MITSUBISHI MONSANTO CHEMICAL COMPANY
APPROPRIATION REQUEST

March 11, 1968

To: Mr. F. E. Reese
Monsanto Company
International Division
St. Louis, Missouri

Project No. 72
Type of Request: New Product (for MMK)

TITLE: Installation of Biphenyl and Chlorinated Biphenyl Manufacturing and Blending Facilities - Yokkaichi
(Functional Fluids Group)

This project will provide facilities for the manufacture of biphenyl, chlorinated biphenyls and blends for the electrical, plasticizer and functional fluid market. The proposed installation at the Yokkaichi plant will have a capacity of 5.5M lbs./yr. of biphenyl and 10M lbs./yr. of chlorinated biphenyls.

Currently biphenyl is only manufactured by Yawata Chemical with Kanegafuchi the only producer of chlorinated biphenyls. In 1967 sales were 8M pounds. With the market for chlorinated biphenyls growing at 15-20% per year, by 1973 20 million pounds will be required. Immediate approval of this project is critical, because MMK must establish its position before Kanegafuchi makes a major expansion. This is an opportune time for MMK to enter this market with the support of Monsanto's technology and marketing technical service. This project is expected to earn 6.2% on the gross investment at 80% of capacity.

The necessary government approvals have been obtained from the Ministry of International Trade and Industry (MITI) and MMK's 1968 long-range plan lists this project. It was included in the MMK Financial Plan approved in principle by Monsanto's Executive Committee on October 9, 1967.

Because of the low demands in the early years, biphenyl will be purchased during 1969 and 1970. Accordingly, the completion of the biphenyl portion of this project will be deferred for 18 months. Approval for the total capital requirements for biphenyl and chlorinated biphenyl strengthens our position as a second source of supply.

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Also, the total plan was accepted by the Japanese government so MMK should confirm its intention to proceed with the total plan. The deferment of the biphenyl portion of this project will aid MMK's cash position in 1969, a period of heavy capital commitments.

Included in the total capital requested is $311,000 for added brine and gas purification facilities to the existing chlorine facilities to meet the demands of this project. The $311,000 capital will be assigned to the chlorine equipment center and reallocated to all chlorine users.

CED in Saint Louis estimated the battery limits fixed capital and prepared the process design manuals for the biphenyl and chlorinated biphenyl installations, which MMK will use to design and construct the plant.

	This Project
NEW FIXED CAPITAL REQUESTED	$1,947,000
ALLOCATED FIXED CAPITAL	569,000
WORKING CAPITAL	408,000
GROSS INVESTMENT	2,924,000
RETURN ON NEW FIXED CAPITAL	9.3%
RETURN ON GROSS INVESTMENT	6.2%
YEAR FIRST ACHIEVED	1972
PAYOUT PERIOD	6.8 years
CAPITAL TURNOVER	0.47 times/year

T. Nishikawa
President

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II. PREMISES

"Return" as employed means the return on gross investment after taxes and after income charges.

Price. (1¢/lb. = 1.5% Return) A price decline to an average of 17.2¢/lb. has been estimated for 1972. 1¢/lb. change in selling price is equivalent to 1.5% change in return.

Volume. (5% = 0.6% Return) Estimates are based on 1972 as a "typical" year, 80% of capacity. A 5% variation in volume will change return by 0.6%.

Raw Materials. (1¢/lb. = 0.3% Return) Benzol price has been forecasted at 24¢/gal. in 1972 and 23¢/gal. in 1973. Variation of 1¢/gal. will change return by 0.3%. For years 1969 and 1970 biphenyl will be purchased at 11.2¢/lb., delivered Yokkaichi.

Overall Effect. With the full range of price, volume and raw material factors anticipated, the return could vary between 9.7% - 4.9%; 6.2% is most probable.

Royalty. 4% of net sales of chlorinated biphenyl after commercial operation begins.

III. ALTERNATIVE COURSES

1. Purchase Chlorinated Biphenyl

Continued importation of AROCLOR from Monsanto is not economic with the 20% tariff barrier and high freight and drum costs. Purchase of chlorinated biphenyl from Kanegafuchi is not possible in quantity; they are short of capacity. In any case, a re-seller arrangement would be a loss or, at best, a no-profit basis.

