

# Western Area Power Administration

## SF6 Program Presentation for DOE - Fugitive Emissions Working Group

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Loveland, Colorado**



- **Western markets and transmits hydropower generated by 57 powerplants operated by the US Bureau of Reclamation and US Army Corps of Engineers.**

- **Western has 687 wholesale power customers that provide service to millions of consumers in 15 western states**

- **Western owns and maintains 17,107 miles of transmission lines and 306 substations split up between 4 Regions.**



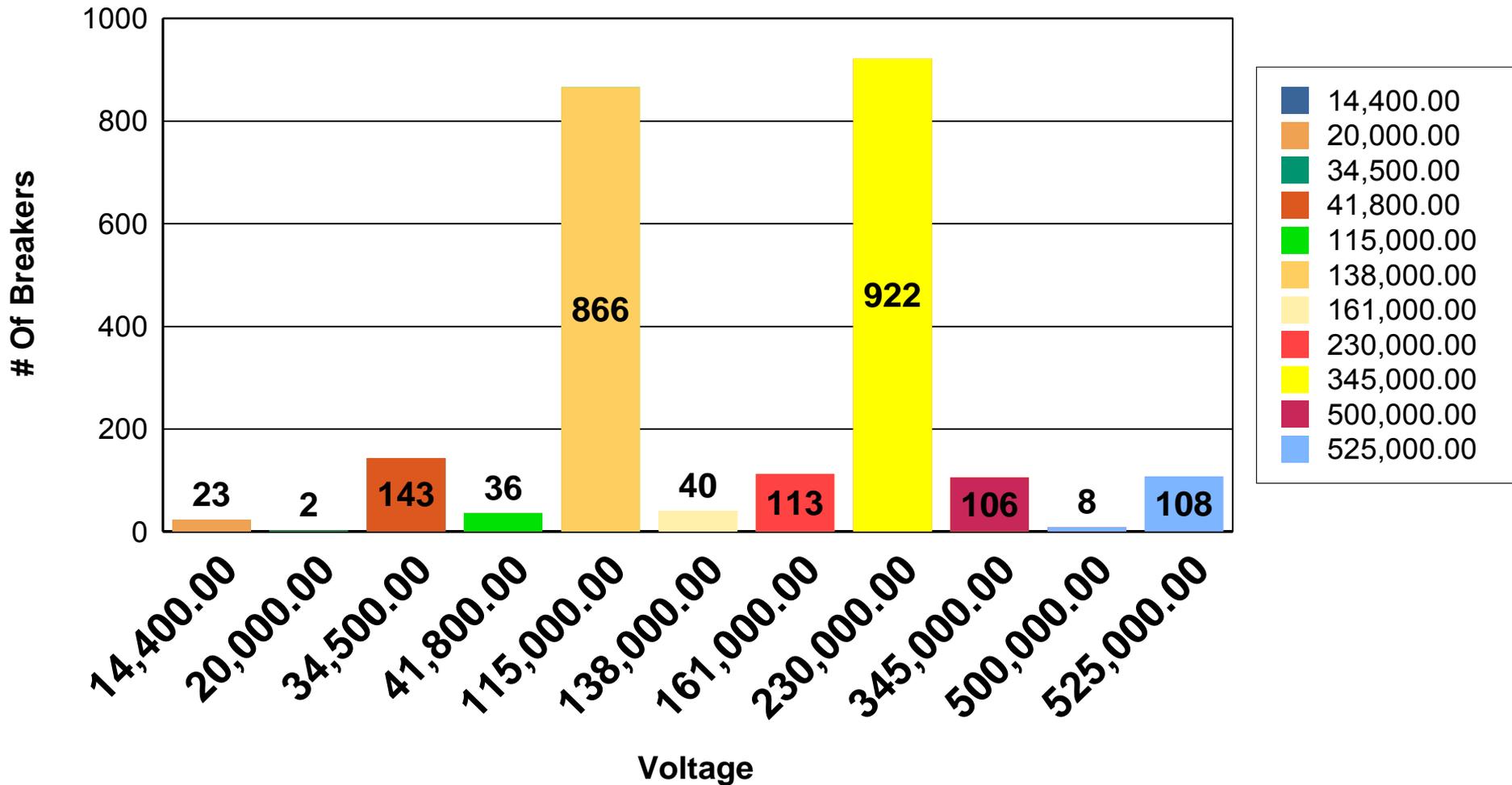


