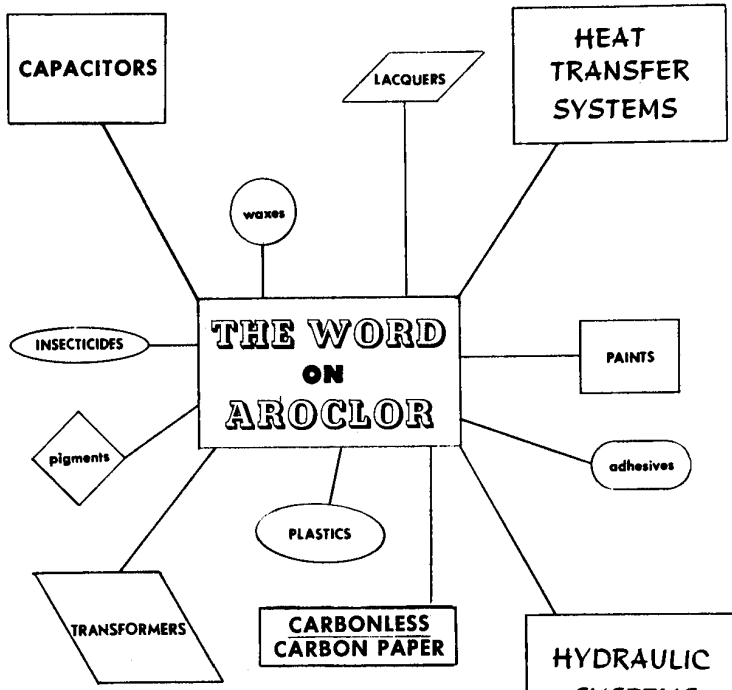

Directors Review Manual

CEA-1800 - Aroclor Expansion - W.G.K.

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Meeting Agenda

AGENDA

For

Directors Review Meeting

On

Aroclor Expansion-WGK (CEA 1800)

I. Introduction ----------W. A. Kuhn and/or J. W. Molloy

II. Objectives (Dated 8/27/68 and Previously Issued) -- Specific Questions

III. Chemistry of Process ---------- C. W. Hamlet - PR&D

IV. Summary of Plant Process and Equipment -- R. S. Yates - CED

V. Current Status of Project

- A. Construction ---------- R. S. Yates - CED
- B. Manning ---------- H. F. Ray - Mfg.
- C. Training Program ---------- H. F. Ray - Mfg.
- D. Overall Timing ---------- H. F. Ray - Mfg.

VI. Start-Up Plan ---------- H. F. Ray - Mfg.

VII. Project Risks

- A. In Process ---------- C. W. Hamlet - PR&D
- B. In Design ----------R. S. Yates - CED
- C. In Operation ----------H. F. Ray - Mfg.

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Aroclor Expansion - WGK (CEA-1800)

Start-Up Objectives

A. Overall

Primary:

1. Demonstrate safe operation of the expanded Aroclor process within the control limits prescribed by PR&D in Tentative Process No. P1504.

2. Effectively define problems and resolve the proper group (CED, Research, Mfg.) in their resolution.

Secondary:

1. Produce Aroclors which meet the specifications outlined in the Tentative Process.

2. Demonstrate the ability of the facilities to produce at designed capacity, specifically:

Aroclor 1242	40 M#/Yr.
All Other Aroclors	30 M#/Yr.
Total -	70 M#/Yr.

3. Demonstrate the ability of the facilities to realize cost standard biphenyl yield or better on total Aroclor production, specifically:

Raw Material	% Theory Yield
Biphenyl	97%

4. Demonstrate the ability of the facilities to meet standard manufacturing cost.

5. Achieve the above objectives within a 45-day start-up and demonstration period and within budgeted start-up expense.

B. Technological Objectives

1. Demonstrate the optimum continuous porocel absorption column operating conditions in terms of capacity, quality, porocel usage and product loss.

2. Demonstrate the ability of the ferric chloride catalyst addition system to insure proper catalyst level in the continuous chlorinator line.

3. Demonstrate the ability of the "dynatrol" to control the Aroclor 1142 specific gravity within specification limits.

4. Demonstrate the ability to continuously monitor the power factor of the finished product with the in-line analyzer developed at Anniston.

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B. Technological Objectives (continued)

5. Demonstrate the effect of maintaining finished product electrical properties (Power Factor and Resistivity) during extended storage periods through use of nitrogen blanketing.

6. Evaluate the effect of aging Aroclor 1142 on Aroclor 1242 stability.

7. Demonstrate operating conditions which will allow duplication of Anniston production.

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Manning Charts

Total plant Batch & Continuous

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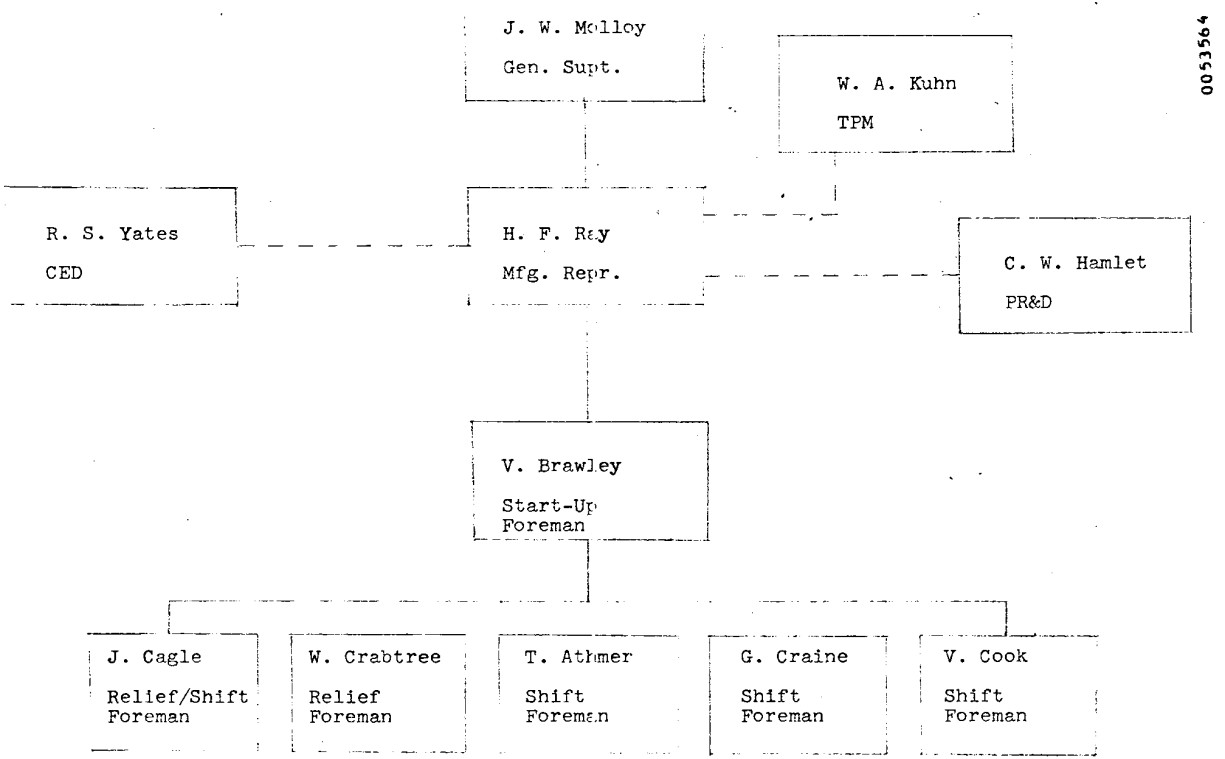
FOREMEN

