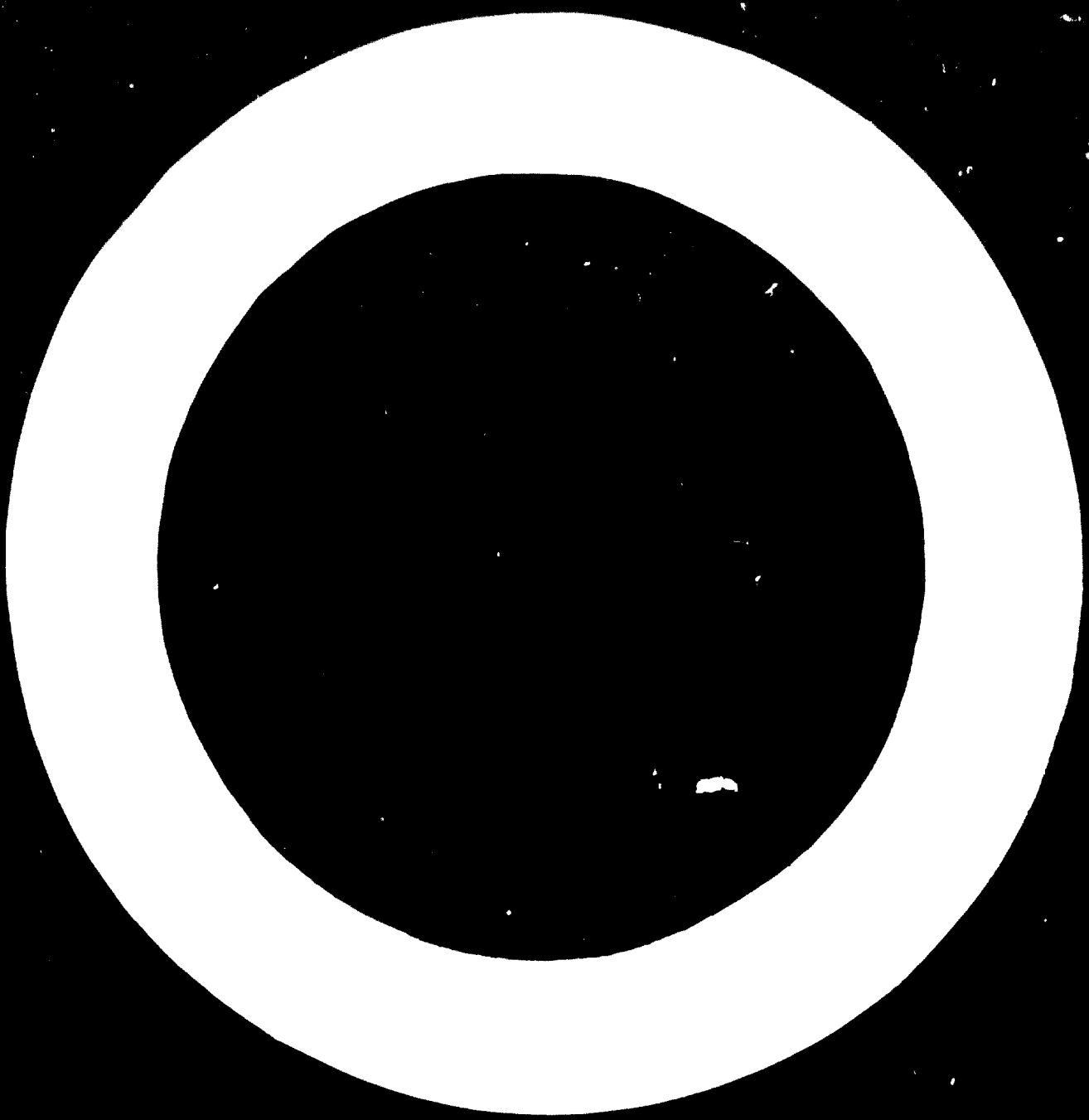


TABLE V

WESTERN EUROPEAN PROPYLENE CONSUMPTION FOR [illegible]LS

Year	000 Tons/Year	Growth in Preceding 5 Year Period, 000 Tons
1965	1265	----
1970	3110	1845
1975	4860	1750
1980	6615	1755