2. Purchase Biphenyl

It is recommended that biphenyl be purchased for use in the chlorinated biphenyl plant for 1969 and 1970. The favorable pricing from Yawata Chemical and the anticipated low plant occupancy in these years favors purchase of biphenyl.

	Purchase Price ¢/#	Manuf. Costs ¢/#	% Occupancy biphenyl plant
1969	11.2	14.6	35%
1970	11.2	13.3	52%
1971	11.2	10.4	68%
1972	11.0	8.7	82%
1973	11.0	8.0	96%

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Detailed economic evaluations confirm that this project is the preferred alternative. Market demands are now at a level where a second supplier with Monsanto's quality position can quickly attain a 40-45% share of the market.

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SCHEDULE I

RETURN ON INVESTMENT AT NORMAL OPERATING LEVEL*
(Dollars in Thousands)

Amount Net Sales	$1,380
Cost of Goods Sold	713
Royalty Paid Monsanto	55
Gross Profits	612
SARE Expense	110
Income Charges Net	139
Income Tax (50%)	181
Net Income	181
New Property	$1,947
Allocated Property	569
Gross Fixed Investment	$2,516
Working Capital	408
Gross Investment	$2,924
Return on New Property	9.3%
Return on Gross Investment	6.2%
Capital Turnover	0.47

*Normal operating level, 80% capacity (first attained in 1972).

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SCHEDULE II

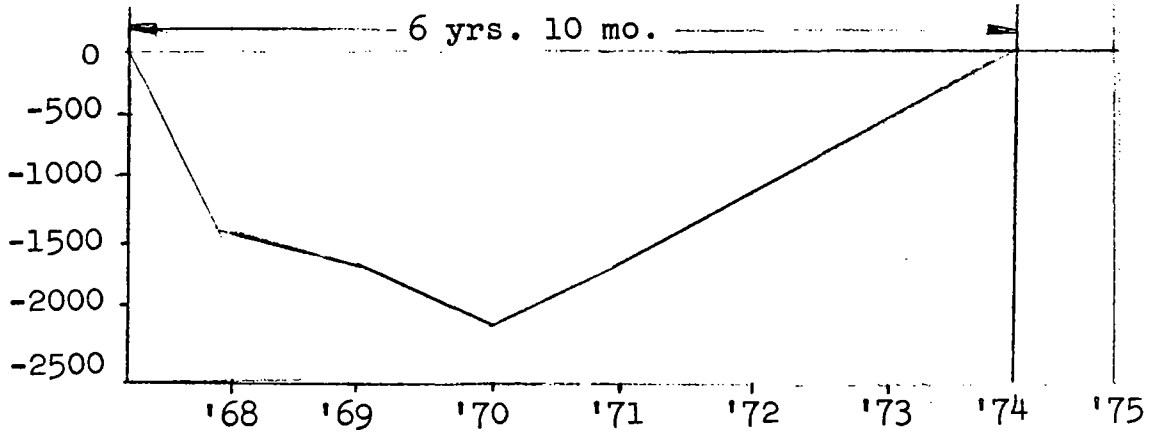
CASH FLOW STATEMENT TO PAYOUT YEAR
(Dollars in Thousands)

	1968	1969	1970	1971	1972	1973	1974
New Fixed Capital	1,294**	497	786				
Proj. Expenses (after tax)							
Pre-Commercial SARE							
Start-up Expenses (after tax)	10	12	20				
Dismantling Expense							
Total Cash Required	1,304	509	806				
Added Net Income*		(3)	56	100	165	220	230
Depreciation		230	230	331	331	331	331
Tax Credit							
Total Cash Sources		227	286	431	496	551	561
Net Cash Flow	(1,304)	(282)	(520)	431	496	551	561
Cumulative Cash Flow	(1,304)	(1,586)	(2,106)	(1,675)	(1,179)	(628)	(67)

*After 7 year straight line depreciation and tax at 50%.

