MONSANTO COMPANY
ANNISTON PLANT

# STANDARD OPERATING INSTRUCTIONS
# AROCLORS

July 1964

MONSANTO COMPANY

ANNISTON, ALABAMA

# STANDARD OPERATING INSTRUCTIONS

# FOR

# AROCLORS

Revised: July 1964

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CONFIDENTIAL

MONS 056845

OPERATING INSTRUCTIONS
AROCLORS

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OPERATING INSTRUCTIONS
AROCLORS

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OPERATING INSTRUCTIONS
AROCLORS

## A. SYNOPSIS OF PROCESS

### General

Aroclors are the reaction products formed by chlorination of Biphenyl and/or Terphenyls using Ferric Chloride catalyst. The by-product HCl gas produced is absorbed in water to produce Muriatic Acid. Crude Aroclors are produced in the chlorinators, air blown, distilled, earth treated, filtered, and loaded for shipment.

Aroclor is a trade name used to designate chlorination products of Biphenyl, Terphenyls or mixtures of the two. The physical properties vary from light free-flowing liquids to crystalline and non-crystalline solids. Depending on the degree of chlorination and the composition of the raw materials, Santowax R, and mixtures of Biphenyl and Santowax R, or Biphenyl and Santowax C, yield products of increasing viscosity up to non-crystalline resins.

A numerical system of nomenclature, consisting of four digits, has been developed for identifying the Aroclors. The thousands digit denotes the raw material used in the chlorination. The figure 1--- indicates 100% technical grade Biphenyl. The hundreds digit denotes whether or not the product is distilled. The 1--- indicates undistilled, and the figure 2--- indicates distilled. The tens and units digit denote the approximate percentage of chlorine contained in the finished product. For example, 1260 is a distilled chlorinated Biphenyl containing 60% chlorine.

There are deviations from the above nomenclature when Solid Aroclors are produced. These are listed below:

1. Aroclors 4065 and 4465

   Aroclor 4065 is the crude and 4465 is obtained by distillation. The starting raw material contains 40% Santowax R and 60% technical Biphenyl. This is chlorinated to 65%.

2. Aroclors 5060 and 5460

   Aroclor 5060 is the crude from which Aroclor 5460 is distilled. The starting raw material is 100% Santowax R which is chlorinated to 60%.

3. Aroclor 5042 and 5442

   Aroclor 5042 is the crude from which Aroclor 5442 is distilled. The starting raw material is 100% Santowax R which is chlorinated to 42%.

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4. Aroclor 2565

   This is an undistilled product. The starting raw material consists of 25% Santowax C and 75% technical Biphenyl. This is chlorinated to 65%.

A. SYNOPSIS OF PROCESS (Cont'd.)

Chlorinator Area

There are four batch operated chlorinators and one continuous operated chlorinator system. The continuous system consists of four batch chlorinators cascaded with overflow from one unit to the next. The product from the last stage is the finished crude Aroclor.

Batch chlorinators are charged with 3,000 lbs. of Biphenyl and/or Terphenyl with 1½ lbs. of Ferric Chloride catalyst. Chlorine gas added through a distributor plate reacts with the raw material to release HCl and heat. The HCl gas goes to the Muriatic Acid Department. Heat is taken away by water cooling coils in the chlorinator. The specific gravity of the crude is checked every two hours until the chlorination is complete.

In the continuous chlorination system Biphenyl is fed to the first stage and chlorinated. Crude Aroclor overflows to the second stage, etc., -- until the final product overflows from the last stage. Each chlorinator is held at a different level of chlorination with the last stage being the final crude Aroclor desired. Normally Aroclor 1142 is produced in this system.

Crude Aroclors from the batch chlorinators and the continuous system are transferred to a blowing tank to be air blown for one (1) hour minimum before distillation.

Still Area

Liquid Aroclors

Aerated Aroclors from a blowing tank or a feed tank is charged to a still, hydrated lime is added, a vacuum of 720 mm Hg (40 mm Hg absolute) is applied, the still furnace is fired, and the Aroclor is distilled into a receiver. The distillation is semi-continuous since ten (10) receivers are distilled prior to drawing bottoms or residue from the still. Every two receivers are treated with 40 lbs. of earth for three hours and then filtered. The finished product is transferred to storage tanks prior to loading into drums or tank cars.

Solid Aroclors

Solid Aroclors are distilled in a similar manner to Liquid Aroclors except for 1168. Aroclor 1168 is not air blown and is charged directly to the still from the chlorinator. A vacuum of 4 mm Hg absolute is applied for distillation. One receiver of 1268 is distilled prior to drawing bottoms in the still. All other Solid Aroclors have 2 or 4 receivers distilled prior to drawing bottoms in the stills.

Solid Aroclors are not earth treated or filtered. They are drummed directly from the receiver or are flaked (Aroclors 1268 and 5460).

SAFETY AND
HOUSEKEEPING

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## B. SAFETY AND HOUSEKEEPING

Safety of operations in the Aroclor Plant depends on the individual operator. Materials being handled and operations must be observed closely to guard against the following:

| | Cause & Action to Prevent |
|---|---|
| 1. Chlorine Gas | Chlorine gas is a very toxic corrosive gas. Leaks or high pressure can occur to liberate it.<br><br>Action to Prevent:<br><br>a. Report Chlorine gas exposure immediately for treatment with Antidote. Milk may be used in mild cases to relieve throat irritation. Oxygen from the resuscitator in the Dispensary is available.<br><br>b. Keep gas mask in good condition. Keep a good canister in the mask. Use these type masks only in Chlorine concentrations to 2-3% Chlorine in air.<br><br>c. Use a Scott Air Pak in concentrations of Chlorine gas above 3% in air. Three units are available in the Aroclor-Biphenyl Department.<br><br>d. If caught in Chlorine gas without a mask, hold your breath and go cross wind until you are out of range of the gas. Place a handkerchief over your nose in small quantities of Chlorine.<br><br>e. Report all Chlorine leaks for repair immediately. Make temporary repairs with tape if possible.<br><br>f. In case of a major Chlorine leak the source of Chlorine gas must be stopped.<br><br>Notify the Chlorine Plant immediately if the pressure on the Chlorine manifold exceeds 30 psig. Cut off liquid Chlorine from the car. |
| 2. Thermal Burns | Contact with hot uninsulated product lines at the chlorinators and still areas.<br>Contact with uninsulated steam lines and open steam.<br>Contact with hot Aroclors from broken lines or leaks.<br>Contact with open flames at stills or from heating lines in the department. |

B. SAFETY AND HOUSEKEEPING

2. Thermal Burns (Cont'd.)

Action to Prevent:

a. Know that contact with equipment and product will cause a thermal burn due to the high temperatures. Make changes in operations with this hazard in mind.

b. Know the first aid treatment for burns. Cold Water Treatment (See Appendix A - Emergency Section).

c. Wear gloves and long sleeve shirts with the sleeves rolled down when operating. Gloves and clothing can make the difference between first and second degree burns.

d. Report uninsulteed lines for repair of insulation.

e. Use only steam lines with hose and hose clamps in good condition.

f. The following operations are hazardous and should be done with care:

(1) Catching samples at the Aroclor chlorinator circulating pumps.

(2) Sampling the Solid Aroclor still receiver.

(3) Drawing bottoms on the Aroclor stills.

3. Explosion

An explosion could occur in the chlorinators by slugging liquid chlorine to the distributor or shutting off the water discharge valve on the chlorinator cooling coil. Slugs of Liquid Chlorine could react fast enough to cause excessive pressure in the vessel. A rupture of the chlorinator could occur. Closing the water discharge valve on the chlorinator cooling coil isolates water in the coil. As the reaction occurs releasing heat, the water will vaporize and could split a coil and tank.

Action to Prevent:

a. Observe operation of the Chlorine vaporizer and do not let liquid Chlorine get into the rotameters. Pipe lines will be frosted.

B. SAFETY AND HOUSEKEEPING

3. Explosion (Cont'd.)

b. In case Chlorine feed lines are frosted, close liquid Chlorine feed valve to the vaporiser. Check steam addition to the vaporiser. Inspect operation of the vaporiser. Do not start up until source of trouble has been located.

c. Do not close valve in water discharge line from the chlorinator coil.

d. Observe temperature of the chlorinator periodically and be sure it is not too hot (180°C maximum).

4. Falls

Slipping on cement floors, stairs, Aroclor on floor, ice conditions; tripping over objects (hose, pipe, valve handles, etc.); or losing footing on ladders, etc., can cause falls.

Action to Prevent:

a. The majority of minor, serious, and near miss injuries in the Aroclor Dept. are the result of falls. Prevention is always within the ability of the operator by use of expert operating practices.

b. The following items should be done:

(1) Return hose to rack after using.

(2) Keep operating areas clean of all foreign objects.

(3) Return ladders to racks when not in use.

(4) Keep gloves on and hands out of pockets, especially going up stairs.

(5) Place guards around any area that presents a hazard that should be guarded.

c. Poor lighting due to burned out bulbs should be corrected at once. Poor lighting due to inadequate facilities should be reported.

d. Spills must be cleaned up immediately following their occurrence. Report any spill that can not be cleaned up within the shift to the Chief Operator. Spills are to be reported in the log book.

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B. SAFETY AND HOUSEKEEPING

5. Fires

Fires can occur by:
Biphenyl, Santowax R, or Santowax C ignition.
Chlorine problems in the vaporizer allowing reaction with steam to release Hydrogen.
Furnace burner backfire.
Wood, rags, or paper on hot lines.
Sparks from welding apparatus or open flames.

Action to Prevent:

a. Area must be clear of trash or flammable materials. Use trash skips and cans.

b. Smoke only in areas so designated.

c. Use spark producing equipment only with a fire permit and proper inspection.

d. Use care in lighting gas torchs or the still furnaces.

e. Fire fighting equipment includes:

(1) Two wheeled dry powder units.

(2) Hose house with 200 ft. of hose.

(3) Two dry powder hand extinguishers, One $CO_2$ hand extinguisher.

(4) Two 3/4" water hoses.

(5) Hose connection north of Santowax.

(6) Scott Air Paks.

(7) Fire truck in fire house.

f. Observe visitors in the plant and be sure they observe safety rules.

6. The following is a list of the chemicals handled in the Aroclor Plant operations and the precautions to be taken during their handling:

a. Chlorine Gas

Chlorine is a very toxic corrosive gas. Leaks or back pressure can occur and liberate chlorine gas in the area. Operators should have their cartridge type respirators handy at all times while in the area. Use of gas masks is explained in Section B-1.

B. SAFETY AND HOUSEKEEPING

6. a. Chlorine Gas (Cont'd.) If you are caught without a gas mask and large amounts of chlorine gas are liberated, hold your breath and go cross wind until you are out of range of the gas. Once out of the area, obtain an emergency gas mask and return to the area and correct the trouble.

A victim of chlorine gas fumes must be removed as quickly as possible from the gaseous area. Place patient on his back with head and back elevated. Milk may be used in mild cases as a relief from throat irritation. If the patient has stopped breathing, start artificial respiration immediately.

b. Biphenyl — Biphenyl is a flammable material which will burn. Burning should not be done in the presence of Biphenyl or Biphenyl vapors. The melting point is 68.7°C., flash point 106°C., the fire point 124°C., and the auto ignition temperature is 258°C. Inhalation of Biphenyl fumes is not recommended since it can cause a drugged effect on the person.

c. Santowax R — Santowax R is a flammable material which will burn. It is relatively non-toxic to human beings. However, the vapors of Santowax R are irritating to the mucous membranes and bronichial tract. Prolonged breathing of the vapors should be avoided. The melting point is 140°C.

d. Santowax C — Same as Santowax R, since it is the crude material prior to distillation.

e. Ferric Chloride — Ferric Chloride is a black-brown solid. It causes only slightly irritating effects on the skin or mucous membranes. When heated it will decompose and release toxic fumes of HCl (hydrochloric acid). It will react with water to produce toxic and corrosive HCl fumes.

f. Attapulgus Earth — This material is a dried earth. No danger in handling. Wash off with water to clean.

g. Hydrated Lime — No particular hazard in handling this material. The dust is irritating to the eyes and skin and should be washed off with water.

h. Crude Aroclors — Crude Aroclors are hot since all are handled in steam traced or jacketed lines. They can easily cause thermal burns in contact with

B. SAFETY AND HOUSEKEEPING

| | | |
|---|---|---|
| 6. h. | Crude Aroclors (Cont'd.) | the skin. Prior to air blowing, the material has HCl fumes entrained in it which are irritating to the skin or mucous membranes. |
| i. | Hydrogen Chlorine Gas | This a corrosive gas which is toxic. It is irritating to the mucous membranes, to the eyes, and to the respiratory tract. It will react with water to form Hydrochloric Acid. |
| j. | Still Bottoms or Residue | Fumes from still bottoms are toxic. They are extremely irritating to the mucous membranes, to the eyes, and respiratory tract. |

HOUSEKEEPING

The Aroclor chlorinator and still operators are responsible for housekeeping during their shift. Good housekeeping is the mark of good operations, safety practices, quality, and costs.

