



PSE&G Field Experience
and Research findings in
SF₆ leak sealing, detection
and training



Karen Noe – PSE&G
Emerging Technology
& Transfer

Acknowledgements

- Harry Mahoney - PSE&G
(Public Service Electric and Gas)
- Mark Baird - EIS
(Equipment Imaging and Solutions, Inc)
- Luke van der Zel, Bienvenido Rodriguez -
EPRI
(Electric Power Research Institute)

Presentation Objectives

In this presentation we present PSE&G's utility field experience on three topics:

- Leak sealing
- Leak detection
- SF6 training

Leak Sealing

Leak Sealing Research - Introduction

- Laboratory research examined a wide range of possible leak sealing approaches
- The research goal was to examine new materials that would seal under pressure but also be easy to remove and with minimal damage to the sealing area
- Field applications within PSE&G, EDF, Consolidated Edison and Duke Energy
- On final removal of the breaker PSE&G produced an economic analysis of the field leak seal – which is presented here

Successfully field trials of an in-service leak seal approach



Economic Analysis of the in-service leak sealing

A successful field demonstration was completed on a New Freedom 230kV circuit breaker.

- ❑ The seal was successful and held for the remaining life of the breaker
- ❑ The breaker was removed from service 18 months later scheduled replacement
- ❑ Estimated 1,800 lbs reduction of SF₆ emissions
 - prevention of emissions of 21,592 tons of CO₂ equivalent
 - potential greenhouse gas credits \$21,600 to \$149,400 (initial CO₂ offset value estimated between \$12 and \$83 per pound of gas reduced)

Economic Analysis of the in-service leak sealing

The estimated financial benefits are:

- avoided breaker capital replacement cost \$18,000
- replaced gas 25 lbs weekly (100 lbs/ month X 18 months X \$8/ lbs = \$14,400)
- traveling operator 2 hours weekly ((8 hours/ month X 18 months X \$75/ hour = \$10,800

Repair lifespan 18 months total savings

- direct gas and labor costs
- avoided capital expenditure
- greenhouse gas reduction

Leak Detection

Leak Sealing - Introduction

- PSE&G has been active in leak detection from the early years of the first camera technologies – and has continued to research and evaluate emerging techniques.
- Recently PSE&G had the opportunity to simultaneously have both an active and a passive leak detection technology in a number of outdoor PSE&G substations.

Leak Detection investigates using two technologies in four PSE&G Substations - Fall 2008

Active System



Passive System



Conclusions from the leak detection experiences with both technologies

Active Technology benefits	Passive Technology benefits
Both technology approaches found all the leak sources discovered in the four substation sites	
The active source reduces the dependency of sensitivity on the weather conditions	Present versions are lighter and smaller
The active approach uses a background to reflect the radiated laser energy back to the camera. In the 4 substations surveyed, backgrounds were always available through choice of the point-of-view	The passive technology works successfully even without a background

Leak Detection examples with both passive and active technologies



Leak Detection examples with both passive and active technologies



SF₆ Training

PSE&G Training

Voluntary Emissions Reduction program

- ❑ Education key element

Regional CO₂ cap and trade program (RGGI)

January 1, 2009

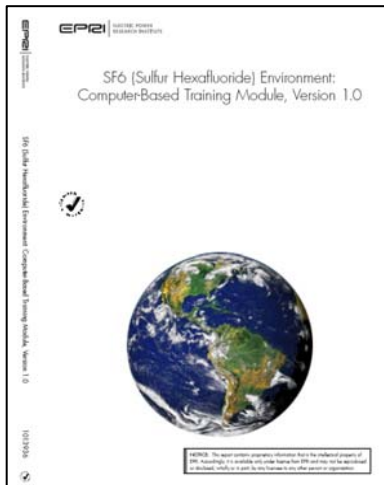
- ❑ Reduction of SF₆ in electricity transmission and distribution sector eligible RGGI offset category
 - SF₆ containing equipment and SF₆ handling equipment owned or operated by utility
- ❑ Detailed SF₆ inventory, monitoring and third party verification
 - Supporting material invoices, receipts, accounting records, cylinder inventory spreadsheets, etc.
 - SF₆ inventory management and auditing protocol