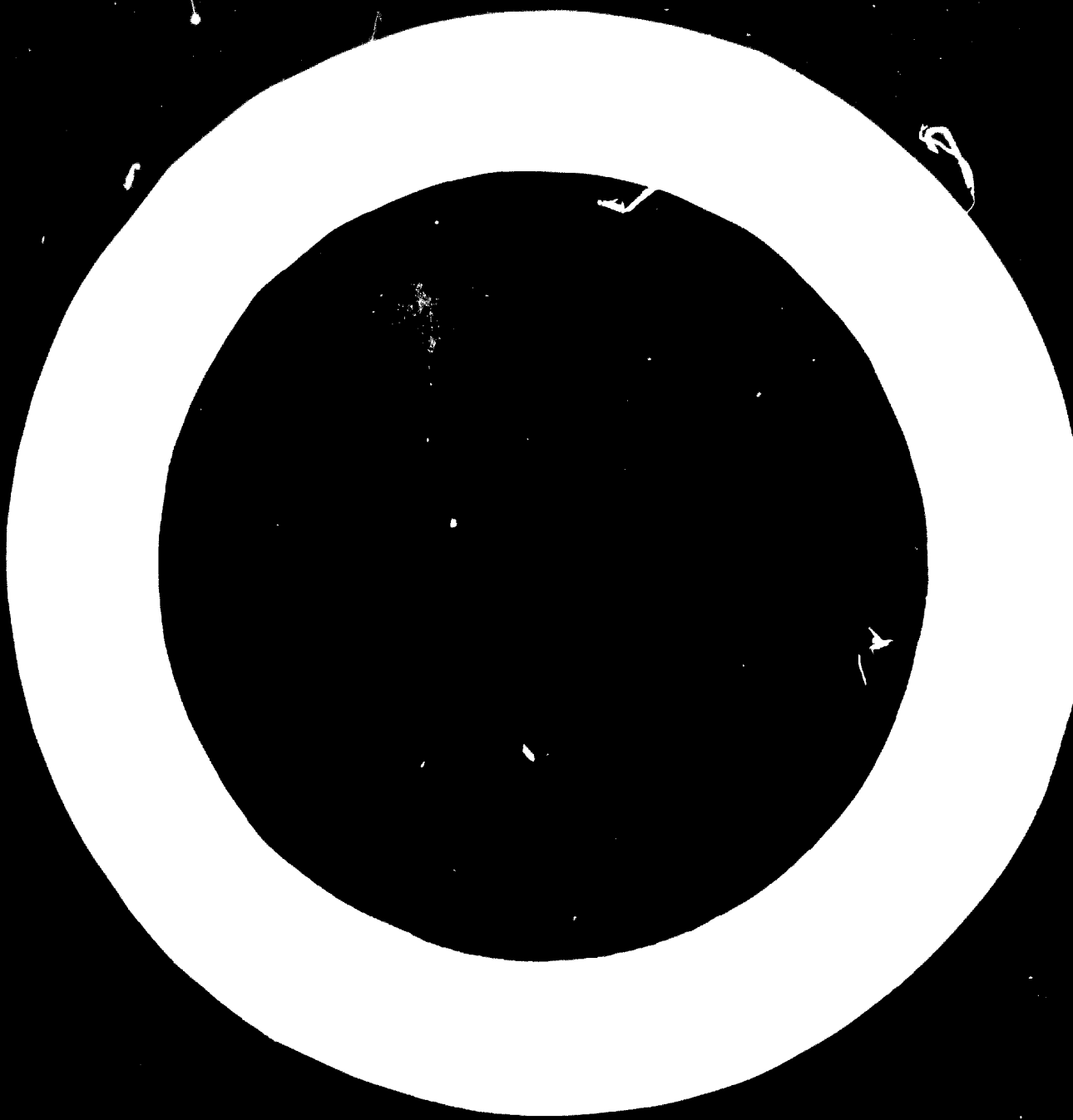


TABLE VI

WESTERN EUROPEAN
PROPYLENE CONSUMPTION BY END USE
000 Metric Tons/Year

	1965	1970	1975	1980
Acrylonitrile	55	510	695	1230
Cumene	405	340	495	630
Isopropanol	300	435	530	665
Propylene Oxide	125	295	565	810
Oxo alcohols[1]	215	655	980	1255
Polypropylene	90	410	890	1415
Others[2]	475	465	505	590
TOTAL	1265	3110	4860	6615

[1] Includes heptenes.

[2] Includes glycerine, epichlorohydrin, dodecene, nonene, ethylene propylene rubber, acrolein, perchloroethylene and others.