Housekeeping duties are equal in importance with all other operating duties.

| | Poor Practices | | Action to Prevent |
|---|---|---|---|
| 1. | Hoses, valve handles, dip sticks, rags, and other material on ground or floor. | a. | Replace after use. |
| | | b. | Have place to store all necessary operating aids. |
| | | c. | Report needs to supervision. |
| 2. | Product leaks | a. | Tighten valve packing glands and flange bolts. |
| | | b. | Report leaks to Chief Operator for maintenance alteration. |
| 3. | Trash and crude drums | a. | Contact chief to have drums moved from area. |
| | | b. | Use trash skip in area |
| 4. | Product spills or clean out masses | a. | Prevent necessity of clean-out by keeping tracing, insulation, or jacket in good repair by getting items turned in for maintenance work. |
| | | b. | Spills must be cleaned up when they are made. Clean up will continue through the following shifts to finish the job. |

MONS 056856

CHLORINATORS

MONS 056857

## C. DETAILED INSTRUCTIONS

### I. Chlorinators and Blowing Tank Operation

Crude Aroclors are produced by batch and continuous chlorination in a vertical vessel. The reaction is cooled by water in an internal coil and agitated by a circulating pump. Biphenyl, Santowax, or a mixture of the two is chlorinated with Chlorine gas added at the bottom of the vessels. HCl gas vented at the top of the chlorinator is a by-product which is recovered in the Muriatic Acid Department. Crude Aroclor produced in batch or continuous chlorinators is transferred to the blowing operation when the chlorination is completed. Chlorine gas can be fed to the chlorinators from the Chlorine Plant or from tank cars.

a. Batch Chlorinator Operation (See Flow Sheet)

(1) Charging Chlorinators:

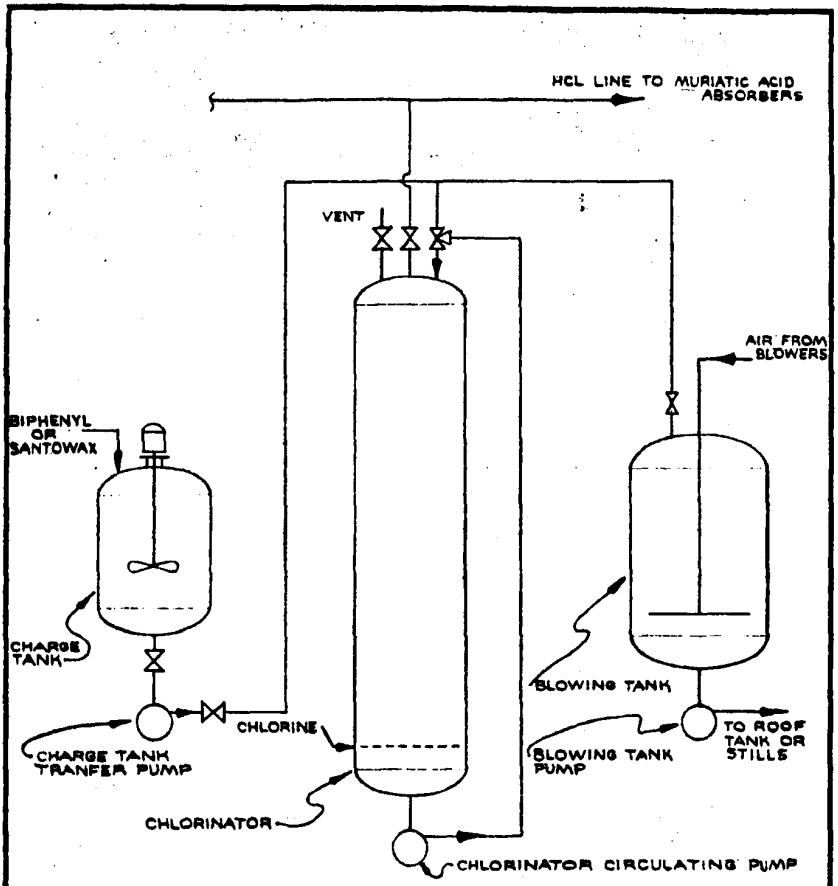
(a) Charges for the various crude Aroclors are as follows:

| Product | Raw Material | Tank Innage or Outage |
|---|---|---|
| Aroclor 1121 | 3,000 lbs. Biphenyl | 68" |
| " 1142 | 3,000 " " | 68" |
| " 1148 | 3,000 " " | 68" |
| " 1154 | 3,000 " " | 68" |
| " 1160 | 3,000 " " | 68" |
| " 1162 | 3,000 " " | 68" |
| " 1168 | 3,000 " " | 68" |
| " 2565 | 1,870 lbs. Biphenyl & 630 lbs. Santowax C | |
| " 4065 | 1,620 lbs. Biphenyl & 1,080 lbs. Santowax R | |
| " 5042 | 3,330 lbs. Santowax R | |
| " 5060 | 2,500 lbs. Santowax R | |

If Crude Aroclor 1142 is to be used to charge a batch chlorinator for 1148, 1154, 1160, 1162, or 1168, the following amounts will be used. Ferric Chloride is not added to this material.

| Source of 1142 | Inches of Material |
|---|---|
| Crude Aroclor Blowing Tank | 18" |
| Crude Aroclor Catch Tank | 50% of Taylor Instrument |

Each charge contains 1½ lbs. of Ferric Chloride.




— BATCH CHLORINATOR OPERATION —

— FLOW SHEET —

MONS 056859

ANNISTON PLANT — MONSANTO CHEMICAL COMPANY — ANNISTON, ALA.

| TITLE | | | | | |
|---|---|---|---|---|---|
| BATCH CHLORINATOR OPERATION — FLOW SHEET | | | | | |
| DRAWN BY | APPROVED | DATE | SCALE | DEPT. | |
| EAE | | 8-7-64 | NONE | AROCLOR | TS-A-701 |

C. DETAILED INSTRUCTIONS

I. a. (1) (b) Drain the charge tank and charging line if the new charge is to be different from the last mix.

(c) Set valves to receive a charge from the Biphenyl or Santowax Departments. Notify the operator you are ready for a charge. Biphenyl is obtained from the #1 or #2 Biphenyl catch tanks or the Biphenyl storage tanks. Santowax R or Santowax C is obtained from the Santowax storage tanks. A normal 3,000 lbs. Biphenyl charge is 35 inches innage in the charge tank for Biphenyl and 28 inches innage for Santowax. Be sure steam is on all transfer lines prior to starting the transfer of Biphenyl or Santowax.

(d) One and one-half (1½) pounds of ferric chloride is slurried in Aroclor and dumped into the charge tank with each chlorinator charge. Start the agitator in the charge tank and let it run 15 minutes prior to charging the chlorinator. Material in this tank should be a minimum 100°C. when charging a chlorinator. A steam coil is in the tank to maintain the temperature.

(e) Close the 2" chlorine valve into the chlorine distributor on the chlorinator.

(f) Open the vent valve on top of the chlorinator.

(g) Open valve on charging line to the desired chlorinator. Check to be sure the valves are closed to other chlorinators.

(h) Set valve at charge tank to the chlorinator. Start the charge tank pump.

(i) Make certain the charge is pumping by observing a drop in the level of material in the charge tank.

(j) Check the charge tank to be sure it is empty. Stop the charge tank pump.

(k) Allow the charge line to drain back through the pump into the charge tank.

(l) Close valve under the charge tank, in charging line at the chlorinator, and at the vent line on the chlorinator.

(m) Set the valves on the chlorinator to circulate the material from the bottom of the chlorinator into the top.

C. DETAILED INSTRUCTIONS

I. a. (2) Batch Chlorinator Operation:

(a) Start-up, Shutdown, and Normal Operation:

Assuming the chlorinator has been completely shut down, start-up is as follows:

1. Make up a charge for the chlorinator and transfer as in the procedure (1) above.

2. Material in the chlorinators must be 120°C before starting the chlorination. Check the multi-point temperature recorder. Steam can be put in the coil of the chlorinator to bring the temperature up if necessary. After start-up cooling water will be put in the coil.

3. Chlorine gas is available from two sources--the Chlorine Plant and tank cars. Chlorine pressure on the manifold should be 20 to 25 psig normally. Chlorine vaporiser operations are in Section f.

4. Open valve 1/3 to 1/2 on inlet rotameter to the chlorinator to be started up. Open outlet valve wide open.

5. Open valve on line to the chlorine distributor at the chlorinator (wide open).

6. Adjust rotameter at chlorinator header to a 600 lbs/hr. chlorine reading for one (1) hour. After one hour the chlorine rate can be increased to 800 or 900 lbs/hr.

7. Cooling water to the coil in the chlorinator can be regulated to maintain the operating temperature of the chlorination as noted on Table I, Page 4-a. As the chlorine feed is increased normally, the water rate must be increased.

8. Samples are taken at the suction line of the circulating pump at the bottom of the chlorinator. Dependent on the material being produced, the specific gravity, softening point, or hold point, are run on all the batch chlorinators every two (2) hours or odd numbered hours (7, 9, 11, etc.). On some of the higher chlorinated products samples are not started until the chlorinator has been on for four (4) hours.

9. When the chlorination is near completion it may be necessary to run the specific gravity, softening point, or hold point every 10 to 15 minutes.

C. DETAILED INSTRUCTIONS

I. a. (2) (a) 10. When the chlorination has been completed (See Table I on Page 4-8), shut off the chlorine feed valve to the distributor at the chlorinator.

11. Note the chlorine pressure on the main header. If it is above 30 psig notify the chlorine plant you have removed a chlorinator or chlorinators from operation. Tell them when you can start it back up. If more than one chlorinator is to be off at a time, notify the chlorine plant prior to shutting off the chlorinator.

12. Measure the outage of the blowing tank to be pumped into.

13. Set valves on the chlorinator to pump out line to allow transferring to the desired blowing tank.

14. Close valve on the chlorinator pump-out line, stop circulating pump, and measure outage on the blowing tank.

15. Record transfer information on each chlorinator in the log book. Normal blowing tank innages are:

| Aroclor | Blowing Tank Innage |
|---|---|
| 1121 | 14" |
| 1148, 1154, 1160, 1162 | 16-18" |
| 5060 | 20" |

16. The chlorinator is now ready to start back up.

NOTE: If this chlorinator has had 1160, 1162, 1168, of 5060 in it, and it is to be shut down for 2 or 3 hours, wash the chlorinator out with approximately 100 gallons of 1142.

(b) Temporary shutdown of a chlorinator:

During normal operation, failure of chlorine feed, a tank car empting, or a cutback at the chlorine plant can cause short shutdowns on the chlorinators. Normally if a partial reduction in chlorine feed occurs, the continuous system is shut off and batch chlorinators are operated.