Premium (4)	Still (4)	Second Oper. (4)	Swingman #2 (1)	Standard (2)	Repair (1)	Swingman #1 (1)	Porter (1/2)
7 Days/Wk. 3 Shifts/Day Duties Batch 5 Chlorinators (Existing) Continuous 4 Chlorinators Catalyst 1 Mix Tank Biphenyl 1 Head Tank (Existing) 1 Off Gas Condenser 1 Off Gas Storage Tank & Mist Eliminator Sample 1 Surge Tank	7 Days/Wk. 3 Shifts/Day Duties 2 Stills (Existing) New 2 Stills 2 Blow Tanks (Existing) 4 Absorbers & Complete Charge of Therminol Heating System 1 Continuous Blow Tank	7 Days/Wk. 3 Shifts/Day Duties 3 Mix Tanks Tank Farm Load all Cars & Trailers Pump Finished Product Tanks To Storage	21st Shift-Still 21st Shift - Second S&S Standard 1 Day Standard	5 Days/Wk. 2 Shifts/Day Duties All Drumming of material in Dept.	5 Days 1 Shift Biphenyl Handling & All Repair Work	Monday 21st Shift - Premium Thurs. & Fri. 2 Days Repairman Sat. & Sun. 2 Days Relief Foreman	5 Days/Wk. 1/2 Shift/Day Clean Control Room, Rest Room, 2 Offices & Smoking Shelter

Total ?

START-UP ORGANIZATION (Tentatively Effective 10/15/68)



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AROCLOR EXPANSION (CEA 1800)

TRAINING PROGRAM

I. Course Content

A. Supervisory

1. Introduction to Key Personnel
2. General Indoctrination
3. Dept. Tour
4. Dept. Organization
5. Security of Information
6. Process Technology
7. Review and Discussion
8. Introduction to Training
9. Assignments, Responsibilities and Authority
10. Process Equipment and Control Limits
11. Process Instrumentation
12. Assignments for Operator Training
13. Operating Instruction of Existing Equipment
14. Safety
15. Materials Handling
16. Utilities
17. Quality
18. Yields
19. Economics
20. Process Description
21. Risk Analysis
22. Communications
23. Equipment Repairs
24. Records
25. Follow Process in Field
26. Preparation for Water Batching

Training Plans

TOWOLDMON0045084

COURSE CONTENT

A. Shift Supervisors

Week Beginning	Subject
Sept. 9, 1968	Introduction to Key Personnel General Indoctrination Dept. Tour Department Organization Security of Information Process Technology
Sept. 16, 1968	Review and Discussion of First Week Subjects Introduction to Training Assignments, Responsibilities, and Authority Process Equipment and Control Limits Process Instrumentation Process Technology Operating Instructions of Existing Equipment Assignments for Operator Training
Sept. 23, 1968	Review and Discussion of Previous Subjects. Safety Process Instrumentation Materials Handling Utilities Quality Yields, Economics Process Technology Process Description Risk Analysis
Sept. 30, 1968	Review and Discussion of Previous Subjects Communication Follow Process Flow in Field Materials Handling Records Equipment Repairs Check-out on Preparation for Operator Training Risk Analysis Review Preparation for Water Batching Materials Handling

TOWOLDMON0045085

MASTER TRAINING SCHEDULE

Shift Supervision

Week Beginning	Subject
Sept. 9, 1968	1. Introduction to Key Personnel H. Ray - Manufacturing Representative and Dept. Supv. R. Yates - Project Manager (C.E.D.) J. Molloy - Production Superintendent V. Brawley -Dept. Foreman R. Cederstrom - CED Construction Supt. 2. General Indoctrination Introduction to Aroclor How it is made Uses 3. Dept. Tour Existing Equipment New Equipment 4. Dept. Organization Salaried: Supervisor, Foreman Hourly: Relief Foreman, Premium Oper., Still Oper., Second Oper., Standard Oper., Repairman, Porter 5. Security of Information Reason for Security 6. Process Technology a. Batch b. Continuous
Sept. 16, 1968	1. Review and Discussion of First Week 2. Introduction to Training Subjects to be Covered Trainers 3. Assignments, Responsibilities and Authority Assignments - shift coverage of entire dept. making flow sheets, completing IFO's, devise data sheets, etc. Responsibilities - Supervise safe running of equipment by hourly personnel, produce scheduled pounds of quality material as outlined in the Start-up Objectives.

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MASTER TRAINING SCHEDULE (cont'd)

Shift Supervision (cont'd)

Week Beginning	Subject
Sept. 16, 1968	3. cont'd. Authority - Overall direction of all operators and operations. Make decisions on process changes for safe operations and quality material. Have equipment maintained on shifts and weekends.
	4. Process equipment and control limits. Explanations of the function of each piece of equipment and safe limits of each. Make flow sheets for operator training.
	5. Process Instrumentation V.B. - Explain instrumentation on existing equip L.V. - Explain instrumentation on new equip. Complete IFO's on new equip.
	6. Process Technology
	7. Operating Instructions of existing equipment. Read & discuss Operating Instructions.
	8. Assignments for Operator Training Brawley - Biphenyl and catalyst mix tank. Sp. Gr. controller. Craine - All chlorinators and Intermediate Storage Tank. Athmer - 3 Blow tanks, 4 stills, therminol system. Cook - All still receivers, surge tanks, blend tanks, absorbers, finish product tanks and power factor analyzer.
Sept. 23, 1968	1. Review and discussion of previous subjects.
	2. Safety General Dept. safety, clean-up and housekeeping. Plant disaster plan for plant and dept. location and use of safety showers, fire extinguishers, gas masks, Scott air pak, emergency clothing, stretcher, fire alarm and eye protection.

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MASTER TRAINING SCHEDULE (cont'd)

Shift Supervision (cont'd)

Week Beginning	Subject
Sept. 23, 1968	2. cont'd. List safety devices for new equipment. List all grounding points in existing and new equipment. Hold Safety Review for project. 3. Process Instrumentation Complete writing IFO's. 4. Materials Handling Cover all chemicals used in dept., toxicity consistency, special precautions. Use "Standard Manufacturing Process" for existing dept. Sample raw materials for identification. 5. Utilities

Utility	Line Location and Shut-Off
Plant Air	Ground Floor at Catch Pot.
Inst. Air	Ground floor north of air dryers.
80# Steam	High-line - Dept. 254
200# Steam	" " " "
City Water	Next to roadway, south of water tank.
Natural Gas	Ground floor, north of sprinkler house.

6. Quality
   Review Spec Sheets
   List most critical properties
   List frequent problems and solutions
   Discuss sampling.

   List sample needs on start-up.

7. Yields, Economics
   Review 1969 Cost Standard (Start-up)
   Process yield loss points
   Blends
8. Process technology
   Read and discuss tentative process for continuous unit.

9. Process Description
   Read and discuss process description of new equipment.

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MASTER TRAINING SCHEDULE (cont'd)

Shift Supervision (cont'd)

Week Beginning		Subject
Sept. 23, 1968	10.	Risk Analysis Read and discuss risk analysis for start-up of new equipment.
Sept. 30, 1968	1.	Review and discussion of previous subjects
	2.	Communications Verbal Written
	3.	Follow process flow in field. Trace all process lines in existing and new equipment. Check out all instruments
	4.	Material Handling Explain trailer, car and drum loading. How to inspect each.
	5.	Records Make new data sheets for gathering information on start-up. Also determine where samples are to be taken, how many, what size and frequency.
	6.	Equipment Repairs Discuss equipment repairs that must be made soon as possible and what equipment can wait until next day. Also discuss how to contact necessary crafts on nights and weekends.
	7.	Check-out on preparation for operating training. Make certain each man is prepared to train, knows when to train and knows who he must train.
	8.	Risk analysis review Review risk analysis so possibly problems and possible solutions are discussed and known.
	9.	Preparation for water-batching Make final check on equipment. Discuss what material will be used for water-batching, how it will be transferred and what will be done with material after water batching. Check inventory of material carefully.