- **The 306 substations contain 2,367 individual SF6 breakers ranging from 14.4 to 525 kV (most are in the 115 and 230 kV voltages)**
- **There are numerous manufacturers and models of SF6 breakers in place throughout Western.**
- **Rocky Mountain Region alone has 53 different models of SF6 breaker, ranging from 2 to 1,840 lbs SF6.**

- **WAPA total nameplate capacity is 173,362 lbs (2009)**

# WAPA SF6 Breakers

## # Of Gas Breakers Per Voltage Class



HISTORY - Oil breakers are being replaced by modern gas (SF<sub>6</sub>) breakers.



# SF6 Breaker Leakage



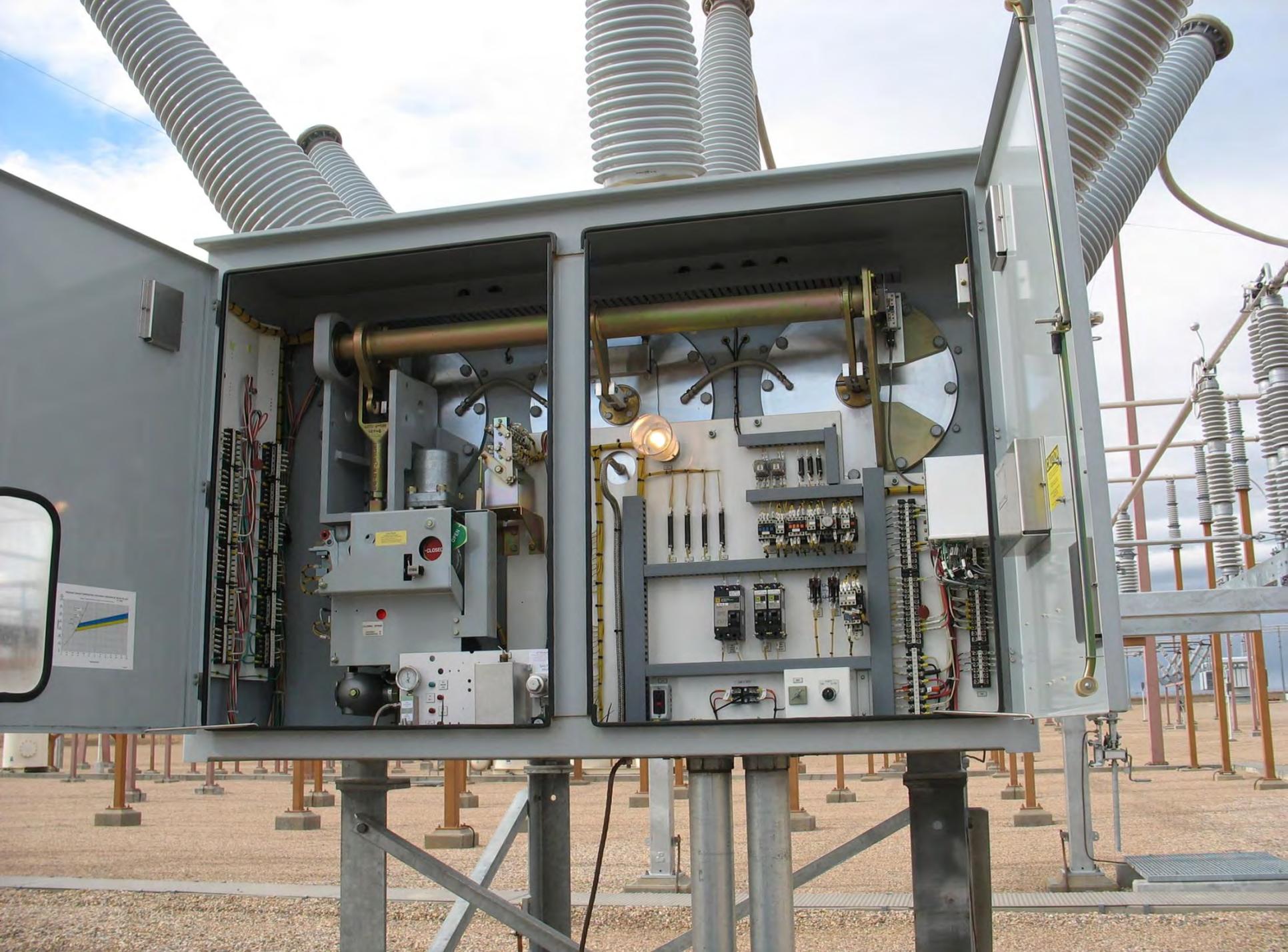
# 345 kV SF6 Breaker – ABB ELF (48 lbs total SF6 with Nitrogen – Almost Never Leaks)



