



Naval Facilities Engineering Command, Mid-Atlantic

## **Safety Lessons Learned Accident Abstract**

**Accident Type:** ELECTRICAL EXPLOSION  
**Injury:** MULTIPLE  
**Damage:** CATASTROPHIC FAILURE  
**Type of Work:** HIGH VOLTAGE SWITCHING OPERATIONS  
**Equipment:** OIL-FILLED PAD MOUNTED TRANSFORMER WITH INTEGRAL SWITCHES



### **DESCRIPTION OF THE INCIDENT:**

- ◆ NAVFAC employee was injured while conducting normal switching operations of a 13.8 kV transformer. As the employee switched feeders the transformer unexpectedly exploded causing a loud detonation, large fire ball and dense smoke plume. The force of the explosion threw the employee approximately fifteen feet back, landing twenty one feet from the transformer on his back.

### **DIRECT CAUSE:**

- ◆ The direct cause of this incident was an internal phase-to-phase flashover in the oil tank between the selector switch and the HV fuse holders.

### **INDIRECT CAUSE:**

- ◆ Reduced dielectric strength of the insulating oil, actual was 14kV; minimum acceptable is 26kV at this distribution voltage.
- ◆ Water contamination due to inadequate sealing of the cover gasket due to age and exposure.

### **ROOT CAUSE:**

- ◆ Probable failed cover gasket.

### **LESSONS LEARNED/RECOMMENDATIONS:**

- ◆ Immediately discontinue operation of gang-operated oil switches on pad mounted transformers while energized until the oil for the specific switch has been tested:

Depending on the oil test results:

- ◆ Discontinue switching operations in the interim.
- ◆ Shutdown, replace the oil and repair seals; or replace the transformer.
- ◆ All satisfactory oil-filled pad mounted transformers of this type would be entered into a sampling and testing program at intervals of every three to five years.
- ◆ Utilize full 65 cal PPE when switching oil filled devices.
- ◆ Utilize air and gas switches in preference to oil filled devices wherever possible during switching.



- ◆ Consider system lineups during switching and minimize the available fault current by minimizing the number of sources whenever possible.
- ◆ Review the distribution system to identify oil-filled pad mounted transformers that are required for switching.
- ◆ For those oil-filled pad mounted transformers necessary for switching, determine if any are of the gang-operated selector switch type.
- ◆ Consider testing oil-filled transformers with separate feeder switches if switching is required at that device.
- ◆ Develop a test plan to include: a visual inspection for oil leaks and deteriorated seals; and oil sampling with dielectric testing and dissolved gas analysis.