PSE&G Training

Comprehensive RGGI strategy

- Operations
- Maintenance
- Training
 - SF₆ 4-Cd Set – Environment, Safety, Handling and Analysis

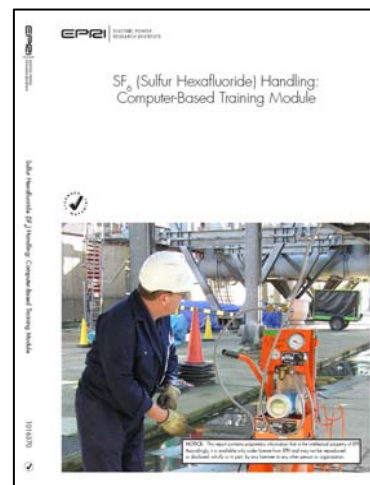
4-CD Training Modules on SF6



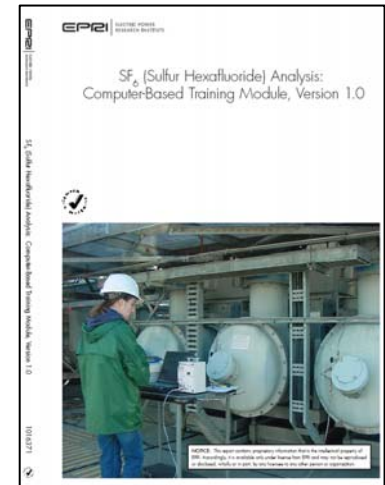
**SF₆ Environment
Module**



**SF₆ Safety
Module**



**SF₆ Handling
Module**



**SF₆ Analysis
Module**

Computer Based Training - Motivations

Quick and universal access to information on the utility use of SF₆:

- Personnel Safety
- Environmental concerns including emission reduction
- Knowledge retention
 - Enhanced delivery to utility staff on current EPRI work
 - Better access to past EPRI reports
 - Compilation of past utility experience
- Updated to keep pace with latest research and utility practice
 - Including regulatory changes

EPRI References and contact information

- 1016886 SF6 (Sulfur Hexafluoride): Computer-Based Training Modules, Complete Library, 11/24/2008
- 1012365 Sulfur Hexafluoride and the Environment, 9/25/2006
- 1013695 Research Demonstrations of a New SF6 Leak Sealing Concept, 09/18/2006
- 1012363 Sulfur Hexafluoride Leak Detection Techniques: New SF6 Camera Development and Testing, 09/08/2006
- 1010597 Sulfur Hexafluoride Leak Detection Techniques, 12/16/2005
- 1007666 EPRI SF6 (Sulfur Hexafluoride) Research -- Past Highlights and Future Plans, 1/24/2003
- 1002067 SF6 and the Environment, 11/2003
- 1002068 Improving the Diagnostic Capability of SF6 Gas Analysis, 10/2003
- 1001781 Complete Field Assessment of SF6 (Sulfur Hexafluoride) and On-Site Reclamation of Contaminated Gas, 10/14/2002
- 1001945 Practical Guide to SF6 Handling Practices, 2/14/2002
- 1001944 The Management of SF6 (Sulfur Hexafluoride) Leakage by Electric Utility Companies, 12/21/2001
- 1000430 Field Trial of Field Hardened Laser Camera for SF6 Detection, 11/17/2000
- 1000131 SF6 Gas Condition Assessment and Decontamination, 6/20/2000
- EL-5551 Gas Insulated Substations Reliability Research Program, Vol 1, 01/1988
- EL-2620 Gases Superior to SF6 for Insulation and Interruption, 09/1982
- TR-113933 Practical Guide to SF6 Handling Practices

- **Contact: Luke van der Zel, lvanderz@epri.com, 704-595-2232**

Questions and Feedback ?