

**BUREAU OF RECLAMATION**  
**FACILITIES INSTRUCTIONS, STANDARDS & TECHNIQUES**  
**Volume 5-5**

**HANDLING FAILED PCB-FILLED  
CAPACITOR CELLS**

# Handling Failed PCB-Filled Capacitor Cells

The purpose of this chapter is to establish the procedure for handling, storing and transporting of failed capacitor cells to minimize electrical, explosive, and environmental hazards associated with failed capacitor cells. A procedure is outlined to be used to dispose of failed capacitor cells.

## ELECTRICAL HAZARDS

Failed capacitor cells can have a charge on them due to an opened discharge resistor. This charge can be eliminated by placing a shorting wire across the terminals.

All new AC capacitor cells are tested at the factory in accordance with ANSI Standards. ANSI requires the manufacturer to install a discharge resistor which reduces the capacitor cell voltage to 50 volts or less within 5 minutes after being disconnected from a voltage source.

## EXPLOSIVE HAZARD

Capacitor cells which have failed in service but have not ruptured may have a built-up Internal pressure from the fault. Cells that have extreme bulging are dangerous to handle until the pressure is relieved. Internal pressure is relieved by puncturing as outlined under "**HANDLING PROCEDURES**".

Askarel, under arcing conditions, produces gases which consist predominately of hydrogen, chloride, HCl, smaller percentages of carbon dioxide, CO<sub>2</sub>, and smaller percentages of combustible gases such as carbon monoxide, CO; and oxygen O<sub>2</sub>. The amount and type of gas generated depends upon the type of askarel. Therefore, a faulted askarel-filled capacitor cell should be considered as potentially combustible when a bulged can is punctured.

## HANDLING PROCEDURES FOR FAILED CAPACITOR CELLS

### Removal from Rack

The following is the recommended procedure to follow when removing failed capacitor cells from the rack, after an outage is obtained:

1. Ground the neutral bus as close as possible to its connection to the ground mat. Series capacitors do not have a neutral bus, but the work platform must be grounded.
2. Short each capacitor cell in the area of work.
3. DO NOT PUNCTURE unruptured failed capacitor cells unless bulging is extreme. If extreme bulging has occurred, the following procedure should be followed:

- a. Puncture only cells which have extreme bulging before they are removed from the rack.

**"CAUTION"**: Personnel must exercise due caution when puncturing failed cells to prevent direct contact with the escaping gas. Also, no smoking or source of flame nearby when puncturing. The gas contains high percentages of Hydrogen Chloride (HCl). Minute concentrations of HCl are very unpleasant and irritating, giving warning of its presence. After puncturing, step into fresh air until the gas escapes and dissipates into the atmosphere, then continue. A tool using a spring-loaded pointed plunger should be used to puncture failed cells. If any askarel leaks from the can follow the procedure listed under "Ruptured Cell Cleanup."

- (1) Vertically mounted cell. Puncture the cell as close to the top as possible. Puncturing at the top results in a smaller potential loss of askarel.

(2) Horizontally mounted cell. Puncture close to the top of the end of the cell facing outward. When the cell is removed, store the cell with the puncture up.

b. All punctured cells must be treated as leakers. PCB-filled cells must be shipped to PCB disposal sites.

4. Use a sheet metal screw to plug the puncture hole and minimize askarel leakage.

5. Remove failed capacitor cells from the rack.

6. Install a wire shorting the cell terminals to the can. Use any scrap copper wire #18 AWG or larger.

7. Wrap ruptured or leaking failed capacitor cells in a double thickness of vinyl plastic sheeting for temporary storage or transport.

8. Non-leaking failed cells must be stored and transported in an upright position.

### **Ruptured Cell Cleanup**

When a capacitor cell ruptures, askarel is splattered onto the adjoining cells, racks and yard rock. When a rupture occurs in a capacitor house, splattered askarel tends to collect in the bottom of the house. Rags or oil sorbent sheets used in the askarel cleanup must be disposed of by the same method as the ruptured cells. Place the rags with the ruptured cell and wrap in plastic. The cleanup should proceed in accordance with existing EPA rules and regulations for PCB's. Workmen should use rubber gloves and protective clothing to avoid contact with the PCB's.

1. Capacitor Racks. Wipe down the adjoining splattered capacitor cans and rack with solvent. It is recommended to pour the solvent onto the rags when cleaning to prevent PCB contamination of the solvent. PCB contaminated materials should be disposed of in 55 gallon drums in accordance with EPA rules and regulations.

2. Capacitor Houses. Soak up askarel found in the bottom of the house with rags or commercial oil sorbents. Wipe down splattered adjoining cells and nonporous

materials with solvent soaked rags. Porous building material should be tested after cleanup to determine if the PCB contamination has been reduced to an acceptable level according to the existing EPA rules and regulations.

3. Yard rock. All yard rock contaminated with PCB's must be removed and disposed of in accordance with EPA rules and regulations.

## **STORAGE OF CAPACITOR CELLS**

The status of all individual capacitor cells must be indicated as to whether they are new, used, or failed. Used and failed cells should be labeled, "used and date" or "failed and date," with a marking pen. Capacitor cells should be stored in the following manner:

1. New Capacitor Cells. New, unused individual capacitor cells do not require a shorting wire across the cell terminals. The discharge resistor will short out any static charge that might occur. The cells must be stored in a location that will contain any askarel leaks that could occur.

2. Used Capacitor Cells. All used Individual capacitor cells must be stored with a wire shorting the cell terminals to the can. The cells must be stored in a location that will contain any askarel leaks that could occur.

3. Failed Capacitor Cells.

a. All failed individual capacitor cells must be stored with a shorting wire across the cell terminals to the can.

b. All ruptured or leaking capacitor cells must be placed in non-leaking PCB containers that contain sufficient absorbent materials to absorb any liquid PCB's that remain in the capacitors and stored in accordance with EPA rules and regulations for PCB's in a qualified storage facility.

c. Non-leaking PCB large high-voltage capacitors are not required to be stored in a qualified PCB storage facility. Store non-leaking failed capacitor cells in an

upright position on a shipping pallet. Tie or otherwise secure the cells so they will not tip over during storage and shipment.

## **TRANSPORTING FAILED CAPACITOR CELLS:**

### **Ruptured and Leaking Capacitor Cells**

Ruptured and leaking capacitor cells must be in an approved container to be transported. The container must be labeled with the appropriate PCB label and the transporting vehicle must be marked in compliance with Department of Transportation rules and regulations.

### **Non-leaking Cells**

Transport non-leaking failed capacitor cells in an upright position on a shipping pallet. Secure cells so they will not tip over. Vehicles transporting PCB materials must be marked in compliance with Department of Transportation rules and regulations.

## **DISPOSAL OF FAILED CAPACITOR CELLS:**

Failed capacitor cells must be disposed of at an approved PCB disposal site within one year of the time they are removed from service.