**Includes $630M new fixed capital from MMK Project No. 70 - VCM-PVC Expansion

FIGURE I
CUMULATIVE CASH FLOW



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SCHEDULE III

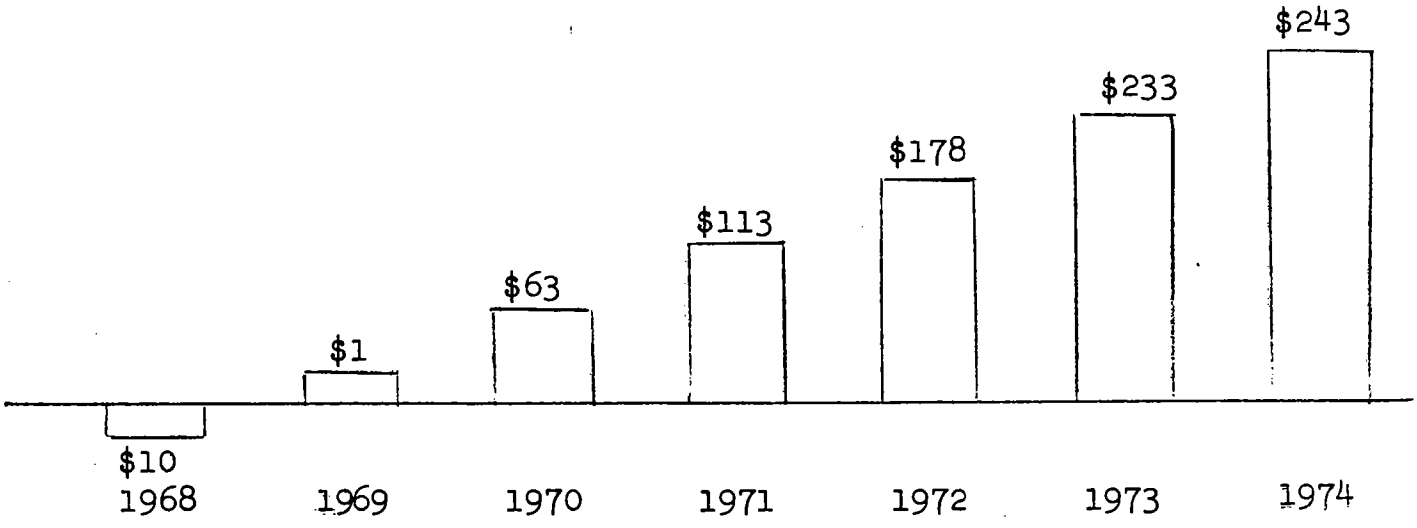
EFFECT OF PROJECT ON MMK REPORTED CORPORATE NET INCOME
(Dollars in Thousands)

	1968	1969	1970	1971	1972	1973	1974
Added Net Income*		1	63	113	178	233	243
Expenses (after tax)	(10)						
Retirement loss (after tax)							
Investment Credit							
Net Effect	(10)	1	63	113	178	233	243

*After straight line (8 year) depreciation and tax at 50%.

FIGURE II

EFFECT ON REPORTED NET INCOME
(Dollars in Thousands)



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IV. MARKET

Demand. Joint market surveys have been made in Japan by MMK and by Monsanto AROCLOR specialists. The chlorinated biphenyl market in Japan is forecast as growing at 15-20% per year. At present, 75% of the demand is for electrical applications in condensers and transformers (these specific equipment markets are also forecast to grow at 18%/year by related trade associations). Additional sales will be in plasticizers including the "carbonless" transfer paper application. A third outlet is to "Therminol"-type fluids for heat transfer. Table I provides additional details of these markets. The Monsanto specialists are confident that the Monsanto products will be well accepted by the Japanese market.

Supply. Estimates for MMK's share of the business by product are shown in Table II. MMK/I ratio should reach 45% by 1971. Mitsubishi-related companies will be major factors in attaining this share of the market. Furthermore, current shortages of supply are encouraging customers to establish a second source of supply.

Kanegafuchi Chemical (KANEKA) has been manufacturing chlorinated biphenyls for 13 years. Present capacity is 8 million pounds per year; their source of biphenyl is Yawata Chemical. Local shortages are being supplemented with imports of biphenyl and AROCLOR from Monsanto. However, Yawata has an expansion in construction which will relieve the biphenyl supply problem by third quarter of 1968. Their construction plans will dovetail into MMK's program as MMK will buy initial quantities of biphenyl from Yawata in 1969 and 1970, until MMK's biphenyl unit starts up. (Although sales of biphenyl have not been claimed in the justification of this appropriation request, from time to time opportunistic sales will be possible both in Japan and export.)