1. Shut off the chlorine valve at the distributor on the chlorinator or chlorinators as necessary.

2. Check the chlorine header pressure and rotometer feed to other chlorinators. It should be 20-25 psig.

## TABLE I
## BATCH CHLORINATOR OPERATING CONDITIONS

| | LIQUID AROCLORS | | | | | | SOLID AROCLORS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AROCLOR | 1121 | 1142 | 1148 | 1154 | 1160 | 1162 | 1168* | 2565* | 4065* | 5042* | 5060* |
| Chlorinator Charge: | | | | | | | | | | | |
| Biphenyl (Lbs.) | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 1,870 | 1,620 | | |
| Santowax C | | | | | | | | 630 | | | |
| Santowax R | | | | | | | | | 1,080 | 3,330 | 2,500 |
| Approximate Pounds Chlorine Required to produce Batch | 1,600 | 3,330 | 5,560 | 7,040 | 9,030 | 9,480 | 12,740 | 9,300 | 10,100 | 3,630 | 7,500 |
| Chlorination Temp.: | | | | | | | | | | | |
| Beginning | 130°C | 130°C | 130°C | 130°C | 130°C | 130°C | 130°C | 140°C | 140°C | 160°C | 160°C |
| Ending | 140°C | 150°C | 155°C | 155°C | 160°C | 160°C | 265°C | 180°C | 210°C | 240°C | 250°C |
| Final Specific Gravity Range | 1.150<br>1.160<br>@ 65°C | 1.344<br>1.357<br>@ 65°C | 1.410<br>1.420<br>@ 65°C | 1.500<br>1.510<br>@ 65°C | 1.558<br>1.572<br>@ 90°C | 1.582<br>1.586<br>@ 90°C | | | | | |
| Hold Point | | | | | | | 155-<br>175°C | | | | |
| Softening Point | | | | | | | | 66<br>72°C | 22<br>72°C | 50<br>56°C | 105<br>115°C |
| Weight of Crude Batch | 3,750 | 5,080 | 5,550 | 6,350 | 7,160 | 7,545 | 7,080 | 6,660 | 7,160 | 4,250 | 6,000 |

*Solid Aroclors

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C. DETAILED INSTRUCTIONS

I. a. (2) (b) 3. Check to see that liquid chlorine is being fed to the vaporiser and that steam is on the vaporiser. Steam pressure should be 10 psig. Discharge pressure on the vaporiser should be 1 to 2 psig greater than the pressure on the chlorine header. (Normally 25 psig on air regulator valve setting).

4. Notify the chlorine plant of the problem and see if they have shut down or cut back.

5. If the shutdown is to be longer than two hours, it may be necessary to put steam on the chlorinator coil to keep the temperature at 120°C minimum. Normally the circulating pump will continue to run.

6. Shutdowns should be minimized. If the cause of the cutback can easily be remedied, start the chlorinators back up immediately.

7. Notify your Chief Operator or Department Supervision immediately in case of a problem.

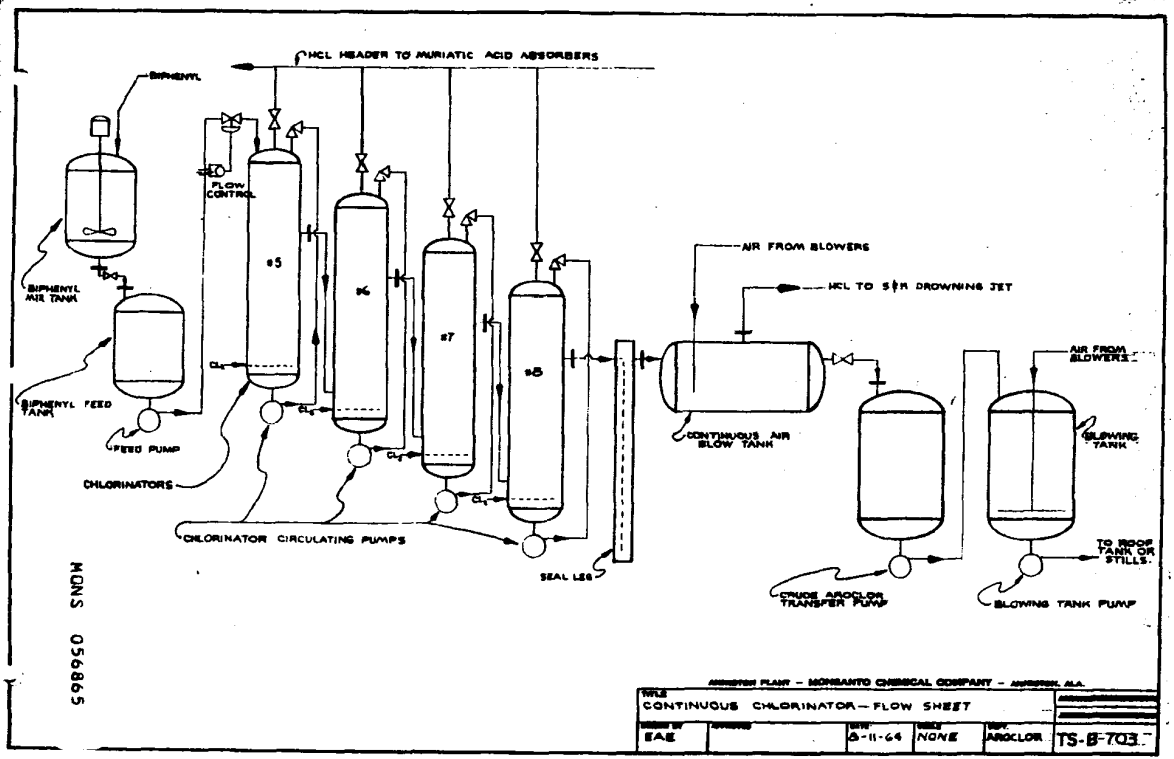
(c) Prolonged Chlorinator Shutdown:

Operations can occur which will require a day or longer shutdowns. Normally a chlorination will be finished and pumped out as in normal operating procedure (a) above. The chlorinator will be shutdown completely and the cooling water cut off the coil. If maintenance personnel are to work on the chlorinator it may be necessary to vent the vessel and purge it with $CO_2$.

NOTE: Chlorine valves on the main header to the chlorinator will be tagged out as well as transfer lines into the vessel. The circulating pump or circuit breaker box switch will be tagged out.

b. Continuous Chlorinator Operation (See Flow Sheet)

The continuous chlorinator operation consists of four cascade flow chlorinators in series where specific levels of chlorination occur. Biphenyl is fed into the first chlorinator where the material is chlorinated and overflows to the second chlorinator. This continues until the finished product comes off the final unit, flows through the continuous blow tank, and to the catch tank. Chlorine is fed to each chlorinator continuously. This chlorination system can be reduced to three (3) chlorinators in series in case problems occur with one unit. Normally 1142 is the only liquid Aroclor produced on the continuous system, however, 1148 and 1154 can also be produced with the chlorinators set for different levels of chlorination.


HCL HEADER TO MURIATIC ACID ABSORBERS
BIPHENYL
FLOW CONTROL
#5
#6
#7
#8
AIR FROM BLOWERS
HCL TO SIR DROWNING JET
BIPHENYL AIR TANK
BIPHENYL FEED TANK
FEED PUMP
CHLORINATORS
CHLORINATOR CIRCULATING PUMPS
SEAL LEG
CONTINUOUS AIR BLOW TANK
AIR FROM BLOWERS
BLOWING TANK
TO ROOF TANK OR STILLS
CRUDE AROCLOR TRANSFER PUMP
BLOWING TANK PUMP
ANNISTON PLANT – MONSANTO CHEMICAL COMPANY – ANNISTON, ALA.
TITLE
CONTINUOUS CHLORINATOR – FLOW SHEET
DRAWN BY
EAE
APPROVED
DATE
6-11-64
SCALE
NONE
DEPT.
AROCLOR
TS-B-703

MONS 056865

C. DETAILED INSTRUCTIONS

I. b. (1) Charging Mix and Feed Tanks:

(a) Check the level in the mix tank. The tank low level annunciator alarm should have sounded (Set for 25% full). Silence the alarm by pushing the acknowledge button on the control panel.

(b) Set valves to receive a charge of Biphenyl. Notify the Biphenyl still operator to pump a charge to the mix tank. Fill the tank to a 75% full level. Close the valve in the charge line.

(c) Start the agitator in the mix tank.

(d) Add 3½ pounds of ferric chloride. Allow the Biphenyl and ferric chloride to mix until the feed tank requires filling.

(e) The feed tank low level alarm sounds the annunciator system at 25% full in the feed tank. The mix tank batch can be dropped into the feed tank.

(f) Stop the agitator in the mix tank.

(g) Open the valve under the mix tank and allow the Biphenyl-ferric chloride mix to drop into the feed tank. The level indicator in the feed tank should indicate approximately 85% full.

(h) Close the valve under the mix tank when the mix tank is empty.

(i) Prepare another mix for the Biphenyl mix tank as noted above. Low level alarm in the mix tank should sound.

(2) Continuous Chlorinator Operation:

(a) Start-up and Normal Operation:

1. Charge each of the four chlorinators (#5, 6, 7, & 8) with Biphenyl as in a regular charge. Start circulating pumps on the chlorinators. See Section C.I.e.

2. Chlorinate the material to the following levels:

| Stage | Chlorinator | Specific Gravity |
|---|---|---|
| 1st | 5 | 1.078 - 1.104 |
| 2nd | 6 | 1.170 - 1.196 |
| 3rd | 7 | 1.254 - 1.280 |
| 4th | 8 | 1.336 - 1.362 |

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I. b. (2) (e) 3. Close the valve on the chlorine distributor on each chlorinator when the correct specific gravity level has been reached. Hold this chlorinator until all four are ready. It may be necessary to put steam on the chlorinator to keep the temperature at 120°C.

4. Check the Biphenyl feed tank to be sure a mix has been charged.

5. Set the valves on the Biphenyl feed line to #5 chlorinator to allow circulation back to the feed tank.

6. Start the Biphenyl feed pump.

7. Set the valves on the overflow lines at the chlorinators as follows. Crude from #5 chlorinator to overflow to #6 chlorinator, #6 overflows to #7, #7 overflows to #8, #8 overflows to the continuous air blow tank, and then to the crude Aroclor catch tank.

8. When all four chlorinators have reached the correct specific gravity level, start the chlorine feed to each of the chlorinators (600 lbs/hr. on each) and open the valve to start Biphenyl feed to #5 chlorinator (2 GPM Biphenyl). (See Table II). Chlorine feed is adjusted at the rotameters on #5, #6, and #7 chlorinators to maintain the required specific gravity level. The required specific gravity is set on the Taylor controller for #8 chlorinator (normally 1.350). The Accu Ray controller will adjust the chlorine feed automatically to #8 chlorinator to maintain the indicated specific gravity. Normally #5 chlorinator chlorine feed is lower than the other three chlorinators.

9. Samples will be caught and the specific gravity run on chlorinators #5, #6, and #7 every other hour on even hours (8,10, 12, etc.). A sample will be run on #8 chlorinator every 4 hours (8, 12, 4, 8,--).

10. Cooling water to the coil in the chlorinators can be regulated to maintain an operating temperature range in the chlorinators at 120-160°C. As the chlorine feed is increased normally the water rate must be increased.

11. Crude Aroclor 1142 produced on the #8 chlorinator overflows into the continuous air blow tank. Air regulated to 5 psig at three manual control valves is blown into the Aroclor. The crude Aroclor then flows into the Crude Aroclor catch tank.

## TABLE II
## OPERATINS OF BIPHENYL FLOW & SPECIFIC GRAVITY RECORDER CONTROLLERS

This procedure starts with the FRC set at manual and gives step-wise changes to automatic and back to manual. This is for the Taylor Recorder Controllers used on:

1. Biphenyl feed on the continuous chlorinators and
2. Aroclor specific gravity on No. 8 Chlorinator.

| Operation | Switching FRC | | |
|---|---|---|---|
| | Manual | Seal | Automatic |
| 1. FRC on manual. Set point moved to give desired flow as indicated on recording sheet<br><br>Adjust FRC set point knob until control valve gives the desired flow indicated by Red recording pen. | X | | |
| 2. Transfer FRC to seal. Place set pointer (Red) opposite flow recording pen (Red). | | X | |
| 3. Transfer FRC from seal to automatic. Adjust FRC set pointer until flow levels out if any fluctuations occur.<br><br>The instrument can be left in this position for automatic control of flow as the set point is adjusted. | | | X |
| Return System to Manual Control | | | X |
| 4. Note FRC output air signal. Transfer from automatic to seal. | | X | |
| 5. Adjust FRC set pointer (Red) to the same output air. | | | |
| 6. Transfer from seal to manual. Adjust set point if fluctuations occur. | X | | |

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I. b. (2) (a) 12. A high annunciator alarm signal will indicate when to transfer material from the crude Aroclor catch tank. The high level alarm is set at 75% full tank on the level gauge. When the high alarm sounds you normally have 30 minutes to start pump out or material begins to back up and fill the chlorinator system. Off-grade material will be produced if this occurs.

