PROGRESS REPORT
PLANT TECHNICAL SERVICES DEPT.- W. G. KRUMMRICH PLANT

JOB NO.	REPORT NO.	DATE
91370:2849	1	9/4/63

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• TO RECEIVE DETAIL SECTION

C O N F I D E N T I A L

TITLE: Aroclor: Logical Capacity Increase

PERSONNEL: W. B. Johnson, M. Magnetti (W. F. Taffee)

PROBLEM: Aroclor production will not be capable of meeting the demand in 1964.

SUMMARY: The latest five-year sales forecast for Aroclors indicates that the total Monsanto, national, Aroclor manufacturing capacity will be insufficient in 1964. A deficit of 4.6M lbs. in 1964, 10.2M lbs. in 1965, 14.6M in 1966, 18.8M in 1967, and 22.4M lbs. in 1968 will exist at present production levels.

This report outlines proposals to increase Aroclor production capacity at W. G. Krummrich in two phases or steps as summarized on pages 4 and 5 to help off-set this deficit. The proposals are based on studies and plant tests which are currently continuing.

Estimated savings (B.T.) will be $106,000/yr. for phase I and $70,000 for phase II which gives a grand total savings of $176,000/yr. The major part or $170,000 of the $176,000/yr. savings is based on the reduction of manufacturing costs by an increased devisor. The savings are dependent on increased sales, but no claim is made as to new earnings or increased sales. The recovery of the chlorinator off-gas carry-over material will save at least $6,000/yr. to Dept. 246, Aroclors. It is estimated that $12,000/yr. additional savings can be realized at W. G. Krummrich if the off-gas quality is improved. This estimate is based on downtime and expenses of other departments resulting from contaminants in the off-gas system.

Production of Aroclor at W. G. Krummrich can be increased from 20.4 M lbs/yr. to 28.6M lbs/yr. in phase I and from 28.6 to 35.4M lbs/yr. in phase II to give a grand total of 15M lbs/yr. The cost will be $88,000 new capital and $43,000 expense for phase I. The cost of phase II will be $53,000 capital and $19,000 expense to give a grand total of $141,000 capital and $62,000 expense or a $203,000 expenditure. This represents a 40% overall department increase in phase I and a 33% increase in phase II or a total of 73% increase

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without any additional labor force. The savings were calculated by comparing the actual current Aroclor manufacturing costs at the maximum rate of 20.4M lbs/yr. to the estimated costs at the proposed rates of 28.6M lbs/yr. and 35.4M lbs/yr. This comparison is found on page 7 in the appendix.

FUTURE WORK

Further PTS work will continue on production rate and quality problems. Work on the expansion of Aroclor capacity will also continue.

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Plant Technical Services

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DETAILS

Aroclors are produced at Anniston and W. G. Krummrich by chlorinating biphenyl and polyphenyls. Only liquid Aroclors are produced at W. G. Krummrich. Biphenyl is first chlorinated to make crude Aroclor. Crude Aroclor is air blown, distilled, earth treated, filtered, and stored as finished product. Several special Aroclor blends called Pydrauls and Pyranols are made at W. G. Krummrich.

There are five chlorinators, 2 blow tanks, and 2 stills at W. G. Krummrich. The chlorinating and storing steps are limiting production at the present time. The stills and other major equipment are capable of handling an increased load with a few minor alterations and/or repairs. Present storage capacity is limited and requires careful scheduling, and would not be adequate to handle the increased load.

Studies and tests indicate the present Aroclor production rate at W. G. Krummrich can be increased in the first phase from 20.4M lbs/yr. to 28.6M lbs/yr. The rate can be increased from 28.6M lbs/yr. to 35.4M lbs/yr. in the second phase, and with substantial savings over-all.

The present average production cost is about $6.78/cwt of product. This cost will be reduced to $6.43/cwt with a savings of $0.35/cwt by increasing production with the same work force. The annual savings expected in phases I and II on 28.6M lbs/yr and 35.4M lbs/yr of Aroclor produced is about $100,000 and $70,000 to give a total of $170,000 as tabulated on page 7 in the appendix.