Price. Historical and forecasted prices for MMK are as follows:

		Average Net Sales Price* Chlorinated Biphenyl ¢/lb.
Actual	1964	23.2
	1965	22.5
	1966	21.9
	1967	20.6
Forecast	1968	20.0
	1969	18.4
	1970	18.4
	1971	17.8
	1972	17.2
	1973	16.7

*Average price of domestic (Japan) and export sales.

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TABLE I

JAPANESE TOTAL MARKET

CHLORINATED BIPHENYL DEMAND

(Unit: M lbs./yr.)

Year \ Uses	Electrical	Plasti-cizer	Heat Transfer	Functional Fluid	Others	Total
1966	5,500	1,000	700	-	-	7,200
1967	6,050	1,230	700	55	40	8,080
1968	7,500	2,000	770	100	60	10,430
1969	7,700	2,090	900	200	120	11,000
1970	8,200	2,800	1,000	500	200	12,700
1971	8,700	3,800	1,100	800	350	14,750
1972	9,900	4,900	1,250	1,200	500	17,750
1973	10,500	6,300	1,400	1,600	700	20,500

TABLE II

MMK's SALES ESTIMATE

CHLORINATED BIPHENYL

(Unit: M lbs./yr.)

Year \ Grade	1242	1248	1254	1260	Total
1969	2,000	400	840	160	3,400
1970	3,000	600	1,150	250	5,000
1971	4,050	700	1,400	450	6,600
1972	4,850	900	1,700	550	8,000
1973	5,650	1,050	2,050	650	9,400

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Price after 1970 is expected to decline only at the rate of drop in benzene pricing, 3% per year. These estimates are most conservative and with only two manufacturers in this market, better price margins may be maintained.

V. TECHNOLOGY

MMK will adopt Monsanto's well established and demonstrated technology for the products to be manufactured under this project. All chlorinated biphenyl products have had at least 30 years of full-scale commercial production experience in the Anniston and W.G. Krummrich plants.

Monsanto has established a firm position world-wide as a chlorinated biphenyl manufacturer, and has been selling about 80% of the world market.

VI. PATENT SITUATION

Monsanto has two Japanese patents on AROCLOR manufacturing process as follows:

414,827 (issued July 9, 1963)
446,532 (issued Nov. 5, 1964)

Use of these patents have been licensed to MMK for production of AROCLOR in Japan.

No infringement problems exist with regard to these processes.

VII. EARNINGS

1. The start-up of the chlorinated biphenyl operation is scheduled for May 1969. The biphenyl unit will be constructed and ready for operation by December, 1970.

2. Operating level for chlorinated biphenyl is forecast as follows:

1969	34%
1970	50%
1971	66%
1972	80%
1973	94%

For conservative purposes a "typical" average of 80% has been assumed for long-term operations.

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3. Delivered costs of raw materials are as follows:

Year	Benzene	Biphenyl	Industrial Salt (92.5% NaCl)
	$/gal.	¢/lb.	$/ton
1968	0.27	-	10.58
1969	0.26	11.2	10.58
1970	0.25	11.2	10.58
1971	0.25	-	10.58
1972	0.24	-	10.58
1973	0.23	-	10.58

Benzene will be supplied by Mitsubishi Yuka at Yokkaichi.

Biphenyl will be purchased only for 1969 - 1970 from Yawata Chemical.

4. SARE Expense. 8% of net sales (MMK's current requirements)

5. Labor Cost. $187/person/month in 1967 will increase by 10% per year. These escalated costs by year were included in the evaluation.

6. Depreciation. 8 years straight line has been taken for estimating average income over the life of this project. Actually 7 years is permitted for tax purposes and has been employed in calculating cash flow and payout.

7. Payments for Technology. The initial payment of $30,000 for the Design Manual has been included in capital for this project. It will be amortized in the first five years of operation. Royalty of 4% of Net Sales has been employed in accordance with the contract between MMK and Monsanto.