13. Crude 1142 may be transferred to a blowing tank, the #3 Aroclor still roof tank, to the charge tank, or to a batch chlorinator. Normal operation is to a blowing tank.

14. Set valves to allow transfer from the crude Aroclor catch tank to the blowing tank.

15. Measure the outage on the blowing tank.

16. Start the catch tank transfer pump.

17. When the level in the tank reaches 0% on the level gauge close the valve in the discharge line at the pump. Stop the pump.

18. Measure the outage in the blowing tank. Record this information in the log book. Approximately 30" to 36" of material will be transferred into the blowing tank.

19. In routine operation Crude 1142 is sometimes charged to the batch chlorinator charge tank or directly to a chlorinator for chlorination to a higher Aroclor. A chlorinator charge of 1142 is 50% of the Taylor level indication gauge on the catch tank.

20. This chlorinator system will continue to operate with the following normal operation.

a. Make mix tank batches.
b. Fill feed tank as required.
c. Check specific gravity on individual chlorinators.
d. Correct chlorine flow rate to individual chlorinators as required.
e. Transfer crude produced in the catch tank as required.
f. Observe temperature on the chlorinators and adjust water rate as required.

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(b) Temporary Shutdown:

During normal operation failure of chlorine feed for any reason can cause short shutdowns on the continuous chlorinator system. For temporary partial cut-backs the batch system is operated and the continuous chlorinators are cut

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I. b. (2) (b) off. The batch chlorinators can be fed chlorine from a car while the chlorine plant blows air to the continuous units. In case of cut back to the continuous chlorinators proceed as follows:

1. Shut off the automatic Biphenyl feed valve to the #5 chlorinator by using the automatic controller.

2. Close the valves at the chlorine distributor on chlorinators #5, 6, 7, and 8.

3. Close the manual block valve at the automatic Biphenyl feed valve to assure no leakage occurs.

4. Proceed to check out system to determine the reason for the cut back if you have not been informed.

   Example: Empty chlorine car, chlorine plant cut back, failure of chlorine vaporiser, electrical failures.

5. Notify the chlorine plant of the problem if it is in the Aroclor Dept. If the chlorine plant has cut back ask for how long. Start feeding from the chlorine car.

6. If the shutdown is to be longer than two hours it may be necessary to put steam on the chlorinator coil to keep the temperature at 120°C minimum. Normally the circulating pump will continue to run.

7. Notify your Chief Operator or Department Supervision in case of a problem.

(c) Prolonged Chlorinator Shutdown:

Operation or inspection of a vessel can occur which will require a longer shutdown than 8 to 10 hours. In this case the chief operator and department supervision should be contacted immediately.

(d) Continuous Operation on 3 Chlorinators:

Routine inspection of the catalyst in the Aroclor chlorinators occurs every six months. At this time a chlorinator must be shut down and taken out of service for 8 to 12 hours. In this case the following procedure should be followed to run 3 chlorinators continuously:

1. Switch valves on the overflow line from one chlorinator to another to allow by-passing a particular chlorinator.

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I. b. (2) (d) 2. Shut off the Biphenyl feed to the first stage chlorinator. Chlorinate the material to the following levels:

| Stage | *Chlorinator | Specific Grevity |
|---|---|---|
| 1st | 5 | 1.108-1.124 |
| 2nd | 6 | 1.224-1.240 |
| 3rd | 8 | 1.345-1.355 |

*NOTE: Indicates #7 chlorinator out of the system. Any one of the four can be by-passed.

3. Start the Biphenyl feed again.

4. Continue operation of the continuous system. The chlorinator removed from service should be chlorinated to a finished Aroclor and pumped out. The chlorinator will be shut down completely. Stop water flow to the cooling coil. If maintenance personnel care to work on the chlorinator it may be necessary to vent the chlorinator and purge it with $CO_2$. The Chlorine in the feed line from the rotameter to the distributor should be vented into the chlorinator and then shut off prior to venting the vessel.

NOTE: Chlorine valves on the main header to the chlorinator will be tagged out as well as transfer lines into the vessel. The circulating pump switch or circuit breaker box will be tagged out.

c. Blowing Tank Operation

Crude Aroclors produced in the chlorinators must be air blown for a minimum of one hour before the material is fed to the stills. Steam is maintained on the coils of the blowing tank during this operation. Residual HCl blown out of the crude Aroclor is drowned in a 56K water jet which pulls a suction on the blowing tanks.

(1) Transferring batch to blowing tank:

(a) Measure outage on blowing tank material is to be transferred into.

(b) Set valves in pump-over line so material will be pumped only to the desired blowing tank.

(c) Open valve at chlorinator from the circulating line into the pump-over line.

(d) Close valve in circulating line back into the top of the chlorinator.

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I. c. (1) (e) Check the blowing tank to be sure material is flowing into it.

(f) When the transfer of material is complete, close valve on the pump-over line and open valve in the circulating line into the top of the chlorinator.

(g) Measure outage on blowing tank after material has been transferred. Note measurements before and after transfer in the log book.

Examples of innage expected are:

| Crude Aroclor | Blowing Tank Innage |
|---|---|
| 1121 | 14" |
| 1148, 1154, 1160, 1162 | 16"-18" |
| 5060 | 20" |

(2) Air Blowing Crude Aroclors:

(a) Open the valve in the water line feeding the Schutte & Koerting drowning jet.

(b) Check the blowing tanks to be sure the Jet is pulling a suction on the tanks. Open hatch on the lid of the tanks to feed the suction, then close the hatch.

(c) Open valve in air distribution line to at least two of the four blowing tanks.

(d) Open discharge valve on the air blower to be started.

(e) Close discharge valve on the air blower to be left idle.

(f) Start motor on the air blower.

(g) Crude Aroclors transferred to the blowing tanks must be air blown for at least one hour before feeding to the still.

(3) Transferring material from blowing tank to a still or roof tank:

(a) Check material in the tank to be sure it is the Aroclor needed and has been air blown the required length of time.

(b) Turn steam on transfer lines and the pump.

(c) Set valves in transfer line to tank material is to be pumped to. Notify still operator if tank is in his operating area.

(d) Start blowing tank pump.

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I. e. (3) (e) Check level in the tank to be sure material is being transferred.

(f) When the transfer is complete stop the pump and close the pump suction and discharge valves. Measure outage in the tank.

d. Method of Running Specific Gravities:

(1) Catch representative sample of material in metal cylinder provided for this purpose. On the chlorinators, the sample point is at the pump suction or inlet.

(2) Take sample to control room.

(3) Allow water to run down outside of cylinder while stirring sample vigorously until the sample is 10°C above the temperature at which the sample is run. See Chart I page 4e.

(4) Cut off the water when the sample is 10°C above the desired temperature. Keep stirring until the sample is 1°C above the temperature at which the sample is to be run. Stop stirring. Allow the hydrometer that has been thoroughly cleaned to sink into the sample until it reaches equilibrium.

(5) Observe reading on the hydrometer. Record on the operating data sheet along with the time the sample was taken.

(6) In case the temperature was off one or two degrees when the reading was taken, a correction can be applied. It is 0.001 specific gravity units per °C. If the sample was 2°C high, add 0.002 specific gravity units to the reading. If the sample was 2°C low, subtract 0.002 specific gravity units from the reading.

(7) Carefully clean the hydrometer and thermometer. Place them in rack provided for this purpose. Dump sample in the 55 gal. drum for this purpose.

e. Method of Running Hold Points

(1) Obtain representative sample of material from sample line at inlet to pump. Catch sample in a pint can.

(2) The receptacle for running the sample is 1" x 4½" pyrex tube sealed at one end. The tube is inserted in a square 8 ounce bottle which is insulated in bottom by a layer of 1" asbestos fiber. The tube is held in place by a large cork. The insulation is used in an effort to keep the Aroclor from cooling too rapidly.

(3) Pour the material into the tube until it is filled within 1½" of the top.

(4) The material will probably crystallize in the cold tube and will have to be melted again.

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I. e. (5) When material is melted, insert a suitable thermometer (0-360°C) which is fitted with a cork to hold it in place. The bulb of the thermometer should be fitted in the center of the sample, care being taken that it is not too close to the side of the tube.

(6) Heat the tube to 200°C, place it in the asbestos jacket and then put it in the bottle.

(7) Take readings on the thermometer every 30 seconds. At first the temperature will drop rapidly (4-6°C between readings). This drop will decrease and finally come to a stop, and stay constant for several readings or will start to go back up several degrees.

(8) Record the point at which the temperature remains constant, or in case of a rise, the highest point of the rise is the hold point of the material.

f. Method of Running Softening Points

(1) Obtain representative sample of material from sample line at inlet to pump. Catch sample in can lid or pyrex beaker.

(2) Heat ring and sample.

(3) Place ring on can lid or metal plate and fill with sample until material stands slightly higher than edge of ring.

(4) Cool ring and lid from bottom of sides until sample sets up, being careful not to get any water on top of sample.

(5) Finish cooling by running water on top of sample, after it sets up.

(6) Remove filled ring from lid and trim off any material that is on the outside.

(7) Make slight indentation on top of sample in the center of the ring with a heated wire to hold ball in place.

(8) Fill beaker with water or glycerine.

(a) Use water when expected softening point is under 80°C.

(b) Use glycerine when expected softening point is over 80°C.

(9) Place ring in sample holder, place ball on sample and put holder in beaker.

(10) Adjust thermometer in holder so that tip of bulb protrudes 1/4" through hole in cross bar that holds samples.

(11) Place beaker on stand with screen under it and set burner under the stand.

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I. f. (12) Light burner and adjust to give a temperature rise as shown on the thermometer of 5°C per minute.

(13) Bring temperature up 5°C per minute until ball falls through sample.

(14) Record temperature at time ball falls to lower cross bar as the softening point.

g. Chlorine Vaporizer

Liquid Chlorine from tank cars is vaporized in a shell and tube exchanger using steam for heat. Vaporized chlorine at 25 psig enters the chlorine header to the Aroclor chlorinators. The vaporizer has the following safeguards:

(1) Chlorine level control on vaporizer.

(2) Steam pressure regulator - maintain 10-12 psig steam pressure.

(3) Steam control valve - regulated by temperature control of chlorine entering the vaporizer.

(4) Chlorine feed control valve to vaporizer.

(5) Chlorine feed pressure control valve to chlorine header from the vaporizer discharge.

The controls for this unit are necessary to minimize the possibility of a chlorine leak or a fire. Excessive heat above 25 psig steam pressure will allow chlorine to corrode iron at excessive rates. Holes will occur in the tube bundle and steam will mix with chlorine. A reaction occurs to form HCl gas and $H_2$. At these temperatures a fire will normally occur and the hydrogen will burn.

(1) Start Up Chlorine Vaporizer:

(a) Open manual valve on the steam line to the vaporizer.

(b) Set the vaporizer temperature control at 65°C to 70°C to allow the steam control valve to open.

(c) Check to be sure steam pressure to the vaporizer is 12 psig or lower.

(d) Hook up take-off lines to the chlorine car. Wear gas mask while making this connection. Open valve on the car to take on chlorine when car is connected. Open valve in the liquid chlorine line.

(e) Open the block valves on each side of the automatic liquid chlorine take-on valve. Close the by-pass valve around the control valve.

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I. g. (1) (f) Check the vaporiser level control to be sure it closes the liquid chlorine control valve when the vaporiser is approximately one-half full.

(g) Set the air regulator to the chlorine feed valve to the chlorine header. Set to maintain a pressure of 25 psig on the chlorine header. Open this valve slowly. This valve begins to open at 18 psig - it is wide open at 30 psig.

(h) Observe operation to be sure the chlorine header pressure does not exceed 25 psig and the steam pressure to the vaporiser is below 12 psig.

High chlorine pressure can cause extreme problems at the chlorine plant and result in chlorine release to the atmosphere.

(2) Shutdown Chlorine Vaporiser:

(a) Close block valve on each side of liquid chlorine control valve.

(b) Allow steam to vaporise liquid chlorine in the vaporiser.

(c) Shut off block valve in steam line to the vaporiser or close the steam control valve by adjusting the set point on the vaporiser temperature controller.