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B. Premium Operator

Week Beginning	Subject
Sept. 30, 1968	Water-batch Biphenyl/catalyst mix tank Check-out instrumentation on BiØ/catalyst mix tank. Water-batch #6 through #9 chlorinators. Check-out instrumentation on all chlorinators. Check-out instrumentation on intermediate storage tank. Check-out panel alarms and instruments. Trouble Shooting Equipment Failure Sampling Data Sheets

1. Water-batch Biphenyl/catalyst mix tank.
   Fill mix tank with 1242 Aroclor. Circulate to check-out line and pump.

2. Check-out instrumentation in Biphenyl/catalyst mix tank.
   Check-out all instrumentation in field and on panel board, including timer.

3. Water-batch #6 chlorinator
   Fill #6 chlorinator with 1242 Aroclor. Circulate to check out line and pump.

4. Check-out instrumentation on #6 chlorinator.
   Check-out all instruments in field and on panel board.

Oct. 1, 1968

1. Water-batch #7, 8 and 9 chlorinators.
   Check-out all instruments in field and on panel board, giving special attention to the specific gravity controller.

Oct. 2, 1968

1. Check-out instrumentation on intermediate storage tank.
   Check-out all instruments in field and on panel board.

2. Check-out panel alarms and instrument control points.
   Discuss each alarm on panel board stating problems and corrections. Discuss settings and control points on instruments.

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B. Premium Operator

Week Beginning	Subject
Oct. 3, 1968	1. Equipment failure Discuss equipment failure and power failure.
	2. Sampling Discuss sampling frequency, size bottles, reason for and necessary analysis.
	3. Data Sheets Discuss record data sheets, what data is needed, how to record and what it should mean to operations.
	4. Check-out HCl line to condenser and drowning jet. Check-out valve line-up from each chlorinator to the HCl condenser and to the new drowning jet.
	5. Check-out chlorine lines Check-out lines and instrumentation for chlorine addition to each chlorinator.
Oct. 4, 1968	1. Review and discuss all equipment and training.

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Aroclor Expansion (CEA-1800)

Training Program

C. Still Operator

Content

1. General Indoctrination
2. Dept. Organization
3. Introduction to Personnel
4. Dept. Tour
5. Security of Information
6. Safety and Housekeeping
7. Introduction to Training
8. Classroom Training
9. Field Training
10. Materials Handling
11. Quality
12. Sampling
13. Instrumentation
14. Trouble Shooting
15. Recording Data
16. Plant Disaster Plan
17. Discussion

TOWOLDMON0045092

C. Still Operator

1st Week	General Indoctrination Dept. Organization Introduction to Personnel Dept. Tour Security of Information Safety and Housekeeping Introduction to Training Train on Existing Equipment
2nd Week Monday	Review Training of Previous Week Materials Handling Quality Sampling Classroom Training on function of equipment
Tuesday	Field training for location of equipment, lines and process flow.
Wednesday	Field training for location of instruments Classroom training for function of instruments
Thursday	Field training on complete operation of continuous blow tank. " " " " still operations " " " " therminol system
Friday	Field training on receivers 3 and 4, surge tanks 3&4, All 4 porocel absorbers both Power Factor Analyzers and finish product tanks 3 and 4.
3rd Week Monday	Review and discussion of previous training. Safety, plant disaster plans. Field train on rework and transfer lines. Field train on therminol system.
Tuesday	Field training on complete process flow on all 4 still systems.
Wednesday	Review instrumentation and panel board. Trouble shooting and discussion on equipment failure.
Thursday	Review record sheets, how to fill out, where to get readings and samples. Run #1 and #2 stills.
Friday	Open discussion of all equipment and training. Final check-out in field of any problem or questionable areas.

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TOWOLDMON0045093

C. Still Operator

1st Week

1. General Indoctrination
   Introduction to Aroclor, areas of responsibilities, plant and dept. procedures.

2. Department organization

Salaried	Hourly
H. Ray - Dept. Supv.	Premium Operator
J. Molloy - Prod. Supt.	Still Operator
V. Brawley - Foreman	Second Operator
J. Cagle - "	Standard Operator
T. Athmer - "	Repairman
G. Craine - "	Porter
V. Cook - "	
G. Schwartztrauber- Cost Analyst	

3. Introduction to personnel

4. Dept. tour
   Existing Equipment
   New Equipment

5. Security of information
   Reason for security

6. Safety and Housekeeping
   Discuss dept. safety record, eye protection, safe working habits. Location and use of emergency equipment & how to turn in fire alarm.
   Discuss housekeeping expected.

7. Introduction to training
   Discuss briefly how training will be done, subjects to be covered and probable timing.

8. Train on existing equipment
   Actual training with Premium Operator on existing blow tanks, preheater, stills 1 and 2, jets, receivers, blend and finish product tanks, city water tank and pumps.

2nd Week
Monday

1. Review training of previous week.
   Discussion of Stills 1 and 2

2. Materials Handling
   Discuss all chemicals used on immediate job in respect to toxicity, consistency, special precautions.

3. Quality
   Review spec sheets and discuss how the operation will affect the material specifications.

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C. Still Operator

2nd Week
Monday (cont'd)

4. Sampling
   Discuss sampling. Importance of good samples and how to sample.

5. Classroom training on function of equipment.
   Chalk talk on function of new equipment and safe limits of each.

Tuesday

1. Field training for location of equipment, lines and process flow.
   Identify new equipment, trace out all connecting lines and follow process flow.

Wednesday

1. Field training for location of instruments
   Locate instrumentation in the field and identify its function.

2. Classroom training for function of instruments.
   Chalk talk on function and operation of instruments.

Thursday

1. Field training on complete operation of continuous blow tank. Dry-run complete operation of the continuous blow tank.

2. Field training on complete operation of #3 & #4 still operations.
   Dry-run complete operation of Stills 3 & 4.

3. Field training on complete Therminol system.
   Dry-run complete operation of therminol system.

Friday

1. Field train on receivers 3 & 4, surge tanks 3 & 4, all 4 porocel absorbers, both power factor analyzers and finish product tanks 3 & 4.

   Dry-run complete operation of the above equipment.

3rd Week
Monday

1. Review and discussion of previous training.
   Review and discussion of all equipment.

2. Safety and Plant Disaster Plan.
   Discussion of all safety devices including therminol unit.
   Review of the Plant Disaster Plan.

3. Field train on rework and transfer lines.
   Trace all connecting process lines so necessary transfers can be made. Also locate all valves in lines.

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C. Still Operator

3rd Week

Monday (cont'd)

4. Field train on Therminol system.
   Final check-out on Therminol system.

Tuesday

1. Field train on complete process flow on all 4 still systems.

   Dry-run complete operations of all 4 still systems.

Wednesday

1. Review instrumentation and panel board.
   Discussion of panel alarms and how to correct problems. Also demonstrate how to change charts.

2. Trouble shooting and discussion on equipment failure.
   Discuss how to correct problems indicated on instruments on panel board and in field. Discuss in detail, equipment failure and power failure.

Thursday

1. Review record data sheets, how to fill out, where to take readings and samples.
   Discuss record data sheets so each operator will know what data is needed and how data should be recorded. Also where readings are to be taken from and what they should mean to operations.

2. Run Stills #1 and #2.
   Run existing Stills 1 and 2 at direction of Premium Operator.

Friday

1. Open discussion of all equipment and training.
   Question, answer and discussion of any or all subjects.
2. Final check-out in field of any problem or questionable areas.
   Make final check-out in field, of previous known problem areas of equipment.