VIII. CAPITAL

A. Scope of Project. This project provides for the following facilities (1) biphenyl manufacturing unit using the Anniston plant's advanced design tubular reactor, (2) chlorinated biphenyl facilities including blending facilities as well as a by-product HCl recovery system and (3) additional brine and gas purification facilities to the existing chlorine manufacturing center.

NOTE: Chlorine gas will be supplied by the chlorine plant recently expanded by provisions in MMK Project 70, VCM-PVC Expansion. However, supplementation of the brine and gas purification accessories are needed to meet the chlorine demands of this project.

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B. Estimate of Capital. The tubular biphenyl facilities and the chlorinated biphenyl facilities with a blending operation were estimated by CED. The St. Louis CED figures represented the capital needs as installed in the U.S.A. -- the CED figures were translated to installation in Japan by the use of the experience factor of 85%, (recently confirmed in the newly completed oil additive plant). Additions for site preparations, HCl recovery, brine and gas purification and extensions for utilities and services have been estimated by MMK engineers based on current actual experience.

New Fixed Capital Required in Japan

Biphenyl facilities	$786,000
Chlorinated biphenyl facilities	684,000
HCl recovery system	136,000
CED Design Manual	30,000
Chlorine Plant Accessories	311,000
Total Requested	$1,947,000

Allocated Property

	Biphenyl	Chlor. Biphenyl	Total
Utilities & Services	$139,000	$111,000	$250,000
*Chlorine Investment	-	630,000	630,000
	$139,000	$741,000	$880,000

*Total allocated chlorine investment to chlorinated biphenyl at capacity rate is $630M (after total chlorine expansion, including the $311 NFC for chlorine accessories described in this project).

C. Project Status. Anticipating approval of this project in March 1968, construction of the chlorinated biphenyl unit will be completed by April 1969 -- the staged biphenyl unit is scheduled for completion by December 1970. Startup of the initial operation is scheduled in May 1969.

D. Working Capital. The basis of the working capital assumes an inventory of raw materials 1/2 month, goods in process 1/2 month, finished goods one month, with receivables at 5 months and accounts payable at 5 months.

IX. LEGAL

No unusual problems are expected in connection with this project.

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X. TREASURY

Interest rates will be 8.5% for long-term loans and 7.5% for short-term loans.

The foreign currency rate is controlled at 360 yen per U.S. dollar ±0.75% and this status will be maintained.

XI. PERSONNEL

At full capacity operations, personnel needs will be:

	Biphenyl	Chlorinated Biphenyl	
Shift-operator	4	8	
Day-operator	1	2	
Foreman	1	1	
Supervisor	1/2	1/2	
			Total
Total	6-1/2	11-1/2	18

Initially, only 8 shift operators and the foreman will be assigned. Additional men will be assigned only when needed.

XII. RISK EVALUATION

Process variables are well known from Monsanto experience hence no unknown specific risk is involved. Operating and personnel safety features and practices as demonstrated in Monsanto's plants will be incorporated in the MMK operation.

XIII. POLLUTION AND TOXICITY PROBLEMS

By-product HCl will be recovered and utilized for oxidative chlorination in producing VCM. There are no other specific problems. Heavy still residues will be drummed off and disposed of in a suitable solid waste dump.

XIV. INTERNATIONAL ASPECTS

The manufacturing location in Japan will provide a fourth source of chlorinated biphenyl, supplementing two plants in U.S.A. and one at Newport, U.K. (MCL). Advantageous balancing of supply, service and freight will permit some exports from Japan.

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XV. CORPORATE DISTRIBUTION REVIEW

Not applicable.

XVI. CORPORATE PLANNING REVIEW

Not applicable.

XVII. SPECIAL ACCOUNTING PROBLEMS

There are no special accounting problems.