(d) Close the automatic chlorine feed valve to the chlorine header. Close the block valve in the line to the header.

(e) If the liquid chlorine car is to be disconnected do the following:

1. Put on gas mask for use in connecting and disconnecting car.

2. Close manual valve in 1" liquid chlorine line to vaporizer.

3. Close angle valve on top of the chlorine tank car.

4. Break union on the pipe connection line. Slowly let the chlorine pressure bleed off. When pressure is released remove the piping.

h. Trouble Shooting Chlorinator and Blowing Tank Operation MONS 056876

| Problem | Possible Cause & Action |
|---|---|
| (1) High Chlorine Pressure on Header (30 psig or more) | a) Vaporizer feeding too much chlorine from car. |
| | Action: Check operation of vaporizer, |

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I. h. Trouble Shooting Chlorinator & Blowing Tank Operation (Cont'd.)

| Problem | Possible Cause & Action |
|---|---|
| | Action: Cont'd. set point of chlorine valve to the header (should be 25 psig or less) |
| | b) Chlorine Plant may be sending an excess amount of air. |
| | Action: Check with Chloine Plant chief operator. |
| | c) Two, three, or more chlorinators may be cut off. |
| | Action: Notify Chlorine Plant chief operator. Get chlorinators back in operation as soon as possible. |
| | d) Pressure gauge could be bad. |
| | Action: Check other gauge. Notify chief operator gauge needs replacing. |
| | e) Valve to HCl Dept. or line could be closed or plugged. |
| | Action: Check acid operator. Observe pressure gauge on HCl off-gas line. Open valve if closed. Go down drowning tower if tower line is plugged. |
| (2) Chlorine leaks | a) Leak at pipe lines, flanges, ruptured line, etc. |
| | Action: Use ammonia bomb to find the leak. Shut off (valve off) leak from system if possible. Nofity chief operator need for repair. Make temporary repair or shut down if necessary. |

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C. DETAILED INSTRUCTIONS

I. h. Trouble Shooting (Cont'd.)

| Problem | Possible Cause & Action |
|---|---|
| | b) Pressure problem at Chlorine vaporizer.<br>Action: Check rupture disc or relief valve to see if they are blowing. Watch chlorine pressure on vaporizer. Shut off chlorine from the tank car and bleed the vaporizer pressure down. |
| | c) Vaporizer tube leaks.<br>Action: Check steam pressure to vaporizer. May fall off. Check vaporizer chlorine pressure. Watch for chlorine leaks. Shut off chlorine from the tank car and bleed the vaporizer pressure down. |
| (3) HCl fumes | a) Fumes from the blowing tanks.<br>Action: Check water pressure to the S&K jet (should be 30 psig minimum). Check to see if a valve in the vapor line is closed. Water line to jet can become plugged with sticks, etc. from the cooling tower. It may be necessary to shut off air blower temporarily. |
| | b) Fumes from the HCl off-gas line above the chlorinators.<br>Action: Check pressure of HCl header (normally 1-2 psig). If greater it may be necessary to go to the drowning tower. If necessary use ammonia bomb to find the leak. Make temporary repair or notify chief operator need for permanent repair. Valve off leak if possible. |
| | c) Fumes from charging a chlorinator.<br>Action: Complete charging of the vessel and shut off the vent valve. |

C. DETAILED INSTRUCTIONS

I. h. Trouble Shooting (Cont'd.)

| Problem | Possible Cause & Action |
|---|---|
| (4) Chlorinator temperature high | a) Cooling coil plugged or plugging.<br>Action: Check water flow to the chlorinator. Be sure maximum water is being used. Check coil to see if it is plugging (water valve wide open & small stream of water flow). Check water feed pressure to cooling coils (normally 60 psig). |
| | b) Chlorine feed to high. (1,000 lbs/hr. or above)<br>Action: Reduce chlorine feed if additional water is not available. |
| (5) Leaking valve, pipe line, flange, pump, etc. | a) Aroclors are a hard material to contain in pipe lines. The material is hot causing leaks.<br>Action: Try to tighten up on valve stuffing box, bolts at flange, etc. Notify chief operator if additional repair work is needed. |
| | b) Leaks at pumps with mechenical seals or packing.<br>Action: Notify chief operator the mechanical seal needs to be adjusted or replaced. On pumps with packing glands, try to tighten leaking gland plate. If leak can not be stopped, notify the chief operator. |
| (6) Plugged Lines | a) Biphenyl, Santowax, and Solid Aroclor lines plug easily when not hot.<br>Action: Check to be sure steam or hot Aroclor is on pipe line. If not, put steam on and give it time to heat up the line. Check pipe lines and valves for exposed areas not steam traced or insulated. Use $CO_2$ and try to blow the line out. Use a gas torch flame to heat the pipe line as a last resort. |

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C. DETAILED INSTRUCTIONS

I. h. Trouble Shooting (Cont'd.)

| Problem | Possible Cause & Action |
|---|---|
| (7) Free Chlorine off Chlorinator | Normally free chlorine is indicated in the off-gas vent line at the HCl absorber sewer box. Free chlorine loss is a safety hazard as well as an excessive cost. It can be caused by inadequate reaction of the Biphenyl and might indicate formation of unstable Aroclors. If this situation can not be corrected immediately the following should be checked: |

Action:

a) Get samples of Aroclor from the chlorinators and check for water. If water is in the Crude Aroclor it will boil and bubble more than usual - appears to sizzle. In case water is found in a sample remove the chlorinator from service. Normally a hole in the cooling coil will be the source of water.

b) Check chlorinator temperatures on the multipoint temperature recorder. Each chlorinator should be above 120°C. Use steam in the coils to heat up if necessary. A quick increase in chlorine will sometimes raise the temperature quickest.

c) Check the off-gas sample for each chlorinator and have the Lab run analysis for free chlorine. Isolate the bad chlorinator. Normally Lab analysis is light yellow to yellow in color. Red indicates excessive free chlorine in the liquid chlorinators. Red color is normal for the solid chlorinators. Resample a chlorinator with excessive free chlorine. Remove this chlorinator from service and see if the problem of free chlorine is solved.

d) Inadequate amounts of catalyst present as Ferric Chloride or iron turnings can cause excess free chlorine in the off-gas line. This situation should never occur since the chlorinators are checked every six months. If it should, notify the chief operator and department supervision immediately.

C. DETAILED INSTRUCTIONS

I. h. Trouble Shooting (Cont'd.)

| Problem | Possible Cause & Action |
|---|---|
| (8) Leaking Cooling Coil In Chlorinators | Corrosion in the chlorinators occasionally results in a water leak into a chlorinator. Wet chlorine and HCl gas are extremely corrosive and can cause extensive damage fast. Any leak should be found and the chlorinator removed from service immediately.<br><br>Action:<br>a) Sample the chlorinators and check for water. If water is present in the Crude Aroclor it will boil and bubble more than usual - appears to sizzle.<br><br>b) Off color acid at the Muriatic Acid absorber may indicate the moisture problem. Excess corrosion would put iron in the HCl gas and cause the tower acid to be yellow instead of clear. |

C. DETAILED INSTRUCTIONS

11. Aroclor Stills, Earth Treatment, and Filtration

Aerated Crude Aroclor from a blowing tank or a roof tank is fed to the still tank. Hydrated lime is added to the Crude Aroclor.

Vacuum is applied to the still and the Aroclor is circulated through the furnace coil and heated to the vaporisation temperature. Vapors pass up an open column to the condenser. Distilled Aroclor is collected in a receiver and then transferred into a blending tank.

STILLS

Distilled Aroclors are treated with Attapulgus Earth in the blending tank, filtered, analysed, and packaged or held in storage.

Aroclor 1268 and all distilled Solid Aroclors do not receive earth treatment. They are drawn directly from the receiver into suitable containers or transferred to the flaker operation.

Still residue or bottoms from each distillation are sold as Montars or discarded.

a. Charging and Start-Up of Aroclor Stills

(1) Charges for various Aroclors:

Under normal conditions Crude Liquid Aroclors are charged continuously to the still from a blowing tank or roof tank to a 53" outage. This level is maintained by an automatic level controller. Occasionally, Liquid Aroclors are charged batch-wise. When this is done, the crude is charged to a 25" outage. Aroclor 1168 is never charged continuously, since this crude is pumped directly to the still from the chlorinator. This Aroclor is not air blown. Crude Solid Aroclors are charged batch-wise to a 30" outage in the still.

(2) Prepare blowing tank for transfer of charge.

(a) Check to be sure steam is on the pump and charging lines. Material to be pumped must be hot or it will damage the mechanical seals on #3 and #4 blowing tank pumps.

(b) Check temperature of material in blowing tank to be sure it is hot enough to transfer (120-140°C).

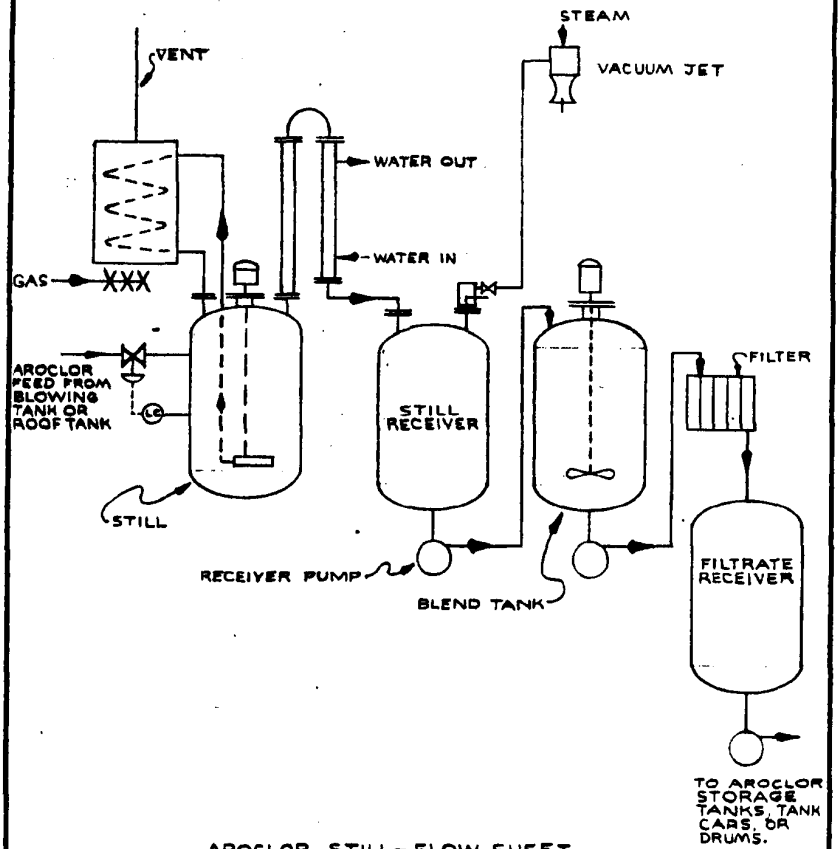
(c) Check with chlorinator operator to be sure Crude Aroclor has been air blown one hour.

(3) Prepare Still to receive charge:

(a) Close valve in bottom line under the still.

(b) Open vent valve on the still.

(c) Remove vent cap on measuring nipple on the still.




AROCLOR STILL - FLOW SHEET

MCNS 056883

ANNISTON PLANT — MONSANTO CHEMICAL COMPANY — ANNISTON, ALA.

| TITLE | | | | | |
|---|---|---|---|---|---|
| AROCLOR STILL - FLOW SHEET | | | | | |
| DRAWN BY | APPROVED | DATE | SCALE | DEPT. | |
| EAE | | 8-10-64 | NONE | AROCLOR | TS-A-704 |

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II. e. (3) (d) Open valve on charging line at the still. Heat on valve is sometimes required on Solid Aroclors.

(e) Set valves in charging line to pump from the desired blowing tank to the correct still.

(f) If Aroclor 1168, 4065, 5042, or 5060 is to be distilled approximately 75-100 gallons of 1142 or 1154 should be charged to the still and heated to 200°C. The material is then drawn out of the still. Otherwise the still pump may plug.