Detailed on page are the figures showing a savings of at least $6,000/yr. resulting from the recovery of chlorinator off-gas carry-over material. This carry-over problem will be even more critical as chlorinating rates are increased. The equipment to solve this problem of poor quality off-gas should be installed immediately, since other departments are suffering downtime and other expenses amounting to approximately $12,000/yr. due to HCl gas line pluggage problems.

The total installation and alteration costs to achieve a 40% production rate increase in phase I will be $131,000 and to achieve a 33% increase in phase II will be $72,000 making a grand total of $141,000 capital plus $62,000 expense or a $203,000 expenditure. This project summary of items, costs, savings, capacities, and dates is on pages 4 and 5.

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W. G. Krummrich Aroclor Expansion Project Summary
Phase I

Item	$ Cost C - capital E - Expense	Annual Savings $ B.T.	Capacity Increase lb/yr	Project Submitted Date	Design Completed wks after approval	Remarks
1. Chlorinator off-gas carry-over	8,000-C 2,000-E	$6,000	0	11/1/63	6	Redesign chlorinator off-gas system to recover carry-over and improve quality of the off-gas. Poor quality off-gas costs Dept. F-218 and 217 approximately $12,000/yr in repairs and downtime.
2. Intermediate crude Aroclor storage.	18,000-C 8,000-E			9-23-63	6	Need additional capacity to "age" crude Aroclor, consequently improve quality.
3. Chlorinator cooling	25,000-C 20,000-E		8.2M	10-1-63	6	Redesign and install better chlorinator cooling facilities to increase production. Air cooled heat exchanger successfully demonstrated on one chlorinator.
4. Chlorinator specific gravity recorder	7,000-C 2,000-E	100,000		10-15-63	6	Install sp. gr. recorder to lighten work load of present labor force so that no additional labor force will be needed.
5. Chlorine gas controls	9,000-C 2,000-E			10-23-63	6	Install automatic chlorine gas control to chlorinators to increase the product output.
6. Chlorine gas supply	1,000-C 4,000-E			11-1-63	6	Chlorine gas supply must be increased if the product output is increased.
7. Product storage	20,000-C 5,000-E			11-1-63	6	Product storage is tight now, and more will be needed as production is increased.
TOTAL PHASE I	$88,000-C 43,000-E	$106,000	8.2M			

Total Aroclor Capacity Will Be 20.4 + 8.2 = 28.6M lbs/yr.

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Phase II

Item	$ Cost C - Capital E - Expense	Annual Savings $ B.T.	Capacity Increase lb/yr.	Project Submitted Date	Design Completed wks after approval	Remarks
1. Car loading facilities	2,000-C 1,000-E			11-1-63	8	Install facilities to load rail cars. Production increase will make this necessary
2. Drum-off station	2,000-C 2,000-E			11-15-63	8	Up-grade present facilities to drum product without an increase in labor.
3. Still Jets	3,000-C 2,000-E	70,000	6.8M	11-15-63	8	Redesign jet system to the increased load.
4. Still Capacity	20,000-C 5,000-E			11-25-63	6	Distillation step is limiting, hence, redesign to increase output. Therminol heating will be considered
5. Product Storage	20,000-C 5,000-E			12-1-63	8	An increase in production will mean a need for more storage capacity.
6. Topping Still	6,000-C 4,000-E			12-15-63	10	Estimated sale of 1.0M lbs/yr. of Aroclor can be had by meeting customer specs which can be met by the use of a topping still
TOTAL PHASE II	53,000-C 19,000-E	70,000	6.8M			
GRAND TOTAL	141,000-C 62,000-E	$176,000	15.0M			

TOTAL AROCLOR CAPACITY WILL BE 28.6 + 6.8 = 35.4M lbs/yr.

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Discussion of Items

1. Tests have been run which indicates that at least $6,330/year are lost by carry-over from the chlorinator off-gas system. An average of 30 gal. a day is lost and biphenyl costs $0.067/lb. 30 gal/day x 9 lbs/gal x $0.067/lb x 350 days/yr = $6,330/yr.

   With a 95% recovery a savings of $6,000/yr would be realized. Poor quality off-gas (contaminated) from the chlorinators last year caused $10,000 downtime in Depts. F-218 and 217.