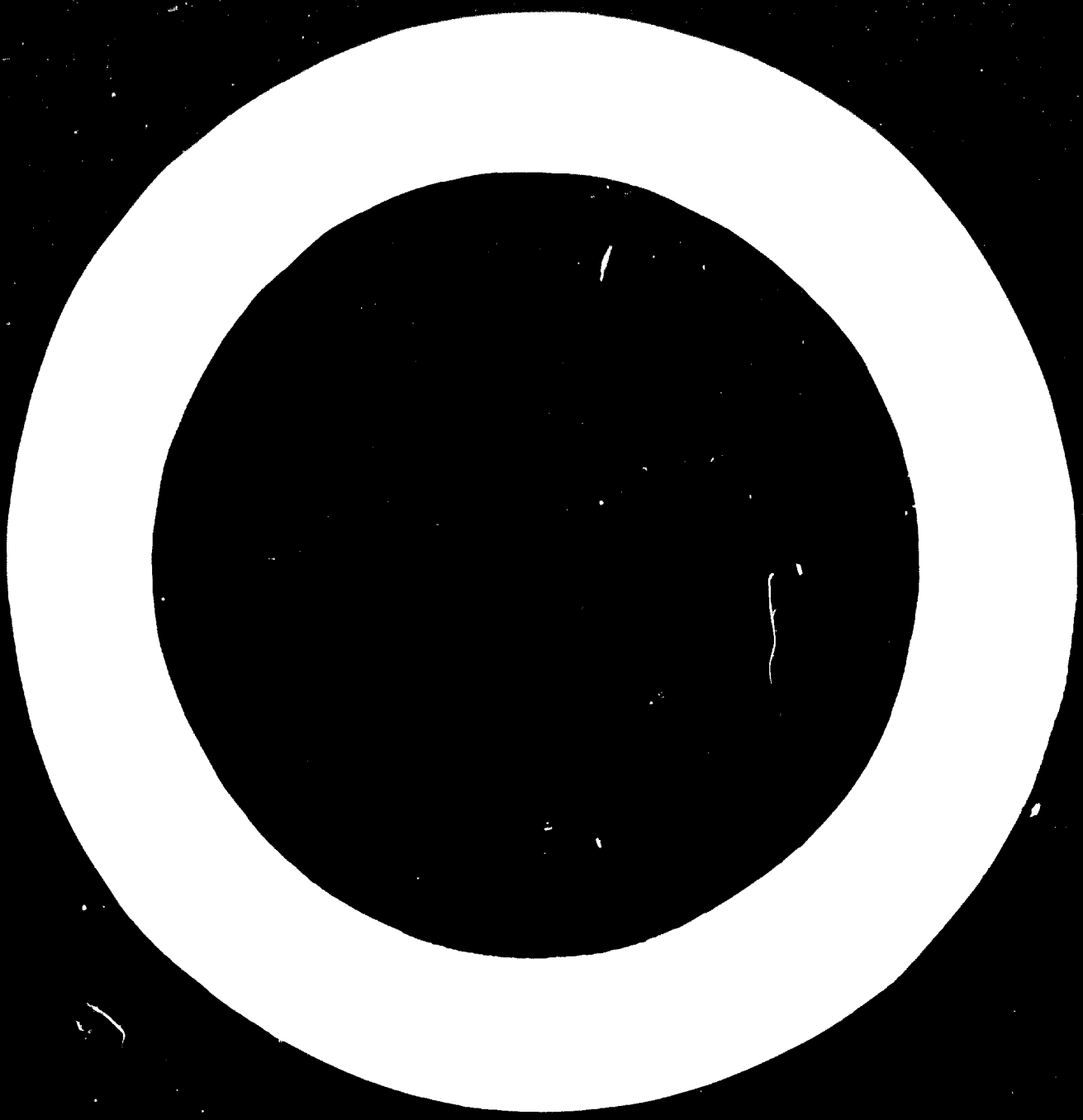


TABLE VII

PROPYLENE BALANCE - WESTERN EUROPE

	1970	1975	1980
Total Surplus/(Deficit) 000 Tons/Year	+325	+295	+545
Surplus/Deficit As % of Demand	10	6	8
Sensitivity Analysis			
Surplus Deficit if:			
Ethylene forecasts Are 5% High, 000 Tons/Year	+185	+85	+225
As % of Demand	6	2	3
Propylene forecasts Are 5% Low, 000 Tons/Year	+95	+14	+111
As % of Demand	3	1	2

TABLE VIII

JAPANESE PROPYLENE DEMAND[1]
000 Tons/Year

	1969	1970	1975	1985
Acrylonitrile	185	370	640	[illegible]
Polypropylene	70	565	975	[illegible]
Propylene Oxide	40	75	115	[illegible]
Acetone	30	85	120	[illegible]
Cumene	20	30	80	[illegible]
Oxo Alcohols	25	155	250	[illegible]
Others[2]	110	145	220	[illegible]
TOTAL	480	1525	2400	3700

[1]Rounded off to the nearest 5.

[2]Includes tetramer, EP rubber, acrylates, epichlorohydrin, chlorinated solvents, isopropanol and [illegible].

