

**Oncor**  
**SF-6 Emission Reduction Program**  
**Transmission Equipment Support**  
**Tommy Johnson**  
**Office Ph: 972 343-3772**  
**E-Mail : tommy.johnson@oncorgroup.com**

**At Oncor Transmission, we began a major effort to repair SF-6 leaks and other problems on our 345 kV system during 1994. We were frequently adding gas and had numerous alarms. Most of our leak problems centered around older two pressure breakers of which we had four basic models, Westinghouse SF and SFA breakers, General Electric ATB's, both dash 6 and dash 7's, and ITE Model C breakers.**

**At first, we were mostly concerned with changing all the gaskets and blast valves seats along with the entrance bushings. This is where most of the obvious leaks were found. During this time, we were using a sonic leak detector or soap bubbles to detect gas leaks. In the first year of our program, we found that there were many other potential problems. We found interrupter problems with contact wear, nozzle erosion, and many cases of mechanical component failures within the operating mechanisms. These problems caused failures to latch on close operations and failures to trip when called upon and pole disagreements during trip or close operations on independent pole operated breakers. Many of these problems can be attributed to a lack of proper maintenance over time letting small maintenance issues be postponed. Once we realized the scope of our problems, we did an extensive cost analysis on each of our transmission breakers for parts and labor versus the installation of new breakers. It was decided to do life extension overhauls on each of our two-pressure breakers with the exception of the General Electric ATB-6 breakers. These were removed from service and replaced with new puffer circuit breakers. Availability and the cost of repair parts along with the interrupting capability was a major part of the decision. This program will yield many years of reliable service from the best of these breakers and give us time to replace the worst performers. The most critical system breakers were the first to be overhauled, and then we began to schedule breakers for the Life Extension program a year in advance. The breakers with the worst SF-6**

leak rates were put at the top of the list. To be considered a life extension overhaul, the breakers must receive all upgrade modifications available within the interrupters and operating mechanisms. The interrupter modifications generally included new upgraded contacts, new nozzles, and pull rod upgrades.

In the operating mechanisms, all bearings were replaced along with worn latch components within the operating mechanism. Air compressors and SF-6 gas compressors were rebuilt or replaced with re-manufactured units.

In our program, all the Westinghouse SF and SFA columns and interrupters were refurbished in Greensburg, PA, by ABB personnel. Spare interrupters and columns were obtained to keep a rotating set available for overhaul.

The General Electric ATB-7's at first were rebuilt in the field with the interrupters on portable stands. We had a mobile work trailer that was used to rebuild the interrupter components and smaller parts that we could handle in the trailer.

In the beginning of our program we had a spare set of bushings for the ITE Model C circuit breakers. These bushings were rotated to and from ABB in Greensburg for rebuilding but the shipping cost and turnaround time became a problem. About 1997 we started using our distribution transformer facility on the Oncor system to rebuild the bushings. ABB personnel rebuilt the bushings at our location during this period. The breaker itself was disassembled and rebuilt on site.

In 1998, Oncor signed the Memorandum of Understanding for the reduction of SF-6. By this time, about half of our two-pressure 345 Kv breakers had been rebuilt.

Oncor is proud to have actively developed processes that reduce emissions from the use of SF-6 gas. In addition to Oncor's pro-active approach of overhauling older equipment we have achieved significant reductions through employee education, utilization of advanced leak detection equipment and implementation of strict inventory standards.

**Before every overhaul, the Gas-Vue equipment is used to detect all SF-6 leaks and to record these leaks on video tape and still digital pictures. This practice lets us know ahead of the job where all the leaks to be repaired are located. After a breaker is overhauled, the Gas-Vue equipment is again used before any SF-6 gas filled equipment is returned to service to make sure all the leaks have been addressed and repaired.**

**In 1999, Oncor Transmission obtained 24,000 square feet of hanger space at the Old Dallas Naval Air Station. The hanger has an overhead crane sixty feet wide, and thirty-five feet of ground clearance that runs two-hundred feet in length. Since moving into the hanger space, Oncor transmission has made great strides in a more efficient operation in the repair of transmission equipment.**

**In our breaker Life Extension program, more spare components have been obtained to use in our change-out program. The concept of having spare components or partial components is used as much as possible. This practice cuts down the outage time. An additional advantage was obtained by rebuilding the parts in a clean shop environment, by the same personnel. To repair SF-6 leaks cleanliness is a big part of the success.**

**Two sets of rebuilt ATB-7 interrupters are now kept in stock for replacement. The interrupter vessels are sand blasted and painted while the internal interrupter components are rebuilt. Fixtures and bushing presses have made this an easy process. The Current Transformer columns are rebuilt in the field. The vertical and horizontal operating columns are brought into the shop.**

**Two spare sets of ITE Model C bushings are kept rebuilt and ready to go. Metal shipping containers have been built because of the constant moving of components to and from job sites.**

**In 2000, Oncor began to experience SF-6 leaks on some of the single-pressure Puffer design breakers that were installed around 1984 and later. Now we rebuild some of these breakers at our facility. Again, by removing several different breakers from service we have obtained**

**spare components to be ready to replace leaking breakers or major components when necessary during a short clearance window.**

**Oncor is committed to the voluntary reduction of SF-6 emissions, and recognizes the significant benefit that these efforts provide the environment. Oncor has experienced additional benefits from the improved operational performance of our equipment due to our efforts.**

**Oncor pledges to continue to reductions of SF-6 gas usage.**