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CHART A

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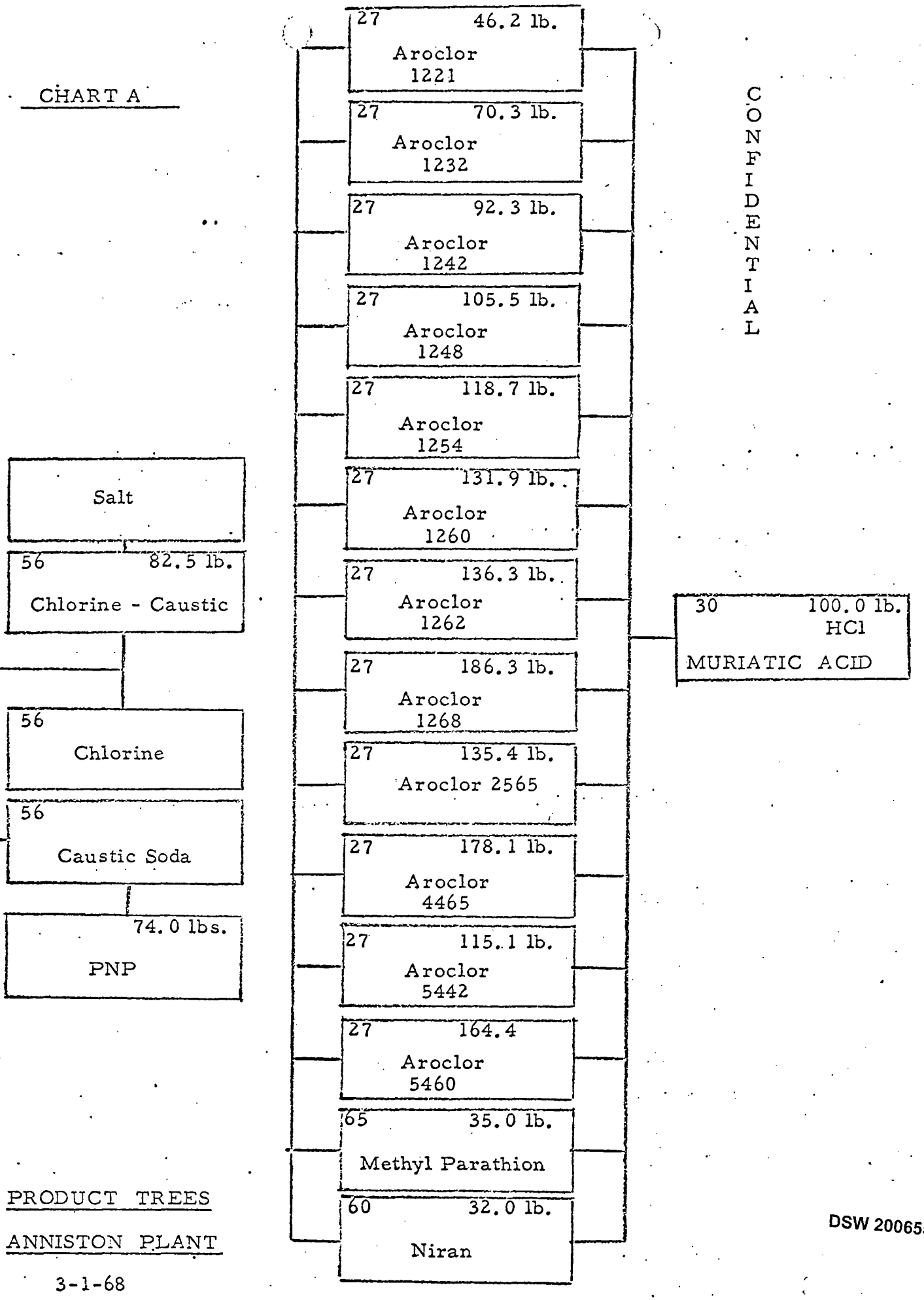