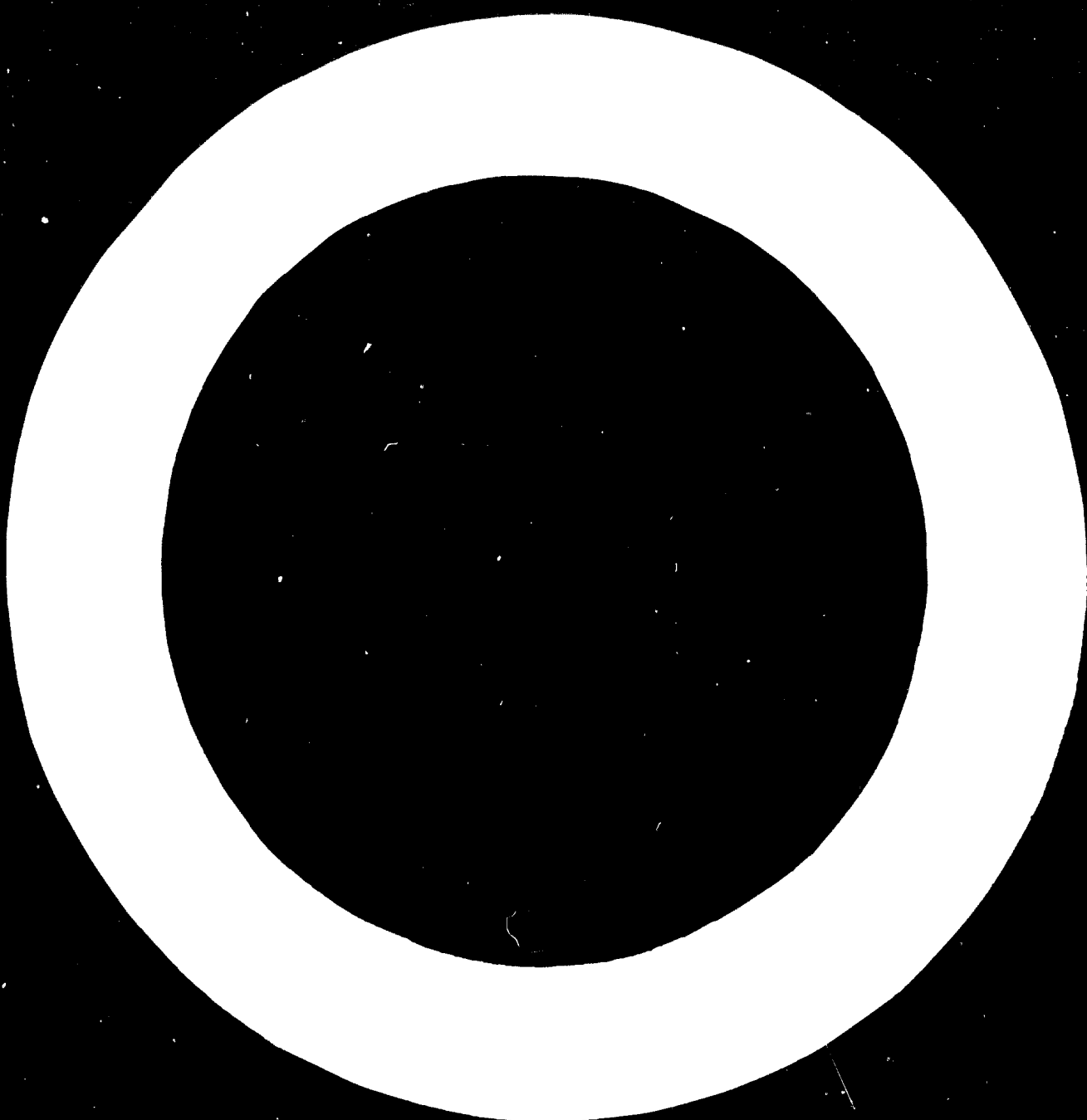


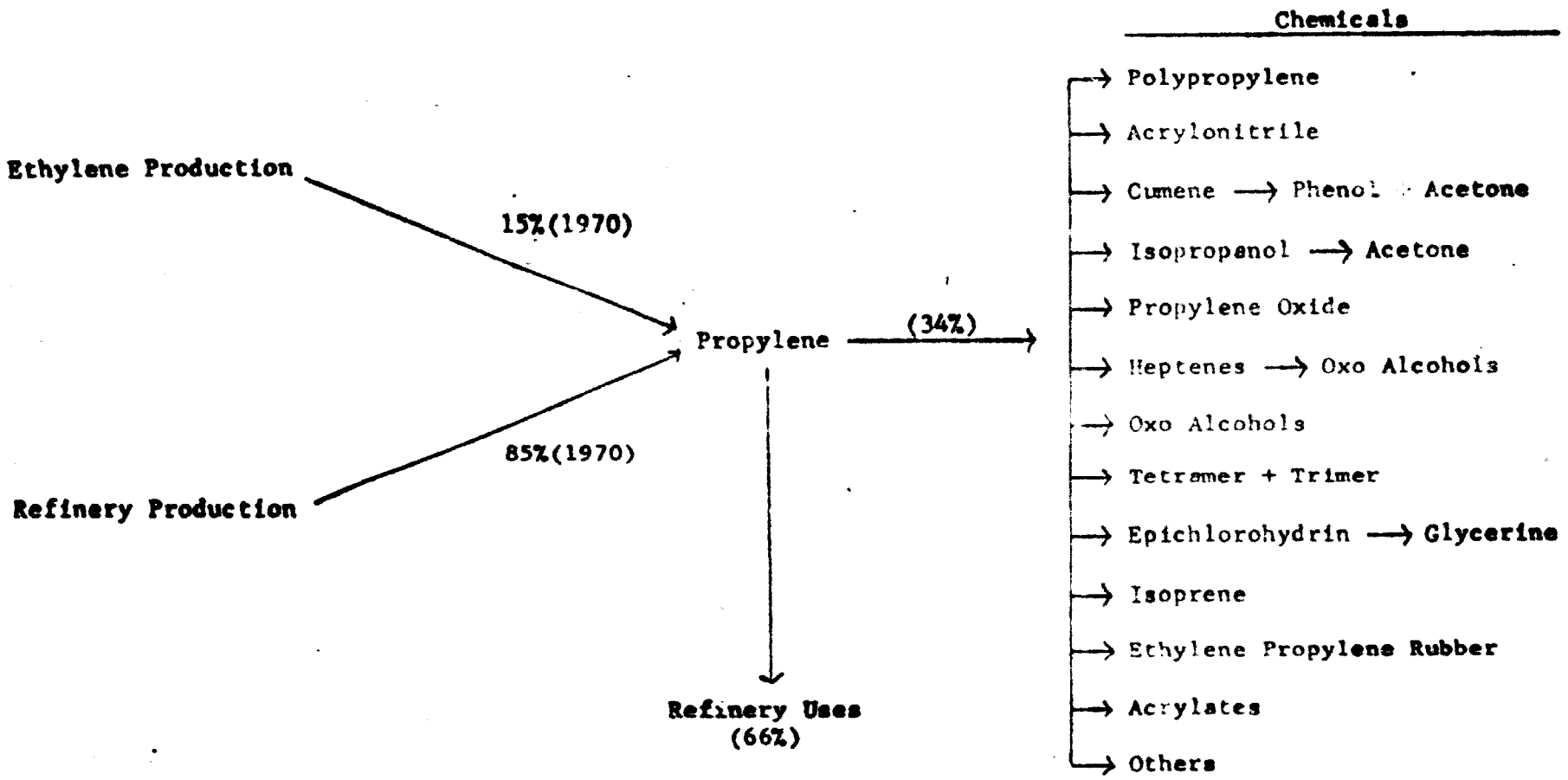
TABLE IX

PROPYLENE BALANCE - JAPAN

	1965	1970	1975	1980
Surplus/Deficit[1] 000 Tons/Year	+60	+50 To -195	+120 To +230	-75 To +265
Surplus/Deficit As % of Demand	12%	+3% To -12%	+5% To +9%	-2% To +7%
Sensitivity				
Surplus/Deficit if:				
Ethylene Forecast 5% High 000 Tons/Year	—	+25 To -256	+45 To +115	+69 To -252
Propylene Forecast 5% Low 000 Tons/Year	—	-22 To -265	+33 To +113	+83 To -260

[1] Depends post 1965 upon cracking severity.