TOWOLDMON0045096

C. Still Operator

3rd Week (Alternate Plan)

Monday	Review and discussion of previous training Water batch & simulate continuous blow tank operation. Water batch & simulate #3 Still operation, #3 Receiver, Surge tank, then Finish Product Tank.
Tuesday	Water batch & simulate #4 still operation, #4 Receiver, Surge tank, then Finish Product tank. Trouble shoot during simulation.
Wednesday	Water batch & simulate Therminol system operation Pack all Porocel absorbers.
Thursday	Review record sheets, how to fill out, where to get readings & samples. Review instrumentation on panel board Field train on rework and transfer lines. Discuss equipment and power failure. Discuss polishing filters on absorber lines.
Friday	Open discussion of all equipment and training. Final check-out in field of any problem or questionable areas.

C. Still Operator

3rd Week (Alternate Plan)

Monday

1. Review and discuss previous training.
2. Water batch and simulate continuous blow tank operation.
   Fill continuous blow tank with 1242 Aroclor and simulate actual operation, pumping material to #3 still pot.
3. Simulate actual operation of #3 still line.
   Circulate material in #3 still pot, check-out all possible instrumentation, then move material to #3 receiver, surge tank, and finish product tank.

Tuesday

1. Simulate actual operation of #4 still line.
   Circulate material in #4 still pot, check out all possible instrumentation, then move material to #4 receiver, surge tank, and finish product tank.
2. Trouble shoot during simulation.
   Trouble shoot in each possible area to learn possible problems and corrective action needed.

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C. Still Operator

3rd Week (Alternate Plan) - cont'd

Wednesday

1. Water-batch and simulate Therminol system operation.
   Fill Therminol surge tank with 1242 Aroclor and simulate actual operation, checking out instrumentation and trouble shoot to learn possible problems and corrective action needed.

2. Pack Porocel absorbers.
   Fill absorbers with Porocel.

Thursday

1. Review record sheets, how to fill out, where to get readings and samples.
   Review record sheets, discussing what information is needed and what value the readings should be to the operator and why it is necessary to record it. Also discuss sampling, where to get samples and what is to be done with them.

2. Review instrumentation on panel board.
   Final check-out on panel board.

3. Field train on rework and transfer lines.

4. Discuss equipment failure and power failure.
   Discuss what is expected to happen if any equipment should fail and necessary action to be taken.

   Discuss what will happen to equipment if the power fails and what are the most critical operation to be performed after failure.

5. Discuss polishing filters on absorber lines.
   Discuss polishing filters, purpose, and actual change of cartridges and gasket.

Friday

1. Open discussion of all equipment and training.

2. Final check-out in field of any problem or questionable areas.

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CEA-1800 - AROCLOR EXPANSION - WGK

Start-Up Plans

PROJECT SCHEDULE

In order to demonstrate the expanded Aroclor facilities at WGK while adhering to the requirements outlined in the start-up objectives, Phase II will be completed on the following construction schedule.

Phase II Area	Construction Completion Date
A. Off-gas Purification System	9/4
B. Chlorinator Area (catalyst mix tank thru continuous blow tank)	9/30
C. Therminol System	10/14
D. #3 Still System and #1 Absorber (1242 Line)	10/21
E. #4 Still System and #2 and 3 Absorbers (1248/1254 line)	11/4
F. #4 Absorber (1260 line)	11/11
G. Anniston Duplication	11/18 thru 12/1 (Demonstration)

PROJECT DEMONSTRATION

A. Off-Gas Purification System - This system was activated on 9/4 due to earlier failure of the existing department purification system. The equipment was thoroughly checked out prior to start-up and as a result no operating difficulties were incurred. The only aspect of the system not yet demonstrated is utilization of the material recovered from the off-gas in production of non-electric Aroclor. This will be completed as soon as sufficient material has accumulated.

B. Chlorinator Area - Process simulation will be accomplished using Aroclor 1242. Chlorination control in the continuous line will be checked out by chlorinating the 1242 to 1148. Catalyst addition effectiveness will be measured by allowing an Aroclor 1242/catalyst mix to cascade thru the system.

When the above operations have been checked-out (1 week maximum) the continuous chlorinator line will be brought on-stream to produce Aroclor 1142. This material will be collected in the intermediate storage tank brine which it will either be transferred to the existing #1 and #2 blow tanks for future processing to Aroclor 1242, or else transferred to the batch chlorinator head tank for further chlorination.

C. Therminol System - This system will be charged with Aroclor 1248 from the department storage tanks. The entire therminol control system can be demonstrated prior to start-up of the stills.

Start-Up Plans

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PROJECT DEMONSTRATION (continued)

D. #3 Still System and #1 Absorber (1242 line) - This line will be simulated using Aroclor 1242. Complete checkout of the system excepting effectiveness of tie-up of residual HCl and ferric chloride with lime will be possible prior to actual start-up on Crude 1142. Demonstration of this system will allow production of Aroclor 1242 and one other Aroclor simultaneously. Only the 1242 will be upgraded in the Porocel columns at this point; however.

E. #4 Still Area and #2 and 3 Absorbers (1248/1254 line) - This line will be checked out similar to the procedure outlined in Section D. Start-up of this system will allow demonstration of the 40 M #/yr. Aroclor 1242 design rate as well as the effect of porocel treatment on Aroclors 1248 and 1254.

F. #4 Absorber (1260 line) - This line will be checked out with Aroclor 1242 prior to start-up. Start-up of this system will allow demonstration of the effect of porocel treatment on Aroclor 1260.

G. Anniston Duplication - Start-up of Item F completes demonstration of the design premises outlined in the CEA-1800 scope report. The final item to be demonstrated in the start-up objectives is duplication of Anniston production. Process conditions will be modified at this time to conform with those at Anniston in attempt to duplicate this production and allow shipment to any customer from both plants.

Prepared by: H. F. Ray

ghw

cc: Messrs. R. S. Yates
C. W. Hamlet
R. Kuster
J. W. Molloy
V. Brawley
J. Cagle
T. Athmer
V. Cook
G. Craine
R. Cederstrom

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TOWOLDMON0045100

Esso

W. G. Krummrich Plant
Sauget, Illinois

August 22, 1968

Aroclor Expansion - WGK (CEA 1800)
Risk Analysis

To:

D. C. Armstrong - WGK		H. S. Bergen	- G.O.
V. Brawley	- WGK	D. B. Hosmer	- G.O.
M. S. Feld	- WGK	R. E. Howard	- G.O.
T. E. Greenman	- WGK	R. M. Kountz	- G.O.
C. W. Hamlet	- WGK	W. A. Kuhn	- G.O.
J. R. McClain	- WGK	R. J. Stratmeyer	- G.O.
R. M. McCutchan	- WGK		
J. W. Molloy	- WGK	M. E. Gibbs	- 2nd St.
P. Verna	- WGK	R. H. Munch	- 2nd St.

Attached are the Aroclor Expansion - WGK (CEA 1800) Risk Analysis Data Sheets indicating the major and minor risk considerations in this start up. Considerable preventive action has been taken to minimize the risk involved in the major problem areas.

If there are questions concerning this analysis or any of the risks indicated, do not hesitate to contact the appropriate representative of CED, Research (PR&D) or Manufacturing.

