

MANUFACTURING

by

R. B. Sawyer, Manager
Manufacturing Planning
Distribution Apparatus Division
Westinghouse Electric Corporation
Bloomington, Indiana

The approach taken to reduce discharges of Aroclor into the environment has been to abate the amount of Aroclor that would come into contact with water. In the late sixties and early seventies, when the potential problem was identified, there was no demonstrated technology, or means, to remove the very small amounts of Aroclor that might be contained in the water. Because of this, we addressed ourselves to the task of reviewing our manufacturing procedures to determine what actions should be taken to prevent this contact with water. Let me explain what we have done.

We use relatively large quantities of this material, from 75,000 to 150,000 gallons per year, depending upon the number and size of capacitor units made. Our first concern was to make sure that large quantities could not escape into the environment. I wish to explain to you how we handle and use this material in our operation.

The fluid is received in 8,000-gallon railroad tank cars. When the tank car arrives, the fluid is pumped into two large storage tanks located on the outside of the plant. To make sure that the fluid could not escape, in the remote event that a tank ruptured, we built a concrete dike around the storage tanks.

Then, the Aroclor is pumped from the storage tanks to treatment equipment inside the plant. Here we remove any minute particles



GBRN003335

906182

that might contaminate the fluid. After treatment, the pure fluid is pumped into six storage tanks above the impregnators. To make sure that none of this material escapes (in the event of an accident, or tank rupture), we sealed all the floor drains in this area. Large quantities of Aroclor cannot escape into the sanitary or storm sewer.

Now then, the assembled capacitor units are placed inside vacuum chambers to remove all the air and moisture from the units, as discussed by Mr. Brittain. These chambers are about 4 feet wide, 5 feet high, and 30 feet long. These impregnators are completely sealed and under vacuum. After removing the moisture and air, each vacuum chamber is filled with fluid from the overhead storage tanks. The fluid flows into the top of the capacitor and completely fills the unit with Aroclor. This is allowed to soak awhile, and then the excess Aroclor is pumped from the chambers into another group of storage tanks. The excess is pumped back through the purifiers and back up into the pure storage tanks. The floor drains in this entire area are sealed off.

The capacitors are removed from the ovens and placed on roller conveyors. Under the roller conveyors drip trays were installed to catch the fluid that dripped off the outside of the capacitor can. We also put floor dry or sawdust under the drip trays to soak up any fluid that might get through these trays. This will be discussed later. The fill hole on top of the capacitor is sealed by means of a plug and solder.

At this point in the manufacturing cycle, we are faced with two situations:

GBRNO03336

1. The inside walls of the vacuum chambers have a film of Aroclor on them. |

2. The outside of the capacitor has film of Aroclor that must be removed prior to painting.

Part of the vacuum cycle in the vacuum chambers is done with pumps that use water as a seal. As the chambers are heated up, the film of fluid on the wall vaporizes, goes into the pumps, condenses in the water which runs into the sanitary sewer. The capacitor units are hung on an overhead conveyor system which takes the units through a water and soap washing machine -- something like a car wash. The rinse water, which contains some of the film of fluid that was on the outside of the can, flows into the sanitary sewer.

As stated earlier, we know of no way to remove the Aroclor from water. So, in 1970 we started looking at the various alternatives that would prevent the Aroclor from making contact with the water. In other words, we needed to keep the ovens dry, or trap the vapors prior to water contact. Moreover, we needed to keep the outside of the capacitors dry, or find a different way to clean the capacitors. We concluded that the ideal way was to keep the fluid in a sealed/plumbers delight/ system -- don't let it make contact with the oven walls or the outside of the capacitor can. We identified a way to accomplish this and called it the manifold fill system. The assembled capacitors are put in dry vacuum ovens to remove the water from the capacitor unit. Then the capacitor units are removed from the oven. Each unit is connected with

a sealed hose connection. A vacuum is pumped on each unit to remove the air. Then the unit is filled through this hose connection.