UNITED STATES PROPYLENE PRODUCTION - USE PROFILE

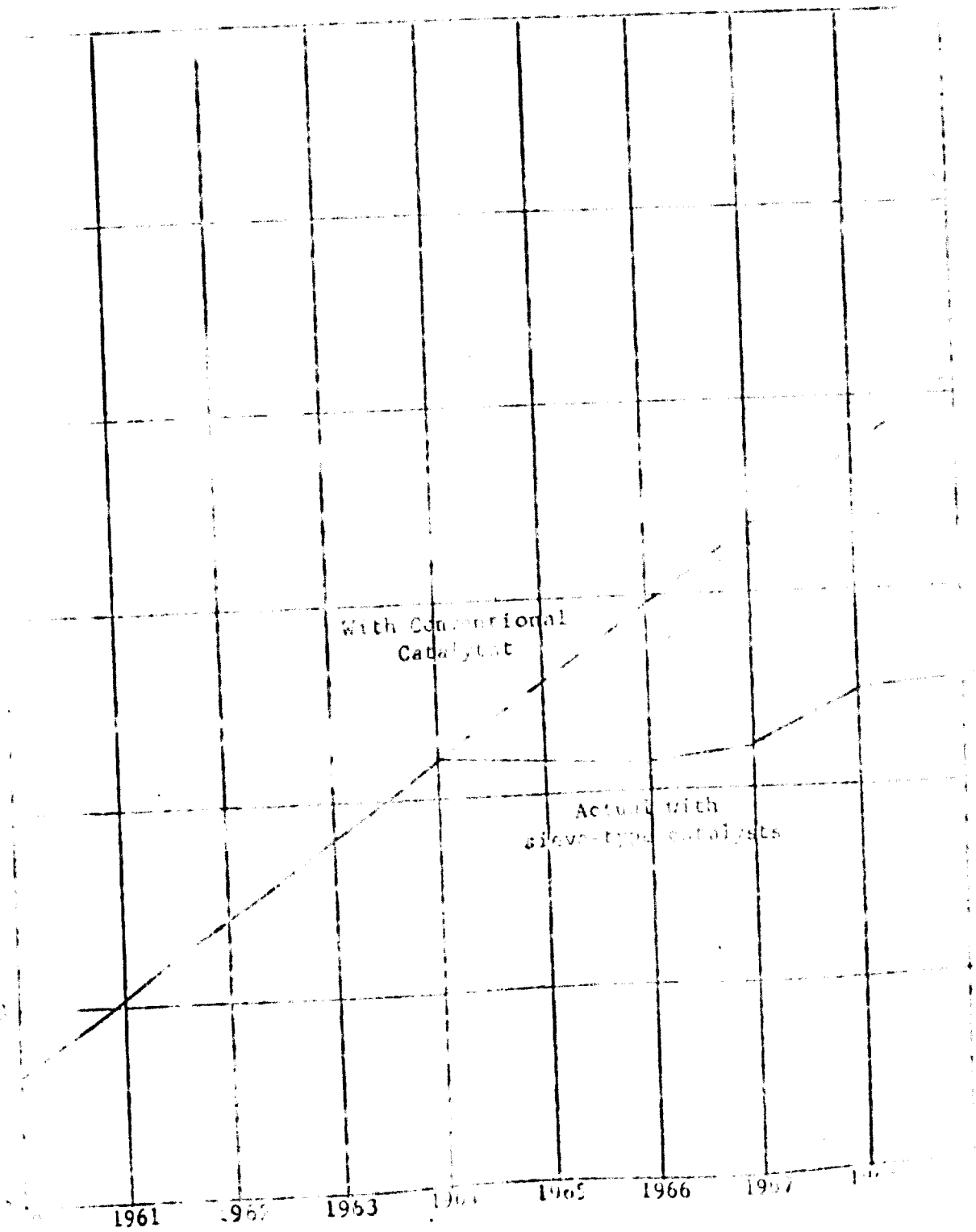


34/23

34/23

FIGURE 2

U.S. CATALYTIC CRACKING CAPACITY