# 230 kV SF6 Breaker – Mitsubishi

(85 lbs total SF6 – Rarely Leaks)

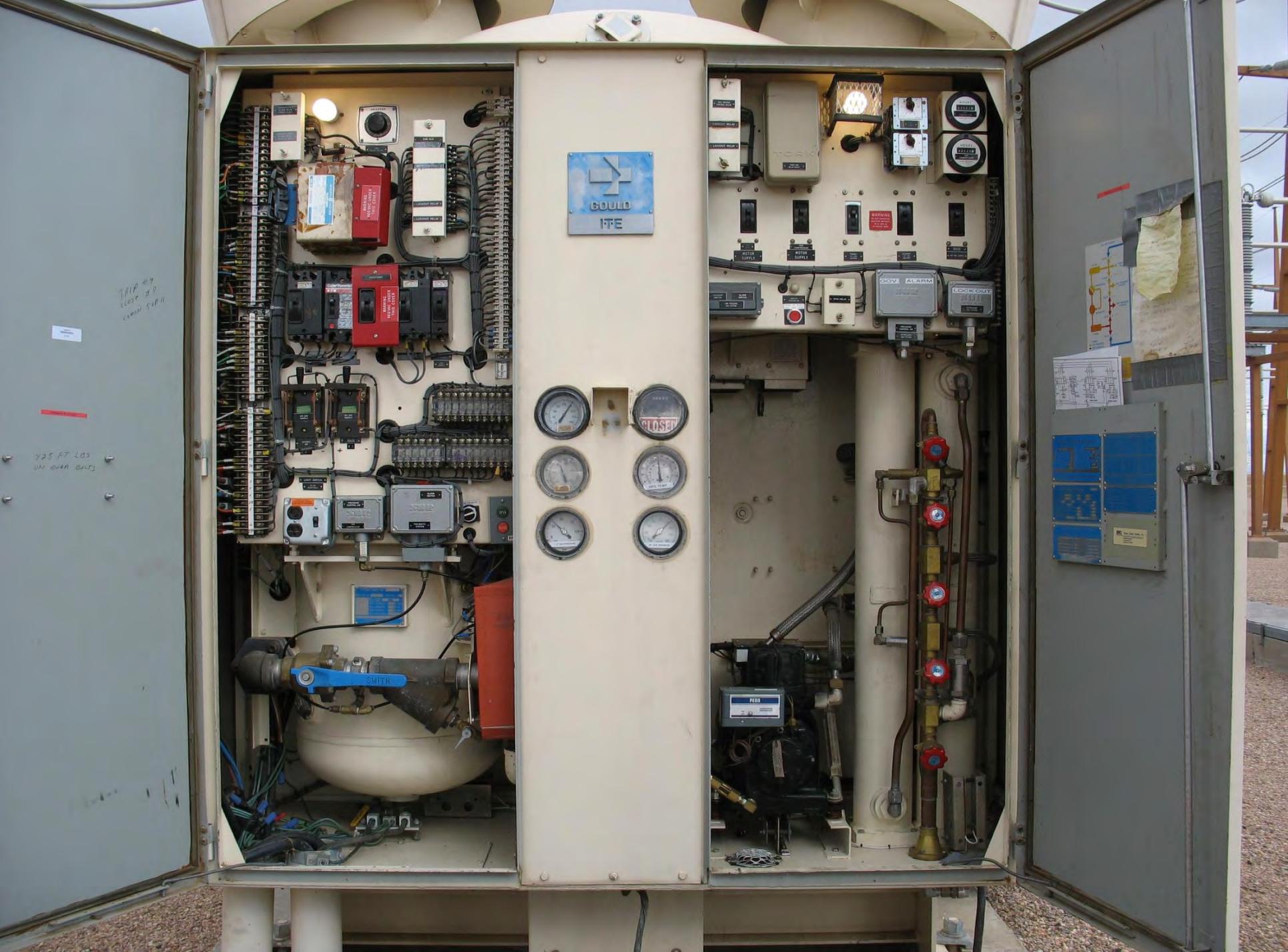




# 345 kV SF6 Breaker – ITE Gould

(1,840 lbs SF6 - Always Leaks)



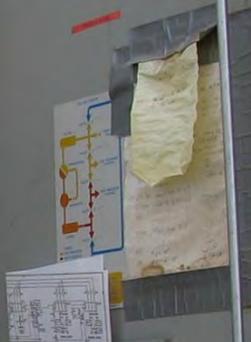


GOULD  
ITE

Panel of six analog gauges and a red 'CLOSED' indicator.

TRIP 49  
CLOSE 20  
LAMP 5111

425 FT LBS  
USE 604A BULBS



FEED

# **HISTORY – SF6 Program**

- **EPA asked us to join a voluntary partnership that prescribed a very specific methodology for SF6 management through a formal MOU.**
- **In the spirit of the MOU with EPA, Western developed its own system of SF6 management and reports to EPA annually.**
- **Rational was cost and what made best sense for us while still complying with the intent of the EPA MOU.**

# SF6 Emissions Reduction

- Leak detection using cameras (EPRI)
- Leak repair by Electrician crews
- BMPs by Electrician crews