(g) Close main valve in vacuum line to the still just above the receiver. Start steam to the vacuum jets. Adjust water to intercondenser on middle stage. The jets on #2 and #3 stills should pull down to 20-30 mm Hg absolute on the receiver. No. 1 still jet should pull down to 3-6 mm Hg absolute on the receiver.

(4) Charging the still and start-up:

(a) Set valves in line to the still.

(b) Start the blowing tank pump.

(c) Observe material entering the still.

(d) Insert rod in measuring middle on the still and check amount of material in the still. As soon as 10-15 inches of material is in the still, start the circulating pump.

(e) When complete charge is in the still stop the charging pump. Allow lines to drain and close valve in charging line at the still.

(f) Close valve under blowing tank.

(g) Add hydrated lime through the measuring nipple using funnel provided for this purpose. Add 250 pounds of lime for each five (5) still receiver batches of liquid Aroclor. All solid Aroclors (1268, 4465, 5442, 2565, and 5460) require 100 pounds of lime for each still batch.

(h) Replace cap on nipple over still.

(i) Light gas burners on furnace and set gas pressure at 5 psig on each burner.

(j) Check temperature recording instrument to be sure it is operating correctly.

(k) In case temperature chart does not indicate a rise in temperature, check for plugged lines or instrument problems.

C. DETAILED INSTRUCTIONS

II. a. (4) (k) Turn the pump off and on a couple of times. It may be necessary to pull a vacuum through the coil. Check the still pump ampmeter to be sure the pump is pulling a load. Have the electrician check the instrument if the temperature does not rise.

(l) Adjust the gas burners to give maximum rate of temperature rise without overheating. A spread of 10-15°C between the coil inlet and outlet is normal. Gas pressure is normally as follows on the stills when maximum rate is achieved:

| Still No. | Gas Burner Pressure |
|---|---|
| 1 | 15 psig |
| 2 | 20 psig |
| 3 | 30 psig |

No. 1, 2, and 3 still furnaces are operated with the dampers 1/3 to 1/4 open.

(m) Open valve in main vacuum line to the vacuum jets above the receiver. Vacuum should be:

| Receiver No. | mm Hg Absolute |
|---|---|
| 1 | 3-5 mm Hg (for Solid Aroclors) |
| 2 & 3 | 20-30 mm Hg (for Liquid Aroclors) |

(n) Start water on condenser as material starts to come over. Adjust water to keep from plugging up the condenser.

NOTE: Vacuum problems on the stills are usually due to flashing of product over, plugged vacuum lines, leaks in the still system, leaks at pump packing, water adjustment on inter-condenser on jets, changes in steam pressure to the jets, or problems in the jet nozzles. Flashing can be stopped by adjusting the cooling water on the condenser or operation of the still at a slower rate. Vacuum trouble must be traced systematically from the jet, to the receiver, and then to the still.

(o) Gas pressure on the burners is adjusted until the coil temperatures reach a point about 20°C below the expected distillation temperature. Normally a 10°C temperature spread is obtained on the inlet and outlet of the coil.

(p) Batch data sheets are filled out during each distillation. Information includes still lot number, material being distilled, start time, finish time, temperature spread on the still coils, and time for the distillation, etc.---
(See distillation sheet next page)

(5) Operation of still during distillation: MONS 056885

(a) Regulate the gas pressure at the burners to give maximum distillation rate consistent with a good color of the product. (See Item 4. (l) above)

## TABLE III
## DISTILLATION OPERATING CONDITIONS

| AROCLORS | LIQUID AROCLORS | | | | | | SOLID AROCLORS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1221 | 1242 | 1248 | 1254 | 1260 | 1262 | 1268 | 4465 | 5442 | 5460 |
| Approximate Temperatures at which various Aroclors start distilling 35-40 mm Vac.Liqs. 3-5 mm Vac.Sols. | | | | | | | | | | |
| Column | 155°C | 165°C | 170°C | 190°C | 195°C | 235°C | 225°C | 220°C | 215°C | 260°C |
| Coil Inlet | 165°C | 170°C | 180°C | 200°C | 210°C | 245°C | 240°C | 235°C | 240°C | 280°C |
| Coil Outlet | 170°C | 175°C | 190°C | 220°C | 225°C | 255°C | 245°C | 245°C | 250°C | 290°C |
| Approximate Finishing temperature when bottoms are not to be drawn | | | | | | | | | | |
| Column | 180°C | 205°C | 230°C | 240°C | 265°C | 275°C | | 310°C | | |
| Coil Inlet | 185°C | 210°C | 240°C | 245°C | 270°C | 280°C | | 330°C | | |
| Coil Outlet | 190°C | 220°C | 250°C | 255°C | 280°C | 290°C | | 375°C | | |
| Approximate Finishing temperature after which bottoms are to be drawn | | | | | | | | | | |
| Column | 215°C | 230°C | 250°C | 280°C | 315°C | 320°C | 285°C | 350°C | 315°C | 355°C |
| Coil Inlet | 225°C | 240°C | 255°C | 290°C | 325°C | 335°C | 295°C | 360°C | 340°C | 375°C |
| Coil Outlet | 240°C | 250°C | 265°C | 310°C | 340°C | 345°C | 340°C | 410°C | 390°C | 410°C |
| Finishing Specific Gravity | 1.182-1.192 @ 25°C | 1.381-1.392 @ 25°C | 1.405-1.415 @ 65°C | 1.495-1.505 @ 65°C | 1.555-1.566 @ 90°C | 1.572-1.583 @ 90°C | | | | |
| Finishing Hold Poing | | | | | | | 150-170°C | | | |
| Finishing Softening Point | | | | | | | | 60-66°C | 46-52°C | 98-105.5°C |

NOTE: Aroclor 1232 is a blend of Aroclors 1221 and 1242

C. DETAILED INSTRUCTIONS

II. a. (5) (b) The lower the vacuum, the faster the distillation rate. (See Table III for Distillation Operation conditions of the different Aroclors.)

(c) Coil temperature spread -

Coil inlet and outlet temperature must be watched closely at the end of the distillation. Still bottoms are very viscous; therefore, if the circulating pump is in poor condition, or the distillation is carried too far, circulation may stop and the coil will become plugged or be burned. Heat from the furnace actually burns the Aroclor to carbon. If the coil outlet temperature jumps suddenly and the inlet temperature stays the same or falls, circulation has nearly stopped. In this case, cut the burners off quickly and suck the coil. If the coil cannot be sucked, it is plugged and will have to be replaced.

Observation of the ampmeters on the still circulating pump motors will also indicate when the pump has stopped circulation. Normally the pump motor will pull 20 to 40 amps during a distillation. A sudden increase in the amp load indicates the coil is probably plugging. A sudden decrease indicates the pump load has dropped off and the coil is plugged.

(d) Transfer of receiver to blend tank or flaker hold tank.

(1) Observe level of material in the still receiver. When material is 8" to 12" from the sight glass the receiver of material is transferred to a blend tank or the flaker hold tank.

(2) Check to be sure steam heat is on the transfer lines and the pump.

If Solid Aroclors are to be transferred to the flaker hold tank the hot Aroclor heat is used.

(3) Set valves in line to the blend tank desired (or the flaker hold tank).

(4) Start transfer pump under the receiver.

(5) Allow material to pump until the receiver is empty. Do not let the still lose vacuum. This entire transfer can be made while the still is operating.

(6) Check the blend tank or flaker hold tank to be sure the material is being transferred.

(7) Close the valves and stop the pump when the transfer is complete.

C. DETAILED INSTRUCTIONS

II. b. Stopping the Distillation

(1) General Operation:

(a) Run down on stills. Stop feed to still and distill off material in the still tank until an outage of 82" to 84" is reached for Liquid Aroclors. Normally an outage of 75" to 80" is reached for Solid Aroclors.

(b) Reduce gas pressure on the burners to 5 psig.

(c) Close valve in vacuum line above the receiver.

(d) Reduce water flow to the condenser as the distillation stops.

(2) Operation dependent on Aroclor being distilled:

Aroclors 1221, 1242, 1248, 1254, 1260, and 1262:

(a) Stop circulating pump after 15-20 minutes.

(b) Release vacuum through the vent valve on the coil. Suck the coil clean for one to three minutes.

(c) Remove cap from the measuring nipple on the still.

(d) Measure bottoms in the still and record in the log book.

(e) Prepare to draw bottoms and then recharge the still to start another distillation.

Aroclors 1268, 4465, 5442, and 5460:

(a) Heat upper and lower valves under the receiver with a small gas flame for 15 minutes before the distillation finished.

(b) Close valve to suction of receiver pump.

(c) Open top valve in drawout line.

(d) Release vacuum through drawout line, controlling rate of release with lower valve.

(e) Flush out line by allowing 1-2 gallons to run into a bucket or 55 gallon trash drum.

(f) Catch sample in small beaker or can lid and check softening or hold point according to method described in instructions for chlorinators.

1. If softening or hold point is too low, close valves, let drawout line drain and run distillation farther to raise softening or hold point.

C. DETAILED INSTRUCTIONS

II. b. (2) (f) 2. If sample is in specification, open vent on top of the receiver and draw out into drums or transfer to the flaker head tank to allow flaking the material.

NOTE: Aroclor 1268 and 5460 is flaked.

3. If the softening point is too high, charge the still for the next distillation and run the first part into the receiver. Check the softening point at intervals; when ok, draw into drums or transfer to flaker head tank as required.

NOTE: Care should be taken in finishing the Crude Aroclor so this does not have to be done.

(g) Stop the circulating pump after 15-20 minutes if the distillate is ready for transfer.

(h) Release the vacuum through the vent valve on the coil. Suck the coil clean for one to three minutes.

(i) Remove the cap from the measuring nipple on the still.

(j) Measure the bottoms in the still and record in the log book.

(k) Prepare to draw bottoms and then recharge the still to start the next distillation.

c. Drawing Bottoms

(1) Schedule for drawing bottoms:

(a) Aroclors 1221, 1242, 1248, 1254, 1260, and 1262: Draw bottoms after every 10th distillation.

(b) Aroclor 1268: Draw bottoms after every 4th distillation.

(c) Aroclor 4465: Draw bottoms after every 3rd distillation.

(d) Aroclors 5442 and 5460: Draw bottoms after every 2nd distillation.

(2) Operation:

(a) Place estimated number of scrap drums required (normally 7 or 8) in an arc on the floor beneath the still and under the hood so each drum can be filled without being moved.

(b) Check bottom line to be sure it can be turned to reach all drums without becoming unscrewed from the valve.

(c) Check to be sure the exhaust fan is running.

C. DETAILED INSTRUCTIONS

II. c. (2) (d) Heat the valve at the bottom of the still to be sure it is not stuck. Use a small gas flame for 15 minutes before drawing bottoms.

(e) Obtain assistance to draw bottoms. Have person put on face shield.

NOTE: Fumes from this operation are toxic. The material to be drawn into drums is hot. Do not stay under the hood while bottoms are being drawn.

(f) Set drawout line at a drum. Open valve under the still. Shut off valve when the drum is filled within 8-10" of top. Use hook rod to determine level in the drum.

(g) Move draw-out line to next drum. Open valve under the still. Continue until the still is empty.

(h) Close valve under the still.

(i) Allow drums to set under the hood until they have cooled (6-10 hrs.). Then palletize the drums at the dock for transfer to the dump.

d. Earth Treatment of Aroclors

Liquid Aroclors 1221, 1242, 1248, 1254, 1260, and 1262 are treated with Attapulgus Earth for three hours per the following procedure:

(1) Collect two receiver distillations in a blend tank.

(2) Prepare Attapulgus earth which is to be added to the blend tank. This earth must be dried in an oven for a minimum of four hours at a temperature of 210-250°C.

(3) Start the agitator in the blending tank and add forty (40) pounds of dried earth for two receiver distillation batches.

(4) Agitate the mixture of earth and Aroclor for three (3) hours at the following temperatures.

| | Temperature |
|---|---|
| Aroclor 1221 | 60 - 70°C |
| Aroclor 1242 | 70 - 80°C |
| Aroclor 1248 | 89 - 90°C |
| Aroclor 1254 | 90 -100°C |
| Aroclor 1260 | 100 -110°C |
| Aroclor 1262 | 110 -120°C |

C. DETAILED INSTRUCTIONS

II. e. Filtration of Aroclors

(1) Prepare filter for filtration of Aroclor by cleaning the earth from the previous filtrations from the press and installing new filter paper.