   This is based on the cost to buy chlorosulphonic acid. $2,000 was spent in cleaning the plugged line to the Dept. to give an over-all cost of $12,000 which can be saved.

2. Limited plant tests show the Aroclor quality can be improved by aging crude Aroclor prior to distillation. Two 10,000 gal. tanks will be needed due to the frequent change of products, usually every 3 days, to prevent excessive downtime.

3. The major factor that is limiting present production at the chlorinators is the inadequate cooling capacity. With an increase in cooling rate the chlorinating rate can be increased proportionally. The cost of increasing the cooling capacity would be $45,000. An air-cooled heat exchanger has been installed on #5 chlorinator. The capacity of this chlorinator has been increased by at least 40% as shown by current data on page 8 of the appendix.

4-6 Some piping alterations will be necessary to increase the chlorine supply to the department. Installation of automatic chlorine flow rate control and specific gravity recorders will be necessary in achieving at least a 40% department production increase with the existing labor force. The cost of this phase is $25,000.

7. Storage for the many different Aroclors, Pydrauls, and Pyranols is real tight at present. Careful scheduling and the use of rail cars will have to be employed with one additional storage tank in order to handle the storage problem. This tank will cost $25,000.

   The engineering time and the installation time will take about 4 months. The production rate will be reduced only 40% for about 2 months. The changes can be made in steps or increments as desired.

   The present and proposed cycles on major department equipment are tabulated in the appendix on page 8.

APPENDIX

The following is a detailed breakdown on the savings calculations and the equipment cycles. These cycles allow 1/2 hours to charge and 1/2 hour to discharge the chlorinators as well as 1-1/2 hours to drop still bottoms. The cycles on the stills we figured on a basis of 22 chlorinator batches to a still-bottom drop. The capacity of the stills was figured at about 3,000-4,000 lbs/hr. All other equipment cycles are not important in affecting production rates.

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* Cost Standard on 1254 Aroclor

Revised Jan. 1, 1963

Production Bracket

Item	1,700,000 lbs/mo. Present cost	2,380,000 lbs/mo. Proposed cost	2,950,000 Proposed cost
Raw Material	$91,069/mo.	$127,500/mo.	158,000
Total Dir. Conv.	19,310	19,828	20,906
depreciation Total Ind. Conv.	2,061	2,711	3,256
F.I. Exp.	2,898	3,018	3,119
Total Prod. Cost	$115,338/mo.	$153,057/mo.	$185,281/mo
Cost per lb Aroclor	$0.06785	$0.06430	$0.06280

Savings per year:

$0.00355/lb Aroclor x 2,380,000 lbs/mo x 12 mo/yr = $101,500/yr.

$0.00505 x 2,950,000 x 12 mo/yr. = $170,000/yr.

* The Cost Standard for 1254 was used because a check of 2 years of cost sheets showed the average cost was $0.067/lb. The 1254 standard was $0.0678/lb or a conservative average. Also the cost of producing 1242 Aroclor is $0.072/lb and 1260 is $0.065/lb. An Aroclor average mix would be $0.0685/lb. Aroclor production is currently running about 30% of 1242, 25% of 1248, 20% of 1254 and 25% of 1260.

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Equipment Cycles at 2.38M lbs/mo.

100% On Stream Time

Equipment Cycles	1242	1248	1254	1260
Ea. Chlorinator cycle	2.5 batches/ day	2.34 bat/day	1.95 bat/day	1.76 bat/day
Ea. Still Cycle (22 chl. batches)	43 hr/bottom drop	45 hrs/bd	54 hrs/bd	60 hrs/bd

Aroclor Production

Ea. Chlor. cycle	2.75 b/d	2.55 b/d	2.14 b/d	1.95 b/d
Ea. Still Cycle	38.7 hrs/bd	40.5 hr/bd	49 hr/bd	54 hrs/bd

Aroclor Production

Chlor. Batches	7.6 hr/batch	8.2 hr/batch	10 hr/batch	11.6 hrs/batch
Current #5 Chlorinator with Air cooled H.E.	Average 6 hrs/batch			Average 14.5 hrs/batch

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