# Leak Detection

- EPRI SF6 Leak inspection results using a GasVue laser camera



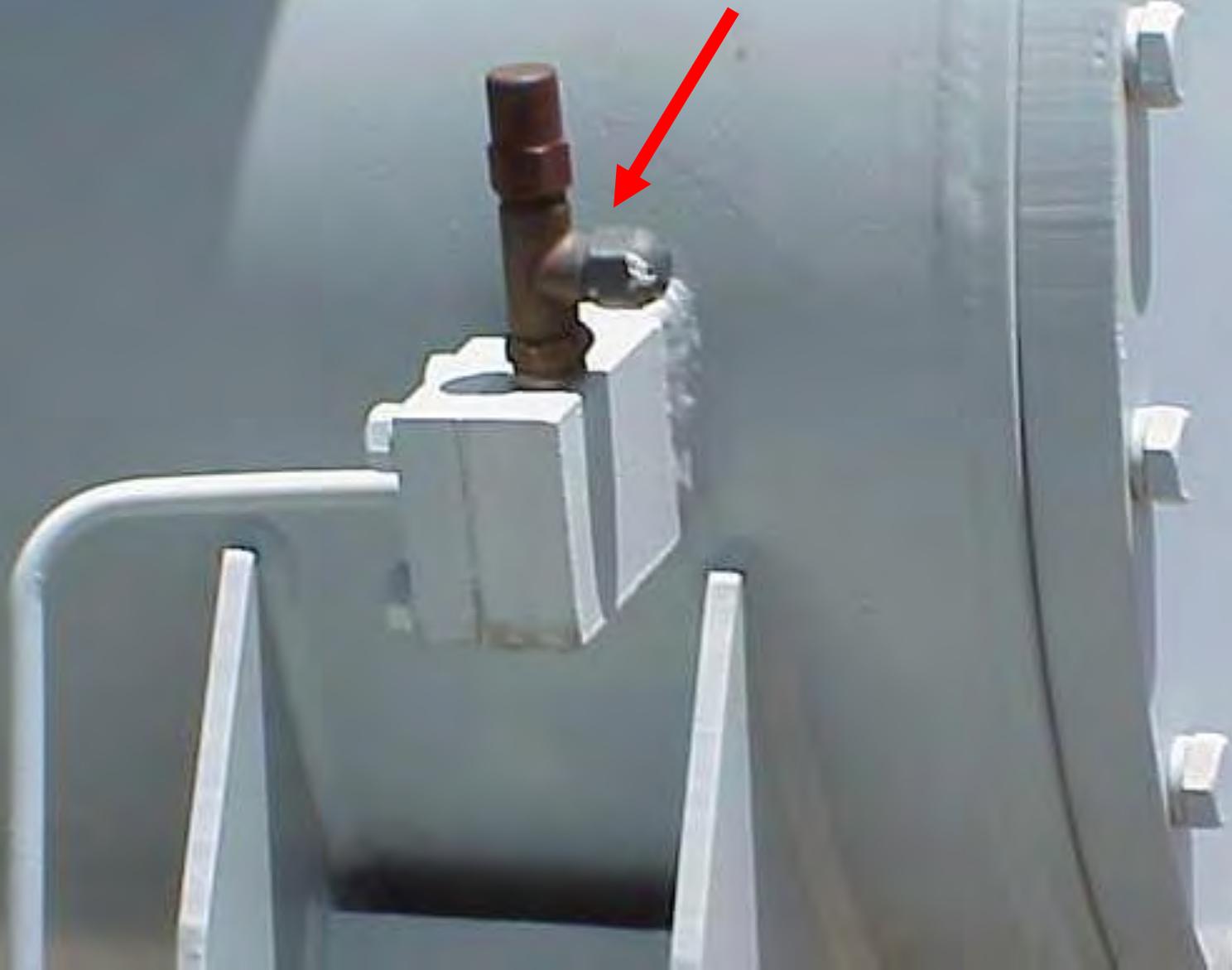
## **Figure 42**

Breaker #1292 Merlin Gerin 345kV –no leaks.