Risk Analysis

H. F. Ray
Mfg. Rep.

R. S. Yates
Proj. Mgr.

ap

Attachments:

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TOWOLDMON0045101

Specific Potential Problems

	Threat.		
	Probability	Seriousness	Total
1. Raw Materials Received			
a. Biphenyl			
1) Variation in quality	60	3	180
a) Moisture contaminated	30	1	30
b) Impurity level	50	9	450
2) Availability	10	10	100
b. Chlorine Snift Gas			
1) Variation in quality	100	9	900
a) Impurity level (Bromine)	100	9	900
b) Sulfuric Acid content	5	9	45
2) Availability	10	10	100
c. $FeCl_3$			
1) Particle size too large or too small	5	5	25
2) Moisture contamination	5	10	50
3) Availability	10	10	100
d. Lime			
1) Availability	5	10	50
2) Moisture contamination	5	2	10
e. Porocel			
1) Availability	5	10	50
2) Moisture contamination	5	9	45
3) Particle size too large or too small	10	5	50
2. Raw Materials In Storage			
a. Biphenyl			
1) Moisture contamination	10	10	100
2) Storage tank freeze-up	10	3	30

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TOWOLDMON0045102

	Threat Probability	Seriousness	Total
3. Chlorinator Area			
a. $FeCl_3$ Mix Tank			
1) Inadequate catalyst supply to #6 chlorinator	5	10	50
b. Chlorinators			
1) Unstable product	20	10	200
2) Crude 1142 out-of-spec on Sp. Gr.	20	10	200
3) Inadequate biphenyl feed to #6 chlorinator	10	10	100
4) Inadequate temperature control	10	3	30
c. Intermediate Storage Tank			
1) Cannot feed stills or head tank	10	3	30
2) Cannot maintain proper aging temperature	10	6	60
3) HCl emissions	20	8	160
d. Blow Tank			
1) Cannot feed stills at required rate	10	8	80
2) Cannot control level in tank	10	8	80
3) HCl emissions	20	8	160
4) HCl is not removed to desired level	10	2	20
e. Off-gas system			
1) Cannot control off-gas temperature	10	5	50
2) Drowning jet will not handle full HCl load	10	8	80
3) High back pressure	10	9	90
4) Water in HCl off-gas	10	10	100

TOWOLDMON0045103

	Threat		
	Probability	Seriousness	Total
4. Stills			
1) Erosion and/or pluggage of reboiler tubes	30	10	300
2) Cannot maintain vacuum	10	10	100
3) Cannot meet forward flow color spec.	10	10	100
4) Cannot control temperature	10	8	80
5. Absorbers			
1) Cannot meet electrical property specs	20	10	200
2) Cannot feed desired rate thru absorber	10	10	100
3) Cannot meet free chloride spec	10	10	100
6. Therminol Furnace			
1) Coil failure	10	10	100
2) Cannot provide adequate heat for stills	10	10	100
7. Housekeeping			
1) Unable to achieve acceptable level	10	8	80

0053585

TOWOLDMON0045104

Aroclor Expansion (CEA 1800)

Risk Analysis Worksheet

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
1. Raw Matls. Recd. a. Biphenyl 1) Variation in quality	1. Anniston operation variances. 2. Tank car coil failure	1. Accept risk 2. Sample every car	1. Review quality variation with Anniston	Lab identifies off-spec material
2) Availability	1. Anniston production outage 2. Rail Strike 3. Coil failure in Associated Sales Stg.Tk.	1. Accept Risk 2. Hold Associated Sales & Dept. Stg. Tks. at least 80% full.	1. Transfer Associated Sales Matl. to WGK. 2. Notify Anniston of low Biphenyl level.	Daily Inventory Sheet indicates quantity on hand below 600M#
b. Chlorine Snift Gas 1) Variation in quality	Chlorine Dept. operation variances	1. Monitor bromine content of KCL shipments. 2. Monitor number of DeNora cells on KOH. 3. Sample snift gas chlorine supply weekly.	Raise chlorination temperature to 195°C.	1. High bromine content in KCL 2. High bromine content in Cl_2 gas
2) Availability	Chlorine Dept. outage	1. Accept Risk 2. Obtain priority to use revaporized chlorine.	Accept risk	1. Notification of scheduled chlorine Dept. outage. 2. Low chlorine supply pressure

0053586

TOWOLDMON0045105

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
3. Chlorinator Area a. $FeCl_3$ Mix Tk. 1. Inadequate catalyst supply to #6 chlorinator	1. System pluggage 2. Circulating pump failure 3. Agitator failure 4. Steam heating system failure 5. Mix tank is empty 6. Catalyst flow controller failure	1. Sightglass provided 2. Motors alarmed 3. Temperature indicated in field 4. Level recorded on panel 5. Catalyst flow timer on panel 6. Catalyst feed valve alarm for abnormal position	1. Accept Risk 2. Manually add catalyst to each chlorinator	Lab identifies unstable product
b. Chlorinators 1) Unstable product	1. Catalyst doesn't carry thru chlors. 2. Inadequate catalyst feed to #6 chlorinator 3. Chlorination temp. too low. 4. High bromine content in chlorine supply. 5. Vapor phase chlorination 6. Sulfuric acid in chlorine supply 7. Circulating pump failure	1. Accept Risk 2. a) Catalyst tank level recorded on panel. b) Catalyst flow timer on panel c) Catalyst feed valve alarm for abnormal position d) Catalyst tank agitator & pump motors alarmed.	1. Spare catalyst addition nozzles provided on each chlorinator. 2. Accept Risk 3. " " 4. Raise chlorination temperature to 195°C 5. Raise overflow level in chlorinators to decrease vapor space. 6. Accept Risk 7. " "	Lab analysis indicates off-spec material.

005387

TOWOLDMON0045106

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
b. Chlorinators (Contd.)	8. Technology inadequate to meet corporate goals. 9. Continuous chlorination technology inadequate to meet specification on stability.	2. e) Sightglass in catalyst circulating loop. 3. Chlorinator temperature recorded & alarmed on panel 4. a) Monitor DeNora cells on KoH b) Monitor KCL Bromide Content c) Monitor bromine content of chlorine supply. 5. Accept Risk 6. Brink mist eliminators in chlorine supply line. 7. Motors alarmed. 8. Accept Risk 9. Continuous chlorination demonstrated at Anniston	8. Lab distill crude & analyze results. 9. Initiate PR&D work to improve technology. 10. All the above.	
2) Crude 1142 out of spec on sp.gr.	1. Chlorine feed in each chlorinator too high or too low. 2. Density control system failure on #9 chlorinator	1. Flow recorded on panel. 2. Accept Risk 3. Flow recorded on panel. Low flow alarm.	1. Regulate flow manually 2. Run sp.gr. manually 3. Regulate flow manually 4. Regulate level manually	Operator analysis indicates off-spec material.

0053588

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
b. Chlorinators (Contd.)	3. Biphenyl feed rate to #6 Chlorinator too high or too low. 4. Level controller failure on #9 chlorinator. 5. Circulating pump failure	4. Intermediate Stg. Tk. level recorded on panel. Hi/Lo level alarm on Int. Stg. #9 Chlor. 5. Motors alarmed. 6. Operator will routinely analyze each chlorinator every two hrs.	5. Accept Risk 6. Have instrumentation system checked for repair. 7. Redesign Sp.Gr. control system if not adequate.	
3) Inadequate Biphenyl feed to #6 chlorinator	1. Biphenyl feed pump failure 2. Line pluggage 3. Flow controller failure 4. Feed tank empty 5. Rate of charging $FeCl_3$ mix & head tanks is too high	1. Motor alarmed 2. Stg. tank temperature recorded on panel 3. Flow indicating controller on panel and at $FeCl_3$ mix & head tanks. Lo flow alarm. 4. Daily inventory.	Use Biphenyl transfer pump to feed #6 chlorinator	Biphenyl flow recorder indicates low/high flow. Lo flow alarms.
4) Inadequate temperature control	1. Circulating pump failure 2. Temperature controller failure 3. Line pluggages 4. Air cooled heat exchanger fan speed too fast or too slow. 5. Too many or too few air cooler louvres attached to controller	1. Motors alarmed 2. Hi/Lo temperature alarms 3. Temperature recorded on panel 4. Two speed fans provided 5. High temperature chlorine shutdown. 6. Low temperature fan shutdown 7. Chlorine flow recorded on panel	1. Adjust number of louvres attached to controller. 2. Change chlorine flow rates 3. Accept Risk	Temperature recorder indicates temperature too high/low.

