Do's and Don'ts of SF_6 Gas Handling

U.S. EPA's SF_6 Emission Reduction Partnership for Electric Power Systems – May 6, 2014

Dave Smithberger – FirstEnergy Corp - Sr. Transmission Specialist

Jeffrey Spoljarick – ABB – SF_6 Gas Product Manager

FirstEnergy®

Power and productivity for a better world™ ABB

Do’s and Don'ts of SF_6 Gas Handling
Outline

- Benefits of SF_6 gas usage in our Industry
- Situational Analysis
- Products that use SF_6 gas
- Benefits of Proper SF_6 Handling Techniques
- The Do’s and Don'ts of SF_6 Gas Handling

Benefits of SF_6 Gas usage in our industry

- High dielectric strength
- High arc interruption capability
- High heat transfer characteristics
- Non-toxic / biologically inert
- Chemically stable and non-corrosive
- Easy to handle

Situational Analysis

- SF_6 gas handling requirements have increased over the years because of environmental and governmental concerns.
- Question is:
  - “How do you prepare in advance for possible changing regulations?”
- We need to plan for the future – NOW!

Situational Analysis

- Successful use of SF_6 has been achieved for over 40 years for insulation and arc interruption in HV transmission and MV distribution equipment because of its unique combination of properties and characteristic.
- We as SF_6 users must execute proper gas handling processes when installing, maintaining or decommissioning these assets "***without emissions!".***
- SF_6 handlers must be properly training while using appropriate testing and handling equipment.

Benefits of Proper SF_6 Handling Procedures

- **Lower risk**
  - Improved Safety performance
  - Reduce risk of non-compliance to climate change regulations
  - Adherence to standards
  - Use of trained SF_6 handlers
  - Make reporting to authorities easier
- **Reduce costs**
  - Reduce asset maintenance and replacement costs
  - Improve protection and extension of asset life
  - Enhance asset management capabilities
- **Decrease carbon footprint**
  - Support environmental policy objectives
  - Reduction in greenhouse gas emissions

FirstEnergy

ABB

HV Assets that use SF_6 Gas

Deadtank Circuit Breaker

Gas Insulated Substation

Live tank and Circuit Switchers

Hybrid Circuit Breaker

Generator Circuit Breaker

Instrument Transformers

Do’s and Don'ts of SF_6 Gas Handling

Cylinder Handling Practices

- Do not drop or roll SF_6 cylinders.
- Do not apply direct heat to cylinders.
- Do not allow cylinder temperature to exceed 122°F.
- Do not store cylinders in direct sunlight.
- Do store cylinders with the valve cap firmly in place.

Do’s and Don'ts of SF_6 Gas Handling

Filling from a SF_6 cylinder

- Do use a blanket heater or submerse in warm water to facilitate the transfer of SF_6 gas.
- Do not use an open fire for this purpose.
- Do not invert cylinders while removing SF_6.
- Do use an appropriate fill hose with a proper regulator or relief device when filling from a cylinder.

Do’s and Don'ts of SF_6 Gas Handling
Record Keeping

- Do weigh and document SF_6 gas usage ***every time*** it is added or removed from equipment, regardless of amount.
- Do use a mass flow controller or weigh scale for this purpose.
- Do not rely on pressure differential calculations.

Do’s and Don'ts of SF_6 Gas Handling
SF_6 Leaks

- Do locate and repair all leaks on equipment.
- Leak detection tools are readily available - such as:
  - Halogen leak detector - “Sniffer”
  - Camera detector – does not require an outage
  - Soap Solution – outage may be required, location dependent

Do’s and Don'ts of SF_6 Gas Handling

- Do keep hoses and equipment sealed and capped
- Do use care when connecting hoses to a SF_6 source so as to not let air into the system
- After the handling procedure is completed – do test for moisture and purity to verify the integrity of the SF_6 gas
- A vacuum of $\leq$ 1 torr must be held for 1 hour. Check with specific manufacturer for their equipment specification.
- Do not fill an asset with SF_6 that has not been evacuated
- SF_6 must be filtered for decomposition products

Do’s and Don'ts of SF_6 Gas Handling

- Do use a multi-gas SF_6 decomposition analyzer that tests for purity, moisture and acids to address safety concerns.
- Do not intentionally “sniff” SF_6 to check for a faulted condition
- SF_6 must be reclaimed – Do not vent to the atmosphere
- Moisture in SF_6 combined with switching could produce harmful acids – Do perform routine moisture measurements.

Questions

Power and productivity
for a better world™

FirstEnergy®