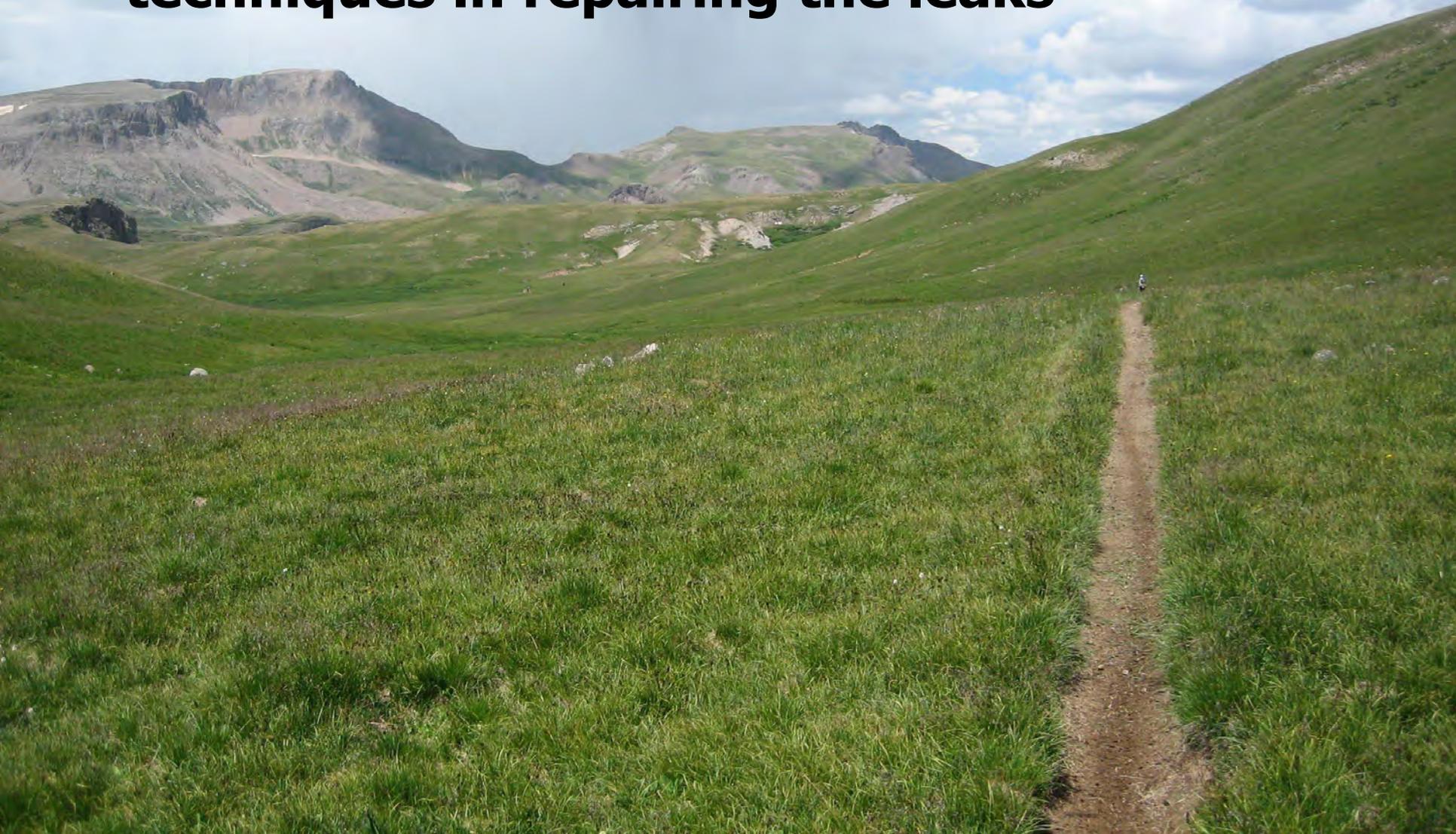
**Figure 43**

Breaker #1982 HVB 230kV is leaking sf6 from the fill valve on pole 3.