(a) Run tightening screw back to permit removal of papers.

(b) Separate and clean frames and remove used papers. Be sure no earth is left on the surfaces of the plates and frames. Discard earth and paper in a 55 gallon trash drum.

(c) Install new papers and tighten the press. Use two papers between each plate.

(2) Starting Filtration:

(a) After the Aroclor has been earth treated for three hours start filtration.

(b) Set valves in the system to pump the treated Aroclor from the blend tank, through the filter press, and back to the blend tank. Recycle this material until no earth is visible in a sample from the filter.

(c) Set valves to direct material to the Filtrate Receiver when the material has cleared up.

(d) Catch a sample of the filtrate. Check specific gravity and color. Record data in log book. At present the Lab must ok color.

(3) Transfer to Storage Tank:

(a) Measure outage of material in the filtrate tank and record in the log book.

(b) Set valves in the line so the Aroclor will be pumped to the desired storage tank.

(c) Check to be sure steam is on the transfer pump and the transfer lines.

(d) Start the pump under the filtrate receiver.

(e) Close the valve under the filtrate receiver and stop the transfer pump when the Aroclor has been pumped out.

(f) Measure innage in the storage tank and record in the log book.

C. DETAILED INSTRUCTIONS

II. f. Trouble Shooting Aroclor Stills, Earth Treatment, and Storage Operation

| Problem | Possible Cause & Action |
|---|---|
| (1) Still Vacuum Problems | a) Jet not operating properly. |
| | Action: Close valve on receiver and be sure the jet will pull down. Check steam pressure to the jet, check vacuum lines for leaks, or plugs, and check the jet for plugging. Notify the chief operator repairs are necessary. |
| | b) Plugged condenser. |
| | Action: Put steam or flame heat on the condenser to unplug. |
| | c) Leaks in the system. |
| | Action: Apply full vacuum to the jet. Check out the piping system, the still, still pump, and the receiver for leaks. |
| | d) Minor jet problems. |
| | Action: Water to the intercondenser must be adjusted properly. Steam to the jet must be constant. Nozzles in the jet must be in good condition. |
| (2) Holes or plugs of still coils | a) Coils occasionally wear until a hole comes in the coil from heating and age. Black smoke in the furnace, or out the furnace stack indicates Aroclor is burning. |
| | Action: If the leak is minor continue operation until the still is finished. Notify the chief operator repairs are necessary. |
| | b) Running down in the still at the end of a distillation, failure of the pump, or excess heating of a coil can cause a coil to plug. |
| | Action: Check the pump ampmeter to see how many amps are required. (Normal 25-30 amps). A higher reading would |

C. DETAILED INSTRUCTIONS

II. f. (Continued)

| Problem | Possible Cause & Action |
|---|---|
| | indicate the coil is plugging. Cut the fire off of the furnace immediately, check the inlet and outlet coil temperature to determine if coil has overheated. Notify the chief operator if the coil must be changed out. |
| (3) Plugged Lines | a) Solid Aroclors and the still residue will plug lines, still coils, and pumps when it is not kept hot. |
| | Action: Check to be sure steam or hot Aroclor is on the pipe line. If not put steam on and give it time to heat up the line. Check pipe lines and valves for exposed areas not steam traced or insulated. Use $CO_2$ and try to blow the line out. Use a gas torch flame to heat the valve or pipe line. |
| (4) Off-Color Aroclor on a Still | a) Rapid or too fast a heat-up on a still. |
| | Action: Decrease fire and stop distillate, then increase temperature slowly to give good color Aroclor (normally 10 on 1242). |
| | b) Rapid surges in the vacuum system can cause material to burp over. |
| | Action: Check vacuum control - adjust to give good control. Notify chief operator if repairs are necessary. |
| | c) Run-down on a still can cause carry-over of high color material at end of a distillation. |
| | Action: Watch temperature spread on run-down. Do not exceed final temperature on a distillation. Do not let temperature spread exceed 15°C. |

C. DETAILED INSTRUCTIONS

II. f. (Continued)

| Problem | Possible Cause & Action |
|---|---|
| (5) High Moisture in Aroclor | a) Moisture above 50 ppm is too high in finished Aroclors. Normally material must be 20 to 25 ppm to be loaded in specification, since moisture is picked up during loading.<br><br>Action: Start sampling to determine where the moisture is being obtained. It may be necessary to run a pressure test on tank coils to determine the problem. Notify the chief operator as soon as material out of specification is found. |
| (6) Bad Electrical Property Problem in Aroclor | a) Resistivity and stability of the Aroclors are very critical in this quality product. Material must be loaded at a 500 resistivity minimum to be in specification. Since the electrical property drops during loading, it should be 700-800 when loaded. If material is low in the storage tank it is transferred back to the blending tank for earth treatment, laboratory check, and then loaded to a car. |
| (7) Still Receiver Transfer Pump Problems | a) Transfer pump will not pump the receiver out under vacuum.<br><br>Action: Check the lines to be sure the valves are set correctly. Check lines at bottom of the receiver to be sure they are not plugged. If necessary to pump out, shut off vacuum on the still and transfer the receiver. Notify the chief operator that the pump, relief valve, or the pipe lines need work. |

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C. DETAILED INSTRUCTIONS

III. Loading Refined Aroclors

Aroclors are shipped in five gallon cans; 55 gallon drums; 4,000, 7,000, and 8,000 gallon tank cars; and 3,000 or 4,000 gallon tank trucks to customers.

a. Spotting Tank Cars

Normally the railroad switch crew will spot cars at the Aroclor loading dock. Occasionally it will be necessary to move a car. When it is necessary use the half track and pull the car into position.

(1) Obtain help to move the car.

(2) Attach hook on cable at front of the half track to a strong part of the car. Do not hook onto the ladder or other weak parts.

(3) Release the winch and let out 15 to 20 feet of cable to connect to the car.

(4) Release the brakes on the car.

(5) Use the half track to pull the car into position. Put the half track in four wheel drive. Do not use the winch to pull the car.

(6) Stop pulling the car when it is in position.

(7) Set the brake on the car.

(8) Remove the cable hook from the car and wind up on the winch drum.

b. Filling Tank Cars or Trucks

Aroclors are shipped in lined vessels to protect the electrical properties from contamination. Most vessels are lined with aluminum or a zinc-tin lining.

(1) Inspection of car or truck for loading:

(a) Enter each car or truck for inspection prior to loading. If necessary clean out the vessel. All material in the tank should be removed. Damaged lining areas should be cleaned of rust particles. Report damaged areas.

(b) Use a tank entering permit and a fire permit when entering a car. Observe safety rules for each permit.

(c) A fellow worker must be on top of the car holding the rope harness. Wear the safety belt harness, an air mask, gas test the car, and use a light when entering a tank car or truck.

LOADING

C. DETAILED INSTRUCTIONS

III. b. (1) (d) Fill out tank inspection sheet.

(2) Put steam on the car after it is clean.

(3) Check to be sure there is enough material in a storage tank to load a car or truck as required. (An 8,000 gallon car requires about 63" of material in #2, #3, and #4 storage tanks.

(4) Circulate the material in the storage tank for two (2) hours, sample the tank, and have the sample checked for loading by the laboratory. If material is in specification proceed with loading of the tank.

(5) Install diaper cloth sock in the filter in the loading line and place a sock over the end of the loading line extension.

(6) Attach extension to the loading line at the dock and place sock end into the dome of the car.

(7) Connect ground wire to the car.

(8) Set valves in the loading line from the storage tank to the loading dock. Do not open valve in line at the car.

NOTE: Care should be taken to see that the correct valves are opened so only the desired Aroclor enters the loading line.

(9) Start pump at the storage tank.

(10) Open valve in drain line at the loading dock and allow one drum of Aroclor to flow through the line to flush out the loading line.

(11) Close valve in drain line and open valve in line to the car. Approximately 2½ hours is required to load a car.

(12) When the car is loaded, stop the pump, and close valve to the loading line. Fill car up one to two feet into the dome of the car.

(13) Remove loading line from car.

(14) Take samples from car and send to laboratory for final analysis. (See Schedule)

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C. DETAILED INSTRUCTIONS

III. b. (14)

SAMPLES TO BE TAKEN FOR LIQUID AROCLOR LOTS

| MATERIAL | TANK CARS - TRUCKS or DRUMS |
|---|---|
| 1221 | 2 x 1/2 Gallon |
| 1232 | 2 x 1/2 Gallon |
| 1242 | 3 x 1/2 Gallon & 1 x 5 Pint |
| 1248 | 2 x 1/2 Gallon |
| 1254 | 3 x 1/2 Gallon & 1 x 5 Pint |
| 1260 | 3 x 1/2 Gallon |
| 1262 | 2 x 1/2 Gallon |

(15) Close and tighten lid on car.

(16) Seal car and record seal number and car number in Aroclor log book.

c. Filling Drums

Liquid Aroclor can be drummed from the storage tanks or the filtrate receiver. Solid Aroclors that are drummed are normally filled from the still receiver. Solid Aroclors 1268 and 5460 are normally flaked and bagged. Aroclor 2565 is a non-distilled product which is drummed from the blowing tanks.

The following steps should be followed when material is to be drummed:

(1) Send a representative sample (1/2 Gal. for Liquid Aroclors) of the material to the laboratory for inspection. If the material is via storage tank it should be circulated for two (2) hours. Material in a filtrate receiver or blowing tank should be agitated for 20 to 30 minutes. If material is in specification proceed with drumming.

(2) Check the scales to be used. Set the scales for the weight specified for each drum (See Table IV).

(3) Start the pump.

TABLE IV
AROCLOR FINISHED GOODS
DRUM WEIGHTS

| Material | Drum Weights Lbs. - 5 Gals. & 55 Gals. |
|---|---|
| 1221 | 50 or 520 |
| 1232 | 50 or 550 |
| 1242 | 55 or 600 |
| 1248 | 55 or 600 |
| 1254 | 60 or 600 |
| 1260 | 60 or 600 |
| 1262 | 60 or 600 |
| 1262 - 10% Toluene | 60 or 600 |
| 1262 - 10% Xylene | 60 or 600 |
| 1260 - 10% Toluene | 60 or 600 |
| A13B3B | 65 or 675 |
| 5442 | 50 or 450 |
| 2565 | 500 |
| 4465 | 50 or 500 |
| Inerteen PPO | 65, 360, or 674 |

C. DETAILED INSTRUCTIONS

III. c. (4) Open the valve in the drum-out line and allow approximately 5 to 30 gallons of material to flow through the line into a drum to flush out the line. Drumming from a filtrate tank should take five gallons of material to flush the line. Drumming from a storage tank should take 30 gallons to flush the line.

(5) Fill 5 or 6 drums of material to the specified weight; stencil the name of product, lot number, net weight of each drum, and the initials of the person doing the work. See next page for drum weights - Table IV.

(6) Sample these drums with a thief for final drum sample per schedule for loading tank cars (b. (14)).

(7) Continue drumming the Aroclor when the lab gives the final ok that material is in specifications.

(8) Drum material until you have the required quantity of drums. Filled drums are palletized and moved to the loading platform for transfer to the warehouse.

C. DETAILED INSTRUCTIONS

IV. Flaking Aroclors

Aroclors 1268, 5460, and 5060 are flaked on a drum flaker and bagged in 100 lb. bags.

a. Preparation for Flaking

(1) Place hot Aroclor heat on the pipe lines, valves, and flaker hold tank. Heat the Aroclor system up to 250°C. Observe temperature on the multi-point recorder in the chlorinator control room.

(2) Pump Aroclor to be flaked into the flaker hold tank.

(3) Check temperature of material in the hold tank. It should be 220°C. min. Temperature recorded on #3 still multi-point recorder.

b. Start-Up of Flaker System

(1) Turn electrical heat in the flaker pan on about 20 to 30 minutes before start-up.

(2) Open valve in water line feed to the flaker drum.

(3) Start the flaker drum. Start breaker at discharge of flaker.

(4) Open valve at bottom of the flaker hold tank.

(5) Open valve at sight glass to start Aroclor feed into the flaker pan. Observe flow in sight glass. Adjust valve to maintain the level in the flaker drum about one inch from the top of the drum.