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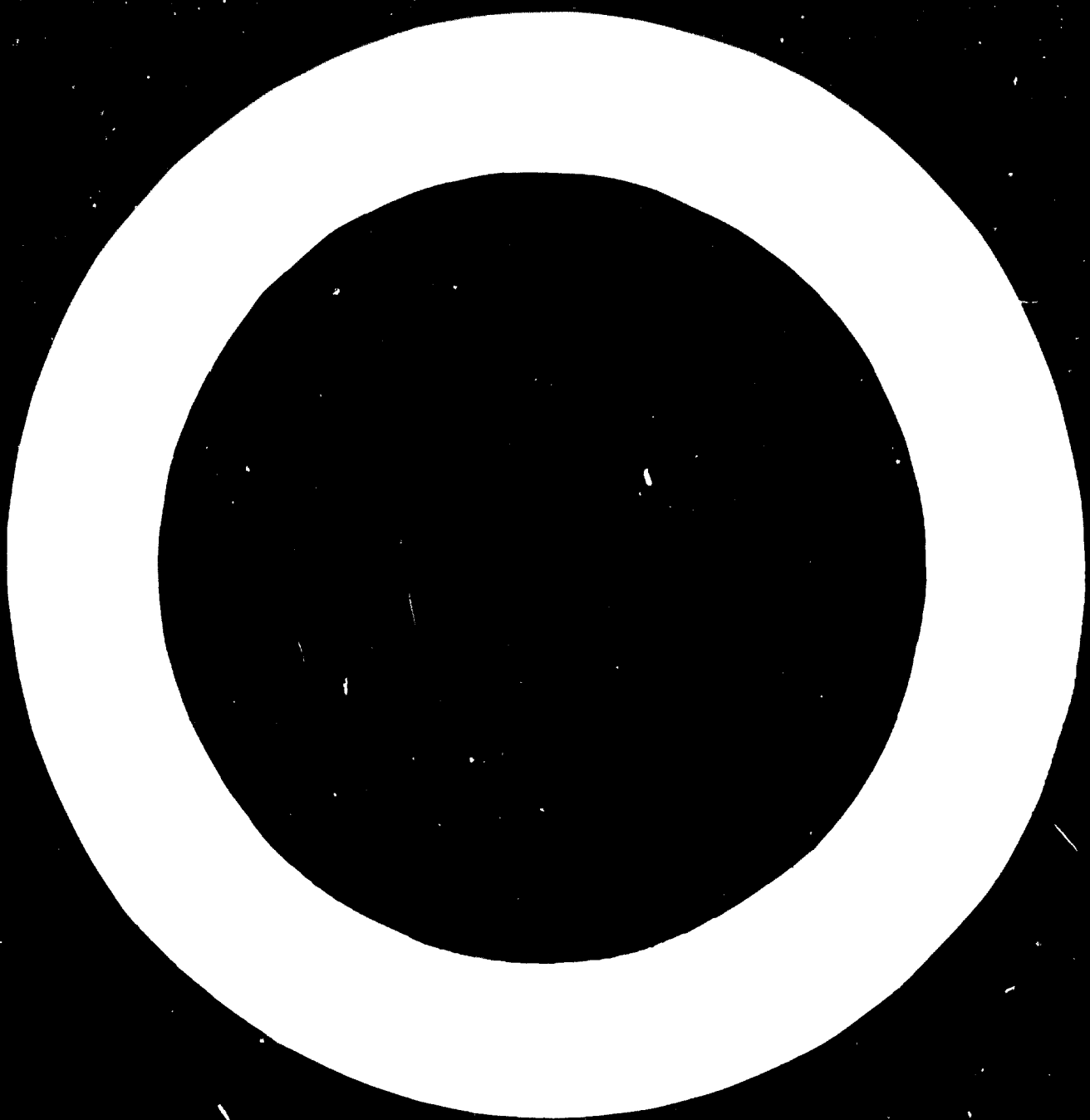
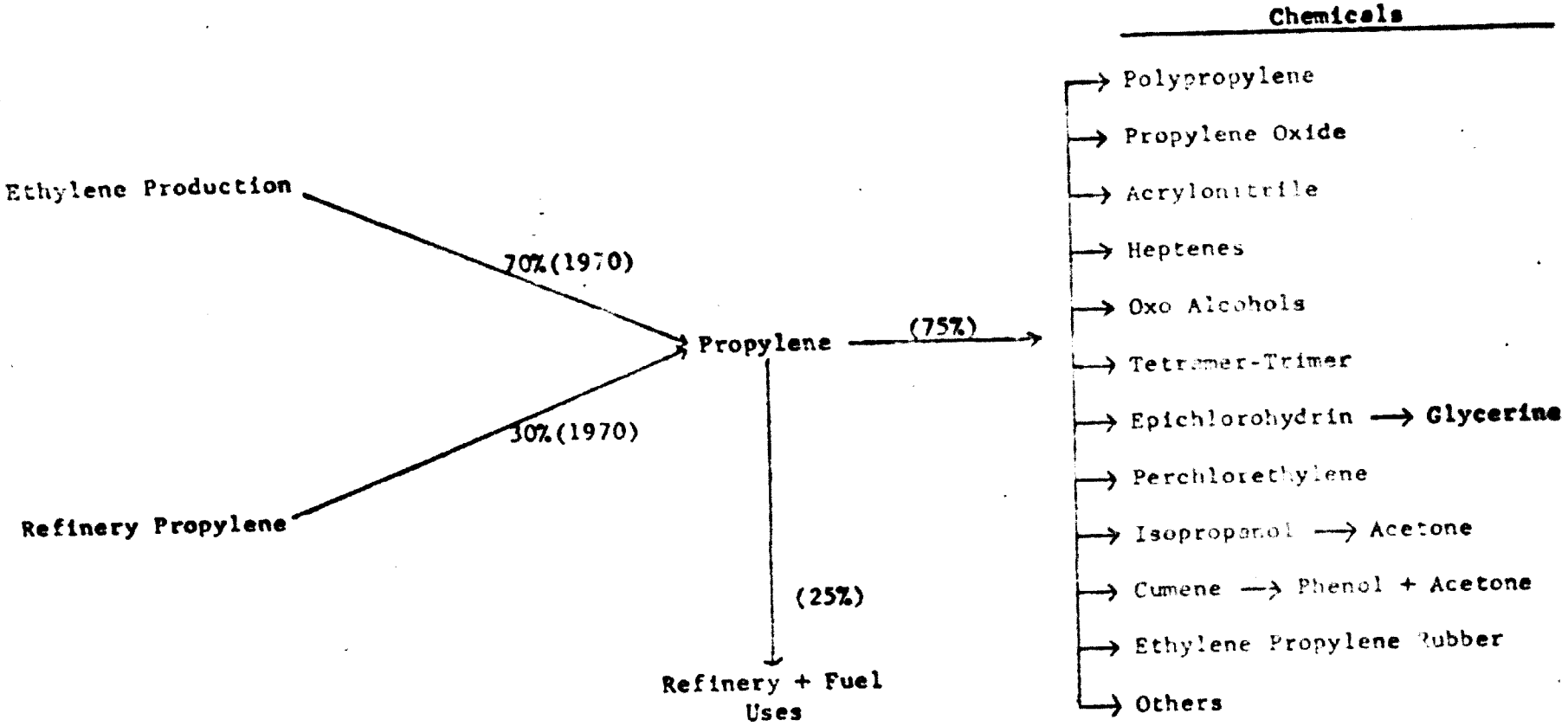