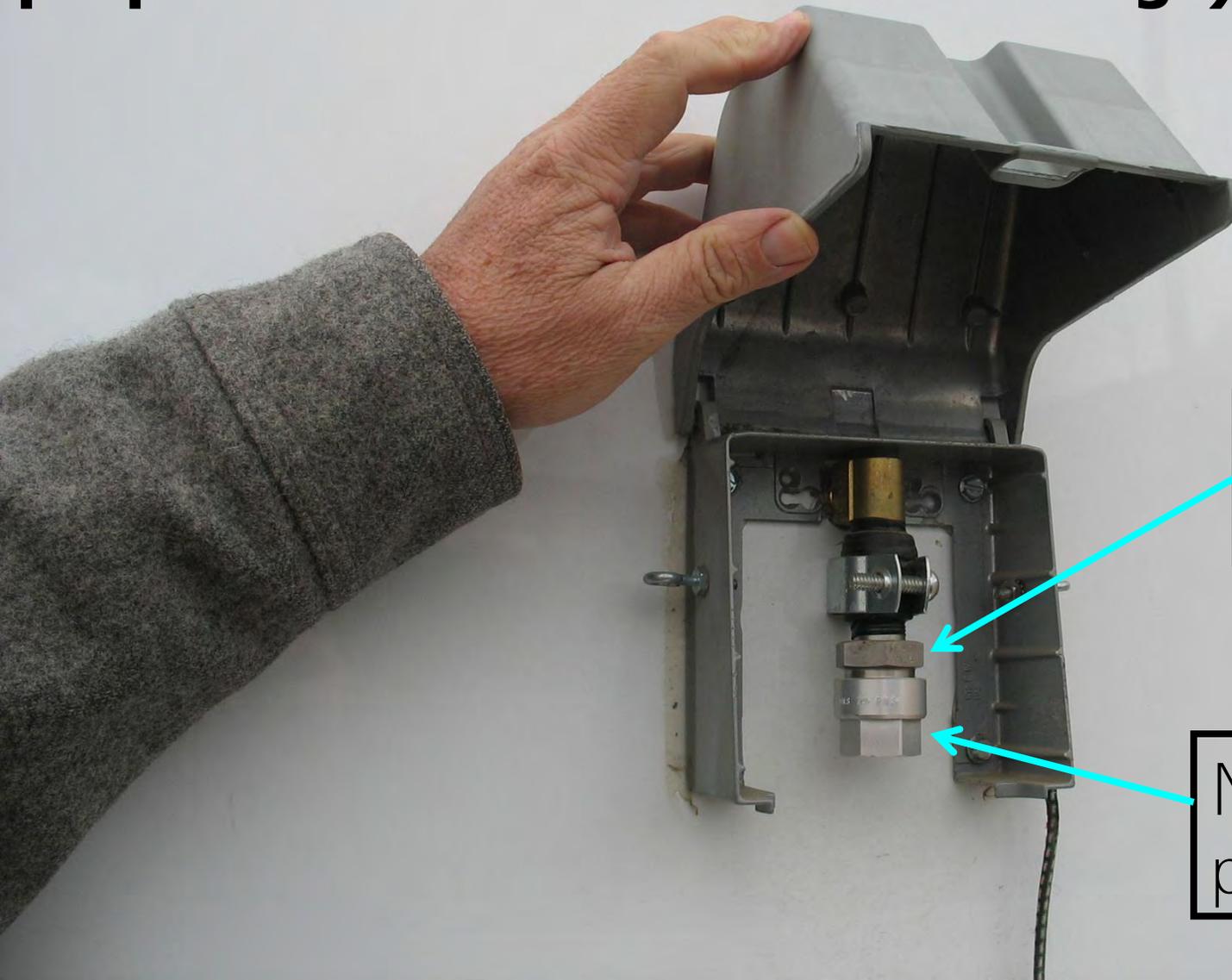


# Leak Repair

- **Electricians used multiple common plumbing techniques in repairing the leaks**