We spent a quarter of a million dollars on this project. Some modifications were made to improve the operation, and we had some minor cleanup to do. Good progress was made in reducing our small discharges. By later 1974, we had about 95 percent of our production on the manifold fill process.

Quite to our dismay, in late 1974 and early 1975, reports from the field indicated a very serious quality problem. Units filled by the manifold filling process were failing in service at nearly twice the failure rate of flooded units. Worse yet, many of the failures were catastrophic. That is, some cans were rupturing when they failed and, consequently, releasing more Aroclor into the environment. We investigated the problem and concluded that it was possible to have minute pockets of air or vapor inside a capacitor section when it was processed with this system. When this happened and when the unit was in service for a few months, the film and paper would break down wherever there may be air or vapor pockets.

Certainly, customers could not and would not tolerate this excessive failure rate, nor could they tolerate the excessive catastrophic rupture failures with attendant risks to people. As a reliable supplier, we did not want this situation and did not want PCBs entering the environment upon failure. We returned to the proven method of flooding the units under a vacuum in the chambers. (I will have a little more to say on this later but I wish to cover some other items first.)

GBRNO03338

906185

In mid-1971, we changed fluids from Aroclor 1242 to Aroclor 1016. The significance of this change will be covered by Mr. Kerns later.

In 1970 and 1971, we reviewed our practices on waste disposal. In our manufacturing process, we generate some liquid waste -- Aroclor from the drip trays that is so contaminated with impurities that we cannot clean it up. Pump oils also become contaminated with the Aroclor. In addition, floor dry, sawdust, paper towels, solid waste from the purifier, etc., pick up Aroclor in the filling area. Further, we have some units that fail on final testing operations. We have not been able to repair many of these failed units, and we have not been able to reclaim the highly contaminated Aroclor. Prior to 1971, these wastes were placed in local landfills. This was a potential problem. Therefore, since 1971, our liquid wastes have been shipped to companies that have approved thermal oxidation incinerators designed for this material. Also we have shipped solid wastes, failed capacitors, saw dust, etc., to scientific landfills. Landfills that are designed and controlled to handle unique wastes of this type.

Our customers have been advised by instructions to the field and with nameplates on the capacitors that the users of these capacitors needed to take the same precautions in disposing of failed and/or obsolete units.

Professional people from our plant shared this knowledge and experience with other manufacturers and users. Mr. Wills will be telling you of our work in establishing voluntary standards for handling PCBs.

Over the years, we have invested research and development time and money to improve capacitor designs and manufacturing technologies.

The object was and is to use less and less Aroclor to produce capacitor units and still maintain an equivalent performance.

. Let's review what has happened since 1970. At the start of 1970, we were producing capacitor units, called Mark I series. During 1970, we introduced the Mark II series of capacitor units. These units used 42 percent less Aroclor than used in the Mark I. In 1973, we introduced the Mark III and Mark IV series. These units required 26 percent less Aroclor than used in the Mark II units. In June of this year, we will introduce the Mark V series. The Mark V will use approximately 20 percent less material than used in the Mark IV. Significantly over a six-year period we reduced the amount of Aroclor per capacitor rating by 66 percent.

We are now faced with the problem of discharges from the water seal pumps and from the washer. Our first attempt to correct this problem failed. However, we are working on the problem and again reviewing the alternatives, and will take another approach -- hopefully, with considerably more success than the last attempt.

Our basic objective is to prevent the Aroclor from coming into contact with the water. We will be exploring new technology some of which may have been proven in a laboratory environment, but may not have been proven in a production environment. In any event, we expect to reduce discharges, but it will not happen overnight. As our plans are formulated, we will be reviewing them with the appropriate agencies. Others will be kept advised of our progress in technology. We will remain constantly alert to techniques others might develop to improve our own processing.

##2610-64##

GBRN003340

906187