(6) Observe operation to be sure the drum is picking up the material.

(7) After the flaker has run 15 to 20 minutes notify the Chief Operator material is in the hopper to be bagged.

(8) Continue to flake until the flaker hold tank is empty.

c. Shutdown of Flaker

(1) Normally the flaker will be run until the hold tank is empty.

(2) Allow the drum to pick up material from the pan until it will no longer contact the hot liquid product.

(3) Stop the flaker drum and the breakers.

FLAKING

C. DETAILED INSTRUCTIONS

IV. c. (4) Turn off the electrical heat to the flaker pan.

(5) Close the valve in the water line to the flaker drum.

(6) Close the valve at bottom of the flaker hold tank and at the sight glass feed to the pan.

d. Bagging Solid Aroclors

(1) Check to be sure flaked material is in the hopper under the flaker.

(2) Get bags ready for use and stack near the bagging machine.

(3) Get a stencil for the bags with name of the product, lot number, net weight of each bag, and the initials of the person doing the bagging.

(4) Set up an empty pallet behind the bagger to stack filled bags on.

(5) Check the scales to be used. Set the scales for the weight specified for each bag (normally 100 lbs.).

(6) Open the slide gate valve above the bagger.

(7) Stencil each bag. Insert the bag on the bagger nozzle. Clamp the bag in position. Be sure the bag support is at the right height.

(8) Start the bagger. Fill the bag until it is nearly full. Stop the bagger.

(9) Check the weight of each bag to be sure it is correct. Add material or take out as is necessary to get correct weight. Place bags on the pallet and move to the loading platform for transfer to the warehouse.

(10) Continue to operate the bagger until all the material in the hopper is in bags. When complete, stop the bagger and put up all items left.

(11) Flaked material may hang up in the hopper. Turn on the electric vibrator for about one minute if this occurs. It may be necessary to remove the plate over the chute from the hopper to the bagger and poke the material into the bagging machine.

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C. DETAILED INSTRUCTIONS

IV. d. (12) Occasionally flaked material hangs up in the screw in the bagger and becomes molten. When this occurs stop the bagger and let it cool for 10 minutes and try again.

At times the screw must be removed from the bagger and cleaned as follows:

(a) Tag out the electrical switch.

(b) Close the slide gate valve above the bagger.

(c) Remove the back cover on the bagger.

(d) Remove the belts on the screw drive pulley.

(e) Pull the screw out. Clean all molten material off the screw and out of the screw chamber.

(f) Replace the screw in the bagger. Put the belts on the drive pulley and replace the back cover of the machine.

(g) Throw the switch on the electrical starter box and remove the tag out card.

(h) Open the slide gate valve above the bagger.

(i) Start the bagger into operation.

C. DETAILED INSTRUCTIONS

V. Crushing Aroclors

Several of the Montars (Aroclor still bottoms or residue) are crushed and repackaged in drums for customers.

a. Select drums of material to be crushed.

b. Break the material in the drum by hitting the side of the drum with a hammer.

c. Place new empty drum under the crusher to collect the crushed material. Check the scales to be used.

d. Start the crusher.

e. Feed the material from the drum into the jaw crusher by use of a hand scoop.

f. Fill the drums to the desired weight. Stencil the drums with the name of the product, lot number, net weight of each drum, and the initials of the person doing the work.

g. Continue this operation until the required number of drums are filled. Then stop the crusher and clean up the scales, crusher, and surrounding area.

h. All drums filled are palletized and moved to the loading platform for transfer to the warehouse.

CRUSHING

C. DETAILED INSTRUCTIONS

VI. Milling Aroclors

Aroclor 1268 is the only Aroclor which is sold as a milled product. The material must first be flaked.

a. Select the drums of material to be milled.

b. Check the scales to be used. Place a new drum under the milling machine to collect the 1268.

c. Crushed dry ice is used during milling to keep the machine cool. This keeps the Aroclor 1268 from clogging up the machine.

d. Start the mill and auger.

e. Fill the bucket with crushed 1268.

f. Blend dry ice with the 1268 and feed it into the hopper over the mill. Use approximately five pounds of dry ice to each 100 pounds of Aroclor 1268 that is milled.

g. Fill the drums to the specified weight (normally 200 lbs.). Stencil the drums with the name of the product, lot number, net weight of each drum, and the initials of the person doing the work.

h. Continue this operation until the required number of drums are filled. Then stop the milling machine and clean up the scales, the milling machine, and the milling room.

i. All drums filled are palletized and moved to the loading platform for transfer to the warehouse.

MILLING

EMERGENCY
PROCEDURE

MONS 056905

D. EMERGENCY PROCEDURE

This is the plan for departmental action in the event a hazardous situation or injuries warrant emergency action either in the Aroclor Department or within the Anniston Plant.

1. Hazardous situations which might occur are:

   a. Operational accidents or difficulties, such as, explosions, fires, release of toxic fumes, etc.

   b. Forces of nature - hurricanes, tornadoes, floods, lightning, etc.

   c. Deliberate damage - malicious actions, sabotage, direct enemy action.

2. The primary considerations in the event of a disaster are:

   a. The care of injured individuals and evacuation of personnel to safe areas.

   b. Measures to prevent any, or further, property or equipment damage.

   c. Measures to provide accurate and thorough information so that other plant personnel and the community can be informed, if necessary.

   d. Prompt restoration of effected facilities and resumption of uninterrupted operations.

3. Responsibility:

   The areas of responsibility and overall department organization for disaster control are as follows:

   a. Chief Operator - Responsible for continuing or closing down production facilities as conditions permit; for directing fire fighting and damage control activities in the department area; keeping department supervision fully informed of conditions within the department.

   b. Operators - Responsible for evacuation of all personnel from danger area; for directing and assisting in first aid and rescue missions; reporting to and keeping chief operator informed of conditions within his area of responsibility.

      NOTE: All actions of the Fire Brigade are coordinated with the Chief Operator.

4. Details of Plan:

   a. In the event of an emergency, personnel must be accounted for. The first assembly area for the department is the open area south of the HB-40 Plant near the ladder rack, the second or alternate assembly area is east of the Aroclor-Biphenyl Building in the road near the shop entrance.

D. EMERGENCY PROCEDURE

4. Details of Plan (Cont'd.)

a. It is very important to know where people are in an emergency or before action is taken to correct an emergency. If the alternate area has to be used, take whatever safety equipment you can, from the department, to the assembly area.

b. If assistance is needed, pertinent phone numbers of Plant personnel to be contacted are as follows:

| | |
|---|---|
| M. J. Williams | 237-1952 |
| J. W. Molloy | 236-3973 |
| E. G. Moody | 236-7906 |
| J. R. McClain | 237-4428 |
| P. H. Sturman | 237-5704 |
| L. C. Fuhrmeister | 236-6773 |
| J. H. Aldridge | 237-7281 |
| E. W. Schramm | 237-7087 |
| Dr. J. C. Francis | 237-5612 (Home) |
| Main Gate | 236-2961 (308 or 317) |

c. In the event of a plant disaster, the Plant Manager's office is the control center. The alternate control center is the Guard Room at the Service Building. The medical center is the Plant Dispensary. The alternate medical center is the Service Building.

d. If the emergency or disaster occurs before or after the day shift, or on a weekend, the department Chief Operator shall notify the guard on duty and the guard will be responsible for notifying plant supervision.

e. Immediately upon discovering a fire, or a current or imminent disaster condition, turn in an alarm. DIAL 211 and tell where and what the emergency is.

If the guard cannot be contacted and the local Fire Department is needed, call them at 237-3541, giving them location, material burning, size of area involved, etc. Then call the department supervision.

NOTE: Chief Operator may designate this job to one of the Operators.

f. Emergency Situations

The following equipment emergencies are possible at the Aroclor Dept. Be prepared to take action in the event they should occur. Prepare yourself by knowing what to do - get help beforehand on any part that is not understood.

D. EMERGENCY PROCEDURE

f. Emergency Situations (Cont'd.)

| Emergency | Action |
|---|---|
| 1. Fire handling Biphenyl | a. Turn in alarm - Dial 211. |
| | b. Remove injured from fire area - take care of them. |
| | c. Proceed under Chief Operator to extinguish the fire: 1. Dry powder extinguisher 2. Fire truck - dry powder and water 3. Water |
| | d. Pull power on all motors. |
| | e. Cut off gas to Aroclor and Biphenyl stills at main cut-off at Northwest corner of blowing tank area. |
| | f. Shut down Department - Notify Chlorine Plant shutdown is necessary. |
| 2. Chlorine Release | a. Obtain help and turn in alarm if necessary - Notify Chief Operator. |
| a. Tank Car | b. Obtain gas mask or Scott Air Pak. |
| b. Chlorine Plant | c. Shut off source of Chlorine. |
| | d. Notify Chlorine Plant if shutdown is necessary. |
| | e. Disconnect $Cl_2$ connection at car if necessary. |
| | f. If vaporizer is full of liquid Chlorine, vent to the Chlorine car; then shut off car. |
| | g. Notify Department Supervision as soon as possible. |

D. EMERGENCY PROCEDURE

| Emergency (Cont'd.) | Action |
|---|---|
| 3. HCl Release | a. Obtain help and turn in alarm if necessary - Notify Chief Operator. |
| | b. Obtain gas mask or Scott Air Pak. |
| | c. Shut off source of HCl gas. |
| | d. Notify Chlorine Plant if shutdown is necessary. |
| | e. Notify Department Supervision as soon as possible. |
| 4. Fire or explosion at HB-40, Santowax, or Biphenyl Dept. | a. Turn in alarm, shut down Aroclor Dept. Notify Chlorine Plant. Obtain gas mask, go to an assembly point, be prepared to assist in stopping the fire as directed by Chief Operator. |
| 5. Emergency in the Plant | a. Prepare to shut down on orders. |
| 6. Equipment failure creating hazard. | a. Notify Chief Operator or Department Supervision. |
| | b. Take appropriate action. |
| 7. Injuries and Treatment | a. Obtain help. |
| | b. Prevent further injuries to person involved. |
| | c. Make comfortable. |
| | d. Know your first aid:<br>1. Mouth-to-mouth resuscitation.<br>2. How to use a resuscitator.<br>3. How to remove from electrical contact.<br>4. Action for a heat stroke.<br>5. Chest massage for heart failure.<br>6. Emergency action in case of burns.<br>7. Location of stretcher, blanket, oxygen.<br>8. Know equipment available from the dispensary. |
| | e. Contact Plant Physician as soon as possible if necessary. Make contact through Plant Guard or Dept. Supervision. |

## COLD WATER TREATMENT OF BURNS

(Thermal & Chemical)

Thermal Burn - The type of burn you would get by:

1. Direct exposure to flame.
2. Skin makes contact with hot surface.
3. Hot materials, such as molten Santowax, solidify when it touches the skin, thereby holding the heat in the skin.

Chemical Burn - The type of burn you would get by:

1. Contact with Muriatic or Sulfuric Acid.
2. Contact with Potassium or Sodium Hydroxide.
3. Contact with any acid or strong alkali material.

Treatment - Thermal Burns

If possible, submerge burn area in container of cold water (50°F). The container may be a drum, water pail, wash basin - anything that will hold the water. Follow these steps:

1. Put water in container to desired depth.
2. Try to obtain a water temperature of 50°F. by adding ice cubes.
3. Submerge burn area below the surface of the water.
4. Transport injured person to the doctor, keeping burned surface submerged in water.

If burn is in area that can not be submerged in water, it is a good practice to take the cleanest cloth or toweling that you can obtain, soak it in cold water (wringing out excess water), and place on the burned area. This would be an area such as the back, shoulders, or stomach. UNDER NO CIRCUMSTANCES SHOULD A PERSON SUFFERING FROM THERMAL BURNS BE PLACED UNDER RUNNING WATER. There is a danger of the small droplets of water striking the burned area, causing pain to such an extent as to result in shock.

Treatment - Chemical Burns

1. Place injured person under safety shower or some other method of washing with large amounts of water.
2. Remove contaminated clothing while under the shower.
3. If goggles are worn, keep in place until all the chemical has been washed from the body.

General

In our dispensary we have an ointment labeled Sulfathisole. This material is used in the treatment of burns, both thermal and chemical. It allows an injury to heal from the inside out, which is usually the situation with a burn injury.