0053589

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
b. Chlorinators (Contd.) 4) Inadequate temp. cont.	6. Chlorine flow is too high or too low. 7. Sulfuric acid in Chlorine supply			
4. Stills 1) Erosion and/or pluggage of reboiler tubes	1. Lime-catalyst slurry at high velocities 2. Tube diameter 3. Circulating pump failure	1. Accept Risk 2. Accept Risk 3. Motor alarmed	1. Set up spare heat exchanger 2. Drill out tubes 3. Set up spare pump 4. Increase pump impeller size	High pluggage frequency Tube failures
2) Cannot maintain vacuum	1. Vacuum jet failure 2. Pressure controller failure. 3. System leaks 4. Receiver level too high or tank is empty 5. Condenser freeze-up 6. Receiver pump packing leakage 7. Vacuum line pluggage 8. High level in catch tanks	1. Spare jet provided 2. Set up spare parts Pressure gauges provided 3. Accept Risk 4. Hi & Lo level alarms provided 5. Sightglass in forward flow line. Forward flow temperature recorded 6. Accept Risk 7. Accept Risk 8. Level gauge provided	1. Change to spare jet 2. Repair controller 3. Repair leaks 4. Isolate problem & resolve 5. Raise cooling water temperature 6. Repack pump 7. Clean-out lines 8. Drain tanks	Vacuum recorder indicates poor vacuum

0053590

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
3) Cannot meet forward flow color spec.	1. Entrainment separator run back line plugged 2. Inadequate lime in still	1. Sight glass provided 2. Record lime charge. Feed integrator alarm on panel	1. Clean out line 2. Re-lime still Modify re-lime frequency	Lab analysis indicates off-spec product
5. Absorbers 1) Cannot meet electrical property specs.	1. Treating temperature too high 2. Packing is wet 3. Clean-up filter not removing porocel particles 4. In line analyzer malfunctioning 5. Packing is shot	1. Column feed temperature controller backed up with temperature recorder. 2. Analyze packing for moisture prior to column start up 3. Accept Risk 4. Accept Risk 5. In-line analyzer provided	1. Manually control temperature. 2. Dry packing with nitrogen prior to start-up. 3. Modify filter and/or change cartridge micron retention size. Change absorber support screen size 4. Check results in laboratory 5. Change packing	Lab analysis indicates off-spec material
2) Cannot feed desired rate thru absorbers	1. Treating temp. too low-high viscosity 2. Pilot plant s scale-up wrong 3. Pumps undersized 4. Packing charge-out time too long. Low on stream time.	1. See #1 above. 2. Accept Risk 3. Accept Risk 4. Absorbers flexibly piped up	1. Raise treating temp. to reduce viscosity. May also need to change electrical property specs. 2. Run more than one absorber at a time 3. Change pumps 4. Install spare absorber	Flow controller indicates below design feed rate Low on stream time

00533591

TOWOLDMON0045110

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
3) Cannot meet free chloride spec.	1. Bad Porocel 2. Clean-up filter leaking thru	1. Accept Risk 2. " "	1. Change packing 2. Change cartridges	Lab analysis indicates off-spec material
6. Therminol Furnace				
1) Coil Failure	1. Flame safeguard system failure 2. Air pockets in coil 3. Therminol degradation products	1. Set up spare coil. 2. Fill system under vacuum 3. Analyze therminol monthly	1. Changeout coil 2. Accept Risk 3. Replace Therminol	Coil leakage Lab analysis indicates off-spec FR-2
2) Cannot provide adequate heat for stills	1. Therminol feed pump failure 2. Low gas pressure 3. Line pluggage 4. Flow controller failure 5. Furnace undersized	1. Motor alarmed. Flow recorded on panel. 2. Low gas pressure shutdown. Pressure gauges in field 3. Low flow alarm 4. Accept Risk 5. " "	1. Changeout pump 2. Notify utilities dept. 3. Isolate problem & resolve 4. Repair controller 5. Install still feed preheater	Cannot obtain 25M#/yr. still rate
7. Housekeeping 1) Unable to achieve acceptable level	1. Processing problems 2. Inadequate workforce	1. All pumps except for one on ground level. Drain pans provided for each pump 2. Trench sewers provided on ground level 3. Ground level curbed & floor sloped to trenches 4. Open structure design 5. Equipment layed-out with housekeeping problems in mind.	1. Accept Risk 2. Modify Facilities	Low ratings in housekeeping inspections

0053592

Potential Problems	Likely Causes	Prevention Take Preventive Action or Accept Risk	Protection Set Contingent Action or Accept Risk	Provide for Information Trigger Contingent
7. Housekeeping (Contd.)		6. Dumpster ramp for changing absorber packing provided 7. Provision made for draining transfer lines, sample points & catch tanks into drums 8. HCl emission sources tied into drowning jet 9. Housekeeping time alloted in work-force study 10. Complete utility stations located at critical points		

0053593

Monsanto

FROM (NAME & LOCATION) Sauget, Ill.

June 27, 1968

cc: Messrs. J. R. McClain
J. W. Molloy
R. D. Williams
R. S. Yates
R. M. Kountz

SUBJECT: Start-up Expense Budget for Aroclor Expansion Project (CEA 1800)

REFERENCE

TO: Mr. W. A. Kuhn (2)
General Offices

Attached for your approval is the Start-up Expense Budget for the Aroclor Expansion Project including estimates of Preparation Expense and Operation Expense. These estimates have been prepared to conform to policy given in Controller's Bulletin 12-06 and Organic Division Bulletin No. OA 5-1.

The totals for Preparation Expense and Operation Expense are summarized below.

Preparation Expense	- $82,000
Operation Expense	- $33,000
Total Start-up Expense	-$115,000

The total start-up Expense of $115,000 is approximately 7½% of the estimated capital provided on CEA 1800 for this project. The basis for the timing of the start-up is Revision No. 5 of the Master Project Schedule dated 5/20/68.

The attached pages give a detailed break-down of expense estimates by type and an estimate basis for major expense items.

Service Account Number 916.55 will be used to collect Preparation Expense charges. These charges will be closed out to the division start-up account (715.00) monthly.

Starting in July, a variance report comparing actual start-up expenses with budget will be sent to you monthly.

H. F. Ray

Mfg. Representative

Start-Up Budget

ghw

Approval J. W. Molloy
J. W. Molloy

7/68 C. E. Anagnostopoulos
K. K. Smith

0053594

IN 10 REV 11-65

TOWOLDMON0045113

Preparation Expense Budget

Aroclor Expansion (CEA 1800)

Job No. 916.55

Budget Item	Totals	3rd Qtr. 1967	4th Qtr. 1967	1st Qtr. 1968	Phase I June 1968	2nd Qtr. 1968	Phase I July 1968	Phase I Aug. 1968	Phase II Sept. 1968	3rd Qtr. 1968	Phase II Oct. 1968	4th Qtr. 1968
Factory Expense												
Chemicals (505)	7,000	0	0	0	0	0	0	0	0	0	7000	7000
Utilities	5,150	0	0	0	1000	1000	1000	0	0	1000	3150	3150
Mfg. Wages (570)	5,790	0	0	0	100	100	965	0	0	965	4725	4725
Mfg. OH (578)	810	0	0	0	15	15	140	0	0	140	655	655
Salaries (575)	16,450	600	900	1500	1200	2200	1200	1650	4200	7050	4200	5200
Salaries OH (578)	2,950	100	150	250	200	350	200	300	650	1150	650	300
Factory Supplies (590)	8,000	0	0	0	0	0	1000	2000	3000	6000	2000	2000
Laboratory (610)	3,300	0	0	0	0	0	1000	1000	1300	3300	0	0
Clothing & Laundry (614)	2,900	0	0	0	0	0	100	0	0	100	2800	2800
Safety Equipment (613)	400	0	0	0	0	0	100	0	100	200	200	200
TSD (621)	3,000	0	0	500	500	500	1000	0	1000	2000	0	0
Mech.Expense (694)	20,000	0	0	0	0	0	1000	1000	8000	10000	10000	10000
Sub-Total -	75,750											
Other Expense												
Vendor Fees (715)	5,000	0	0	0	0	0	0	1000	1000	2000	3000	3000
Meetings (798)	1,000	0	0	0	0	0	0	0	500	500	500	500
Office Supplies (864)	250	0	0	0	0	0	100	0	100	200	50	50
Sub-Total -	6,250											
TOTAL -	82,000											