PRODUCT TREES

ANNISTON PLANT

3-1-68

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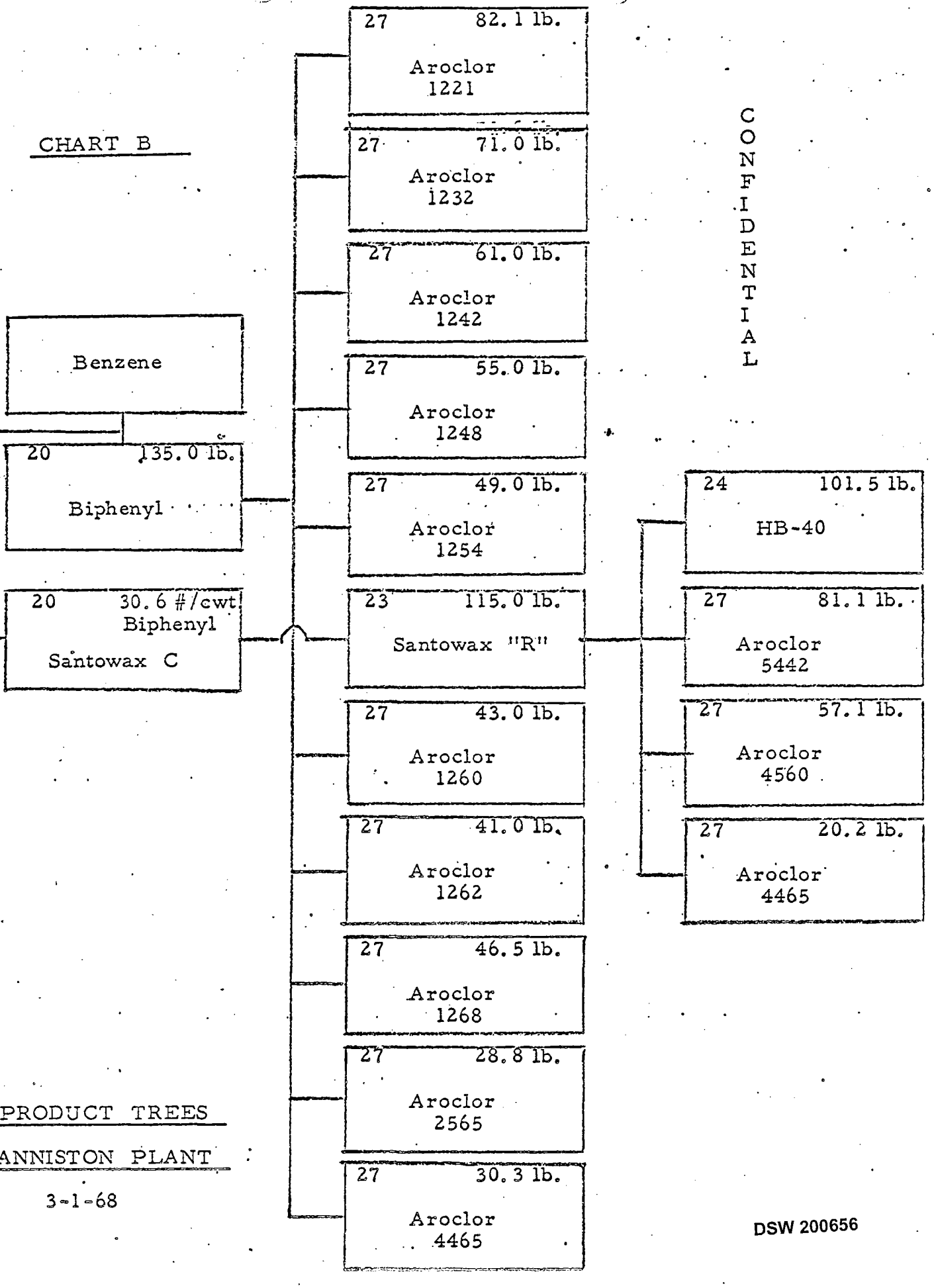
CHART B



PRODUCT TREES

ANNISTON PLANT

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LIQUID AROCLORS

5-YEAR FORECAST (In Thousands of Lbs.)

Total Required from U.S. Plants

	1968	1969	1970	1971	1972
Krummrich					
1242	17,453	19,160	21,937	26,219	26,013
1248	4,975	4,636	4,602	4,481	4,910
1254	4,521	4,679	5,102	5,597	5,897
1260	6,676	6,939	7,329	8,120	8,463
1262	129	135	145	155	165
Total WGK	33,754	35,999	39,115	44,572	45,448
Anniston					
1242	35,951	37,495	38,941	41,791	43,497
1248	1,862	1,960	2,049	2,374	2,764
1254	5,000	5,223	5,002	4,822	4,642
1260	2,304	2,360	2,725	2,878	3,009
1262	638	649	641	656	694
1221	113	120	130	140	150
1232	843	863	926	993	1,045
Total Anniston	46,711	48,670	50,414	53,654	55,801
DIV. TOTAL	80,465	84,669	89,529	98,226	101,249
CAPACITY	81,600				

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