WESTERN EUROPE PROPYLENE PRODUCTION - USE PROFILE

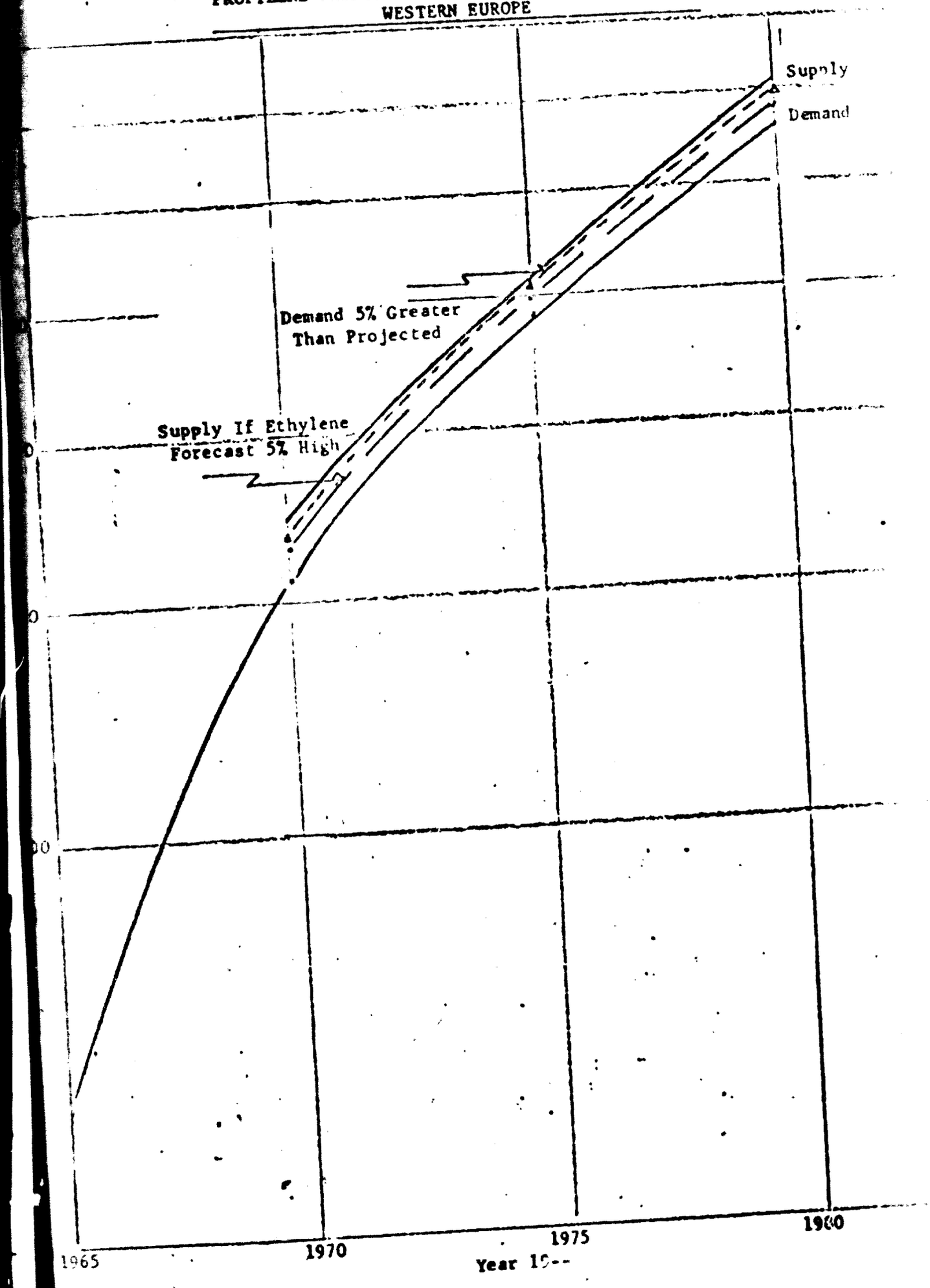


64/23

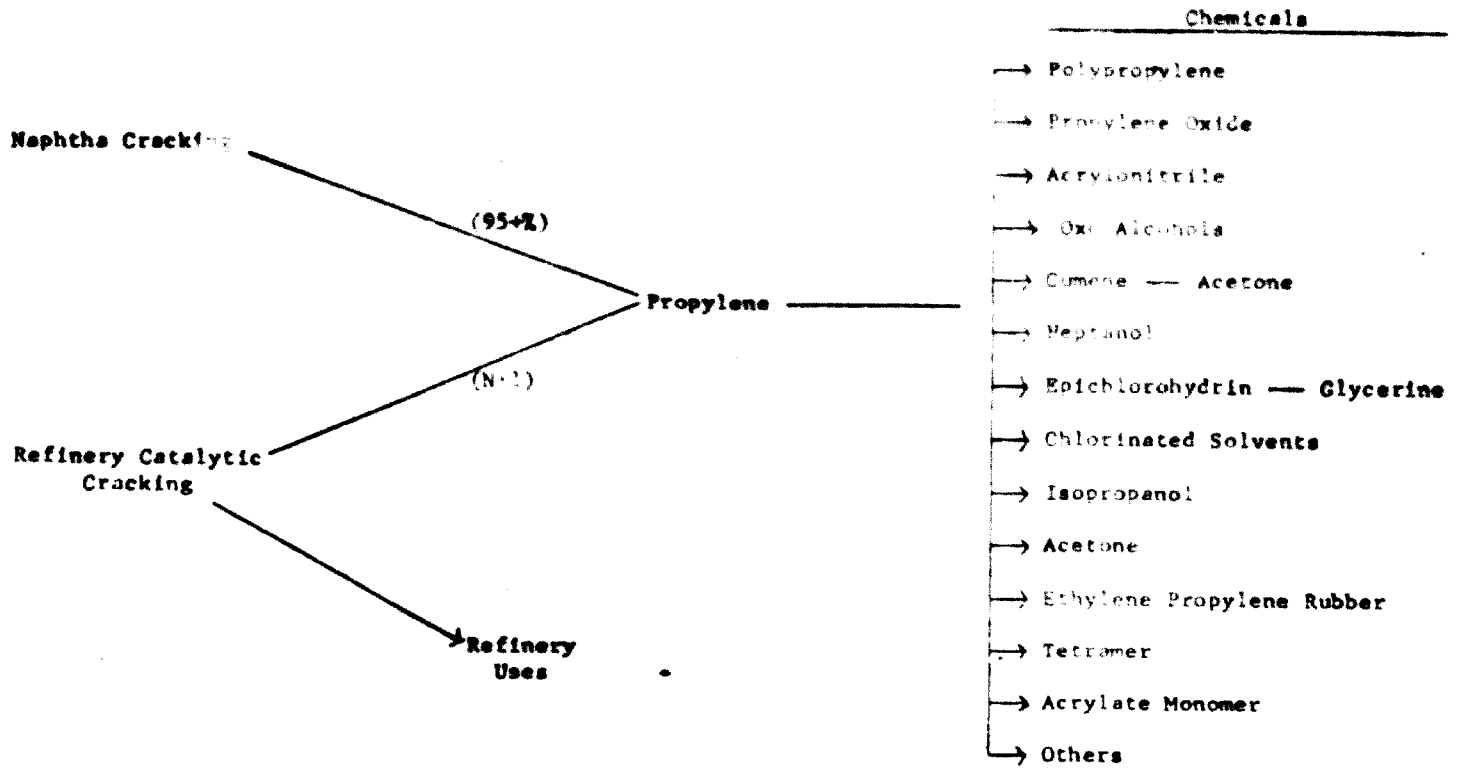
FIGURE 4

34/23

PROPYLENE PRODUCTION - CHEMICAL DEMAND BALANCE
WESTERN EUROPE



JAPANESE PROPYLENE PRODUCTION - USE PROFILE



34/13

FIGURE 6

PROPYLENE PRODUCTION - CHEMICAL DEMAND BALANCE
JAPAN

34/23