0053595

Estimated Preparation Expense
for
Aroclor Expansion (CEA 1800)
Job No. 916.55

1. Chemicals — $7,000

Phase I

Since only storage tanks and associated equipment are involved, it is anticipated no start-up cost for chemicals will be incurred. $0

Phase II

Process simulation on new process equipment using Aroclor 1242 -10,000G. @ $0.70/gal. $7,000

2. Utilities — $5,150

Phase I

	6/68	7/68
Steam @ 15% Std. -	$900	$900
Electricity @ 10% Std. -	$100	$100
	$1000	$1000

Phase II

	10/68
Steam @ 40% Std. -	$2500
Electricity @ 25% -	250
Purchased Water @ 50% Std.	$400
	$3150

3. Mfg. Wages — $5,790

Phase I	No.	Rate	Hours		Cost
Repairman	2	3.705	24		90
Second Operator	5	3.540	180		635
Std. Operator	2	3.405	48		165
Swingman	1	3.855	12		45
					935
Vac. & Hol. @ 12.824% -					130
					$1065
Phase II					
Premium Operator	4	3.660	240		880
Still Operator	4	3.620	480	(1)	1735
Second Operator	4	3.540	48		170
Swingman	1	3.855	60		230
Swingman	1	3.620	320	(1)	1160
					$4175
Vac. & Hol. @ 12.824% -					550
					$4725

(1) New classifications. Will receive training on straight time. All others are regular department personnel and will be trained on overtime.

4. Mfg. Wages O.H. (13.993%) — $810

TOWOLDMON0045115

5.	Salaries (Training, Start-up Planning, Preparation for Start-up)	$16,450
	Phase I	
	a. Mfg. Representative $300/mo. - 8/67 thru 12/67, $500/mo. 1/68 thru 8/68 -	$5,500
	b. Production Supervisor $250/mo. 6/68 thru 8/68	$750
	c. Production Foreman $450/mo. 6/68 thru 7/68	$900
		$7,150
	Phase II	
	a. Mfg. Representative $500/mo. 9/68 thru 10/68	$1,000
	b. Start-up Foreman $900/mo. 8/68 thru 10/68	$2,700
	c. Production Supervisor $250/mo. 9/68 thru 10/68	$500
	d. Shift Supervision 3 men $850/mo. 9/68 thru 10/68	$5,100
		$9,300
6.	Salaries OH (17.75%)	$2,950
7.	Factory Supplies a) Housekeeping Equipment b) Safety Signs c) Equipment Tags d) Safety Equipment e) Laboratory Equipment f) Miscellaneous Start-up Supplies	$8,000
8.	Laboratory a) Develop routine methods for electrical property measurement based on Organic Research Work. b) Analyst Training	$3,300
9.	Clothing & Laundry (5% of Wages)	$2,900
10.	Safety Equipment	$400
11.	Technical Services a) Training Assistance b) Materials Engineer c) IFO Review	$3,000

TOWOLDMON0045116

12. Mechanical Expense — $20,000

Phase I -	$ 2,000
Phase II -	$18,000
	$20,000

Includes:

a) Equipment, Instrument and Electrical checkout prior to start-up (beyond nominal service provided by Engineering).

b) Alterations to equipment prior to and during process simulation (water batching).

c) Maintenance coverage during start-up.

13. Vendor Fees — $5,000

14. Meetings — $1,000

15. Office Supplies — $250
$50/mo. - 6/8 thru 10/68

Total - $82,000

TOWOLDMON0045117

Operation Expense Budget

Aroclor Expansion

(Over-and-Above Standard)

Budget Items	Totals	Phase I Aug.'68	Phase I Sept.'68	3rd Qtr. '68	Phase I Oct.'68	Phase II Nov.'68	Phase II Dec. '68	4th Qtr. 1968
Utilities	3,000	1000	1000	2000	1000	0	0	0
Salaries	5,100	0	0	0	0	2,550	2,550	5,100
Salaries OH	900	0	0	0	0	450	450	900
Factory Supplies	2,000	0	0	0	0	1,000	1,000	2,000
Laboratory	2,000	0	0	0	0	1,000	1,000	2,000
Mechanical Expense	20,000	0	2000	2000	0	9,000	9,000	18,000
TOTAL -	33,000							

0053599

Estimated Operation Expense
for
Aroclor Expansion (CEA 1800)
(Over-and-Above Standard)

Following is the basis for estimating Operation Expense for the Aroclor Expansion Project. These costs are for over and above standard costs for chemical operation. All other costs were assumed at standard.

Utilities (Tank farm on line prior to Mfg. Plant) — $3,000

Phase I
Steam @ 15% Std. - 900
Elec. @ 10% Std. - 100
1000/mo. 8/68, 9/68, 10/68

Salaries (Shift supervision on start-up) — $5,100

Phase II
Shift Supervision
3 men @ $850/mo. 11/68 & 12/68

Salaries OH (17.750%) — $900

Factory Supplies
$1000/mo. over-and-above standard 11/68 & 12/68 — $2,000

Laboratory
$1000/mo. over-and-above standard 11/68 & 12/68 — $2,000

Mechanical Expense — $20,000

Phase I - $2,000
Phase II - $18,000
$20,000

Includes: All mechanical expense required for minor modifications and correction of facilities to obtain smooth and trouble free operation at design rate, quality and cost.

TOTAL - $33,000

0053600

TOWOLDMON0045119

SECTION NO.
PROJECT NO. 5611 (-)

PREPARED BY H F Ray	APPROVED BY	APPROVED BY
DATE 11/5/67	DATE	DATE
REVISED		

PREMISES

(1) 70 mm #/yr
(2) Salaries & wage rates escalated 4% over 1968 - also added 4.0 operators, 1.0 painter, 1.5 electrician
(3) Effective date 4/69
(4) Raw material prices: Diphenyl & Ferric Chloride - used 1967, All others - used 1968
(5) Depreciation based on addition of $1.5 mm new capital with 12 year life
(6) Fix based on addition of $1.5 mm new capital and initial expansion layout

CREDITS BASED ON:

RAW MATERIALS

MATERIAL	UNIT	PRICE	FREIGHT	WHSE & HAND.	DEL. COST	ANNUAL USE LBS. CAPACITY

SERVICES - ANNUAL QUANTITY USED

PRODUCTION BRACKET	UNIT	Bracket 1	Bracket 2
STEAM M Lbs. B.U.	650	450	942
ELECTRICITY OKWH	820	600	1134
COMP. AIR MCF	.070	2003	1.1[illegible]
WATER PURCH. MGF M. GAL	145	500	2445
WATER PLANT N.GAL.		—	—
FUEL - GAS M BTU	.370	—	1735
REFRIGERATION		—	—
LABOR HRS.	4.34	173	27.7
LABORATORY HRS.	.800	2.00	6.24

PACKING COST

KIND OF CONTAINER	5 Gal	5 Gal
PKG. NET WT. LBS	6.0	6.0
COST OF CONTAINER (1)	1.380	8.600
COST OF OTHER USAGE /UNIT	1.615	0.103
OTHER COSTS CONTAINER COST/UNIT	2.221	1.445
COST PER CONTAINER		
ANNUAL NO. CONTAINERS		
ANNUAL CONTAINER COST		
ANNUAL PACKING LABOR (MH/M)	Bkt 1 - 1.0	Bkt 2 - 2.0
TOTAL		

DEPRECIATION

	CAPITAL $	$ YR.	$ YR.
M & E			
BLDG.			