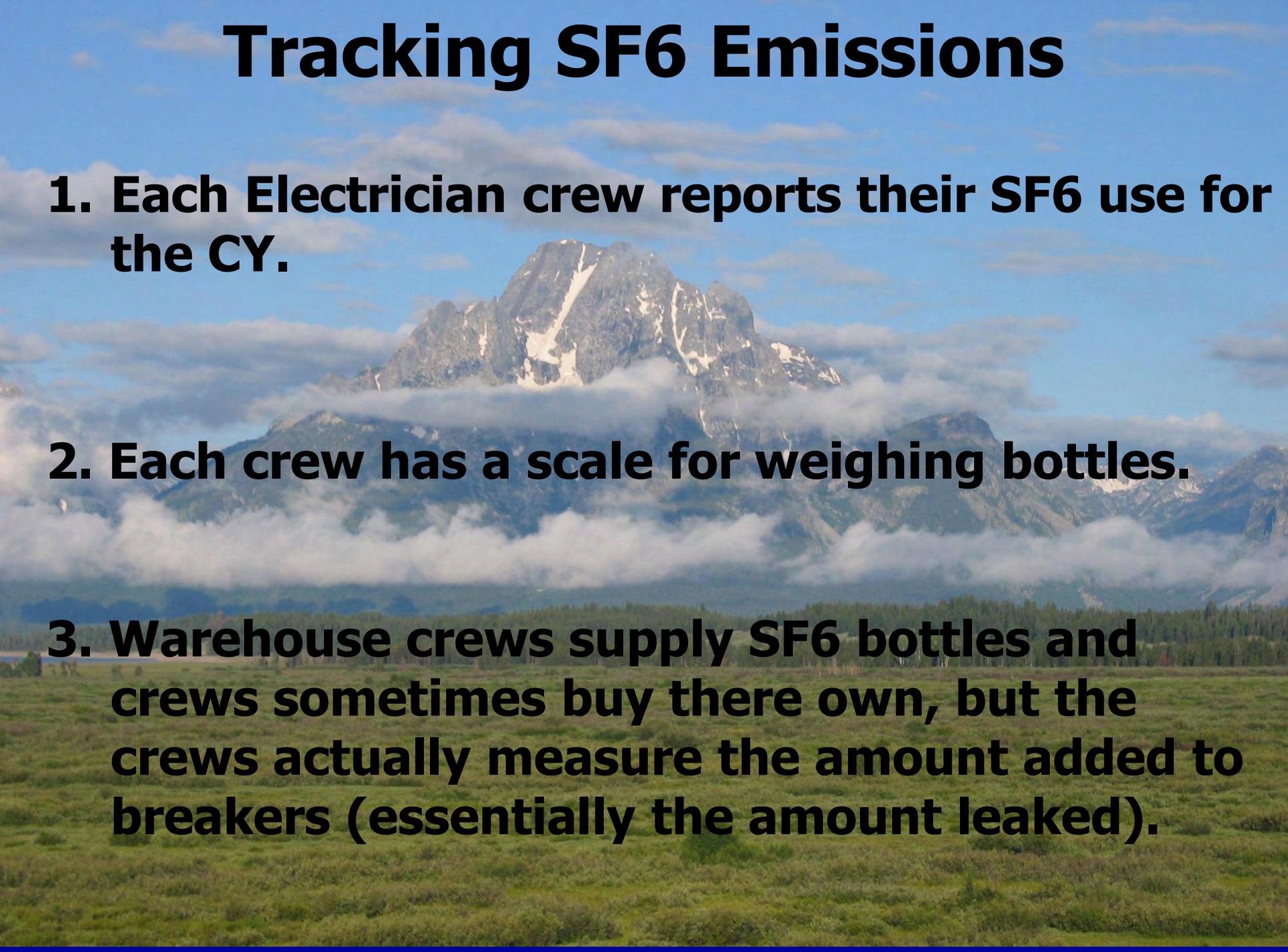
**BMPs** - Different methods used by different crews (For example, use of good fittings and proper maintenance of those fittings).



DILLO fitting  
doesn't leak

Note cap to  
protect fitting

# Tracking SF6 Emissions



- 1. Each Electrician crew reports their SF6 use for the CY.**
- 2. Each crew has a scale for weighing bottles.**
- 3. Warehouse crews supply SF6 bottles and crews sometimes buy their own, but the crews actually measure the amount added to breakers (essentially the amount leaked).**

# SF6 Gas Cart - Used for recovery, service, and maintenance of SF6 Breakers



Scales used for weighing bottles.

FLAMMABLE GAS  
2

S  
F  
G

For Steve F.

1-70-544-8888  
Champion 6700 502-8887

Dayton

8000 Plus SF<sub>6</sub> Gas Recycler - Flow Diagram

8000 Plus SF<sub>6</sub> Gas Recycler - Flow Diagram





XTERA  
CARGO

**Western's CY2009 Leakage Rate was 1.1 %  
(1,845 lbs emissions / 173,362 lbs nameplate capacity)**



# Leakage Rate History

**CY2000 = scanned 200 known leakers and made repairs**

**CY2001 = scanned 100 known leakers and made repairs**

**CY2002 = scanned 7 known leakers and made repairs**

**CY2003 = continued leak detection/repair and refined tracking program**

**CY2004 = 3.2 %**

**CY2005 = 2.8 %**

**CY2006 = 2.0 %**

**CY2007 = 1.2 %**

**CY2008 = 1.2 %**

**CY2009 = 1.1 %**

**Questions?**

