SF₆ Equipment Maintenance, Repair, and Replacement and Emissions Programs


ITC Holdings Corp
Mike McNulty, Environmental Department
Joe Jasinski, Asset Management
ITC Holdings Corp is the largest independent electricity transmission company in the United States.

ITC was founded in 2003.

ITC has four business units:
- Michigan Electric Transmission Company (METC), MI
- ITC Transmission, Southeast MI
- ITC Midwest, IA, MN, IL
- ITC Great Plains, KS, OK
ITC Holdings Corp
SF₆ Emissions Monitoring and Reduction Team

Jon Jipping
Executive Vice President and Chief Operating Officer
Provides direction and resources to ensure proper management of SF₆

Steve Sczytko
Director Supply Chain
Oversees the purchase and storage of SF₆

Mike McNulty
Manager Environmental
Developed the EMS and SF₆ gas management procedures. Oversees the reporting of emissions.

Jessica Uher
Manager Warehouse & Logistics
Oversees the storage of SF₆ gas and the measurement of emissions.

Marine Pollution Control
Developed work practices for the management and disposal of SF₆ gas equipment.

Environmental Consulting & Technology, Inc.
Developed work practices for the measurement and reporting of emissions.

Steve Stout
Director Asset Management
Oversees the maintenance, repair and replacement of SF₆ gas equipment.

Substation Maintenance Operation
Maintains, repairs, and replaces SF₆ gas equipment.

Equipment Engineering
Evaluates SF₆ gas equipment/assets and schedules the repair and replacement of equipment.
ITC has developed and implemented an ISO 14001 based Environmental Management System
- 23 Environmental Procedures
- 28 Environmental Work Practices/Policies

SF₆ Gas Emissions Tracking WP and Greenhouse Gas Monitoring Plan
- spells out roles and responsibilities
- guidance on the weighing, storage, labeling, and inventory of gas cylinders
  - Warehouse Cylinder Log Sheet
- Guidance on the measurement, calculation, and reporting of emissions
Results of SF₆ Reduction Efforts

ITC Holdings Inc. SF₆ Gas Emissions Chart

- Begin inclusion of data provided by equipment manufacturers into emission calculations per regulation requirements.
ITC Initiatives to Reduce SF₆ Emissions

- ITC is reducing its SF₆ gas emissions through two key programs
  - Preventive maintenance program
    - Maintenance
    - Leak Detection – Proactive Approach
    - Equipment Repair
  - Infrastructure improvement program - equipment replacement
    - Gas Insulated Switchgear (GIS) Station Replacement
    - Circuit Breaker Replacement – with SF6 Gas Breakers
      - Older SF6 Gas Breakers
      - Older Oil-Filled Breakers
Preventive Maintenance
Leak Detection

- Leaks identified - the low-gas density alarm included with the circuit breaker
  - Problem recorded in Asset Sentry
    - work request is issued to identify/repair leak
    - Don’t just add gas to raise pressure
  - Actively investigate leaks via the “leak kit”
  - Inexpensive electronic leak detectors
    - Thermometer
    - CPS brand refrigerant leak detector, Model LS790B
    - Snoop liquid leak detector
  - Leak history investigated during pre-breaker preventative maintenance
    - Avoid subsequent shutdowns
  - Repair leak avoiding future refill visits and associated costs
    - Install bolted-on clamp/seal rings around leaking gas breaker bushings
    - Repair gas breaker tube fittings
    - Replace seals at interrupter flanges
SF₆ Response Procedure

- At the breaker, the bottom of cabinet enclosure is checked first for the presence of SF₆ with the leak detector. Helps troubleshooting leak inside (or outside) breaker.
- Gas pressure is raised to the max fill amount. Details of the As-Found / As-Left Temperature and Pressure are recorded for communication to TSC / Dispatcher (for Exception closure).
- Attempt will be made by the crew to pinpoint the leak location and fix the leak(s) when possible.
- Unsuccessful leak location & repair will prompt creating exception for outage RE: Leak locate & repair. The Region foreman submits the EOR when ITC Asset Management approves this exception.
Asset Sentry – SF₆ Leak Exception Report
- Worse performers surveyed throughout system with FLIR camera
- Check for leaks otherwise inaccessible/dangerous places without the need for a shutdown
  - Bushings
- Used the camera to pursue known manufacturing defect on ABB 145PM breakers (bushing flange corrosion)
  - Repaired 17 in 2011
FLIR Camera in Action
Cato GIS Disconnect Leak

Conventional Photo

FLIR Camera Screen Shot
FLIR Camera in Action
GE-Hitachi HVB145 Breaker Defect

Conventional Photo

FLIR Camera Screen Shot
SF₆ Gas Recovery and Purification

Applications
• Recover and filter SF₆.
• Evacuate air and moisture prior to filling equipment.
• Cylinder transfer
• Liquid storage

12 Dilo Trailers in ITCT, METC and ITCM

Dilo SF₆ Trailer

DILØ SF₆ Gas Reclaim Trailer
SF$_6$ Gas Recovery and Purification

Liquid-Liquid Transfer Trailer
• Quick and efficient means of transferring liquid SF6 and consolidating cylinders
• Provides means to separate contaminants in gaseous form
Gas Insulated Switchgear (GIS) Replacement Project

• Acquired five in-service GIS sites manufactured between 1970 and 1972
  • St. Antoine, Caniff, Midtown, Goss and Cato
• GIS substations were a significant source of SF6 emissions
  • Leaks and intensive maintenance
• ITC has replaced 4 of the 5 stations at a cost of about $10,000,000 per station
  – Cato Station is being replaced this year.
• Replacement has resulted in a significant reduction in emissions and recovery of reusable SF6 gas
• GIS replacement at the St. Antoine site alone
  – Eliminated approximately 104 man-hours of labor in the winter and 24 man-hours in the summer
  – Eliminated purchase approximately 16 cylinders of SF6 gas annually (about 1,840 pounds) to replace losses from the leaking equipment.
Circuit Breaker Replacement Project

- Maintenance costs and performance records of leaking equipment are compared to cost of replacement and additional benefits of new equipment.
- ITC has selected variations of SFMT models supplied by Mitsubishi Electric as its equipment replacements.
- Since beginning the circuit breaker replacement project in 2004, ITC has replaced or decommissioned 81 SF6 circuit breakers.
- The cost of breaker replacement ranges from $200,000 for a 120kV breaker up to $500,000 for a 345kV breaker.

GE ATB-7 with free standing gas CT

Mitsubishi 300SFMT-63E with slip-over non-gas CTs
Thank You

Any Questions?

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