REPAIRS

	CAPITAL $	$ YR.	$ YR.
M & E			
BLDG.			

AREA RECOG. $/FT.

INVENTORY VALUES

RAW MATERIALS $ IN PROCESS $ FINISHED GOODS $

REMARKS

Page 1 of 2

MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION
ENGINEERING DEPT. - ST. LOUIS, MO.

PRODUCTION COST ESTIMATE

PLANT LOCATION W. Virginia
DEPT. NO. 24 (-)(-)(-)
UNIT C.W.T.

YIELD ON Diphenyl 113 - THEO.
YIELD ON Chlorine 100 - THEO.

	Material Code	Name	QUANTITY PER UNIT	UNIT PRICE	(1) COST PER C.W.T.
MATERIALS	1440	Aromatic 150 Clay	.150	.0397	.005
	33300	Ferric Chloride	.200	.1630	.033
	34900	Lime	.200	.01126	.002
	43019	Natural Gas Natural 1292 - 9101	170	.00345	.001
	90[illegible]	Chlorine	90.320	.02170	1.960
	34891	Diphenyl Natural 1298 - 9102	61.020	.05525	3.371
	90[illegible]	Chlorine	103.220	.02170	2.240
	32601	Diphenyl Aromatic 1254 - 9103	55.660	.05525	3.075
	90[illegible]	Chlorine	116.130	.02170	2.520
	32601	Diphenyl	47.810	.05525	2.708
	GROSS TOTAL MATERIALS				
	CREDITS				
	TOTAL CREDITS				
	NET TOTAL MATERIALS				

ANNUAL PRODUCTION BRACKETS

		Exh 1 - Exist. Facility Exh 2 - 5,833,000 #/mo.							
		UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT
MATERIALS	V								
	V		2.125	.105	6125				
ELECTRICITY	V		414	.016	733				
COMPRESSED AIR	V		14	.041	1225				
WATER PURCHASED	V		7	.013	15.8				
WATER PLANT (GAL.)	F		—	.004	165				
FUEL GAS	V		—	.011	682				
REFRIGERATION	F		100	.004	180				
LABOR	F		—	2.23	11341				
SUPERVISION	B		2182	.054	2765				
SD TAX, COMP. INSPEN.	F		1141	.035	2035				
REPAIRS	B		1115	.214	11115				
WORK EXP. STR. ETC.	F		—	.002	123				
SUPPLIES	F		503	.026	1503				
LABORATORY	V		2.33	.070	3523				
CLOTHING & LAUNDRY	F		50	.008	411				
TECH. SERVICES	F		1000	.017	1000				
EXPERIMENTAL	F		—	.035	204				
PACKING LABOR	F		1[illegible]	.029	1601				
PACKING SUPPLIES	F		100	.004	204				
RE TREAT AT MF 1	I		1253	.02	1250				
TOTAL DIRECT COST			21[illegible]	3.75	4[illegible]				
GENERAL & ADMIN.	B		[illegible]	.15	23453				
DEPRECIATION									
PLANT INDIRECTS	C		1[illegible]	.70	1[illegible]				
TOTAL COST			[illegible]	[illegible]	[illegible]				
TOTAL PROFIT			[illegible]	[illegible]	[illegible]				
TOTAL SALES PRICE			[illegible]	[illegible]	[illegible]				
ESCALATION COST									
CONTINGENCY COST									
TOTAL PROJECT COST									

0053601

Start-Up Cost Standards

TOWOLDMON0045120

SECTION NO.
PROJECT NO.

PREPARED BY	APPROVED BY	APPROVED BY
DATE	DATE	DATE
REVISED		

PREMISES

PRODUCT CODE	MAT'L. UNIT	CONV. UNIT	TOTAL UNIT COST
81101	4.811	1.499	6.310
81102	4.680	1.499	6.179
81103	4.547	1.499	6.046
81105	4.415	1.499	5.914
81101	4.370	1.499	5.869
81115	5.031	1.499	6.530

CREDITS BASED ON:

RAW MATERIALS

MATERIAL	UNIT	PRICE	FREIGHT	WHSE & HAND.	DEL. COST	ANNUAL USE LBS. CAPACITY

SERVICES - ANNUAL QUANTITY USED

PRODUCTION BRACKET	UNIT COST					
STEAM M LBS.						
ELECTRICITY (KWH)						
COMP. AIR MCF						
WATER PURCH. MCF						
WATER PLANT M GAL.						
FUEL						
REFRIGERATION						
LABOR HRS.						
LABORATORY HRS.						

PACKING COST

KIND OF CONTAINER			
PKG. NET WT.			
COST OF CONTAINER			
COST OF LINER			
OTHER COSTS			
COST PER CONTAINER			
ANNUAL NO. CONTAINERS			
ANNUAL CONTAINER COST			
ANNUAL PACKING LABOR			
TOTAL			

DEPRECIATION

CAPITAL $	% YR.	$ YR.
M & E		
BLDG.		

REPAIRS

CAPITAL $	% YR.	$ YR.
M & E		
BLDG.		

AREA REQ'D. Sq. FT.

INVENTORY VALUES

RAW MATERIALS $ IN PROCESS $ FINISHED GOODS $

REMARKS

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MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION
ENGINEERING DEPT. - ST. LOUIS, MO.
PRODUCT: Aroclor
YIELD ON Biphenyl 97.0 % THEO.
YIELD ON Chlorine 73.8 % THEO.

PRODUCTION COST ESTIMATE

PLANT LOCATION W.G. Krummrich
DEPT. NO. 24 (411.00)
UNIT Cwt

	MATERIAL CODE	NAME	QUANTITY PER UNIT	UNIT PRICE	(1) COST PER Cwt.
MATERIALS	$1059	Aroclor 1260 - 81105 Chlorine	129.020	.02170	2.800
	$2601	Biphenyl	43.000	.05525	2.376
	$1059	Aroclor 1262 - 81107 Chlorine	138.380	.02170	3.003
	$2601	Biphenyl	40.990	.05525	2.265
	$1059	Aroclor 1232 - 81115 Chlorine	66.820	.02170	1.493
	$2601	Biphenyl	71.040	.05525	3.925
	$2851	- By Product HCl Gas Credits			
		81101	34.391	.01625	.561
		81102	39.475	.01625	.641
		81103	44.410	.01625	.722
	GROSS TOTAL MATERIALS				
	CREDITS	81105	47.344	.01625	.902
		81101	50.981	.01625	.829
		81115	26.317	.01625	.419
	TOTAL CREDITS				
	NET TOTAL MATERIAL				

ANNUAL PRODUCTION BRACKETS

		UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT
DIRECT CONVERSION COST	MATERIALS								
	STEAM								
	ELECTRICITY								
	COMPRESSED AIR								
	WATER PURCHASED								
	WATER PLANT								
	FUEL GAS COAL OIL								
	REFRIGERATION & ICE								
	LABOR								
	SUPERVISION								
	SS TAX, COMP. INS PENS								
	REPAIRS EQUIPMENT								
	REPAIRS BUILDING								
	SUPPLIES								
	LABORATORY								
	CLOTHING & LAUNDRY								
	TECH. SERVICES								
	TOTAL DIRECT CONV.								
INDIRECT	DEPRECIATION M & E								
	DEPRECIATION BLDG.								
	FACTORY INDIRECT EXP.								
	TOTAL INDIRECT CONV.								
	TOTAL PRODUCTION COST								
PKG.	PACKAGING COST								
	SHIPPING COST								
	TOTAL PRODUCT COST								

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