

SOUTHERN CALIFORNIA EDISON ADVANCEMENTS IN SF₆ EMISSION REDUCTIONS

Presented By

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MISSION STATEMENT

Southern California Edison (SCE) strives to be a steward of the environment by seeking out opportunities to protect the environment and to implement sustainable business practices. Our SF₆ gas management and emission reduction program is our utmost critical duty to protect our environment.



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BRIEF HISTORY OF SF₆ AT SCE

Presented By Hrishikesh Dalvi – SCE Air Quality

- Earliest SF₆ gas insulated equipment (GIE) used in SCE’s substation space from 1960s and 70s
 - In the 80s, actively transitioned away from oil to SF₆ due to safety and reliability considerations
 - Reason for our large inventory shown below
 - Total SF₆ Gas in possession (GIE + cylinders) ~ 1.2 million lbs.

Asset	Count	SF ₆ Range (lbs.)
Circuit Breakers	5,645	1~1,600
Gas Insulated Substation components	834	10~1,100
Switches	33,826	1~31
Other GIE	27	1~200
100 lbs. SF ₆ Cylinders	~ 700	0~100
Hermetic Equipment	115	1~15



BRIEF HISTORY OF SF₆ AT SCE

Presented By Hrishikesh Dalvi – SCE Air Quality

- ❑ Regulatory perspective –
 - ❑ Subject to EPA's *Subpart DD* since early 2010s
 - ❑ As a CA utility, we were subject to CARB's *Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear* from 2011
 - ❑ CARB latest amendment: *Regulation for Reducing Greenhouse Gas Emissions from Gas-Insulated Equipment* went into effect Jan 1, 2022
 - ❑ Reporting burden >> EPA
- ❑ Prior to 2011, SF₆ GIE and Cylinder Inventory had limited tracking due to a lack of existing requirements
- ❑ From 2011 to 2020, per CARB's regulatory direction, we implemented a more careful SF₆ inventory and emissions tracking approach
 - ❑ During this period CARB SF₆ emissions limits declined linearly from 10% in 2011 to 1% in 2020 [stepped down by 1% every year]
 - ❑ 2022 amendment introduced mass emissions limits to accommodate alternative gases.
 - ❑ From 2021-2034, SF₆ emissions limit is to be calculated in mass emissions based on a 1% leak factor.
 - ❑ For 2034 and beyond, the leak factor is 0.95%
 - ❑ The regulation also requires phaseout of SF₆ GIE
- ❑ SCE continues to advance and develop our compliance and emissions reduction programs



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PMA INSPECTION REPORT TEAM

- SCE has 4 Trained Gas Finding Thermographers who perform Substation Inspections.
- Inspectors implement IR, liquid reactant, and IR sniffer leak detection methods.



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PMA INSPECTION REPORTS

EMAIL ALERT IS SENT
WITH LINK TO THE
FINDINGS REPORT



**Substation Maintenance Programs
(WM&TS)**

PMA Report – SF₆

This is to inform you the following SF₆ Predictive Maintenance Assessment (PMA) Priority was identified during a recent substation inspection. A complete report is in progress.

05-22-2023	Notification Overview	MAYSA	Copy	Page 2 of 2
Notification	413040055		Notification Type	E1
Order	904119841		Order Type	ESMA
Reporter	MAYSA	2:44:17 PM	Notification Date	05-18-2023
Start Date	05-18-2023		End Date	05-14-2029
Funct Location	ES-5090-0220-CI-5102	TIE NO.10 220KV/ CB 5102		
Equipment	200004491	TIE NO.10 220KV/ CB 5102		
Sort Field	ELDORADO		Main Work Center	31M1ELD
Activity	EE-PTRL 3034	SF6 Diagnostic Inspection		
Description	REPR LEAKING GAS CIRCUIT BREAKER		Priority	2

05/22/2023 14:21:10 PST (CMSPIWSUSER) Steven May * 05/22/2023 13:57 * Eldorado; Tie #10 220 KV/ CB 5102 - There are 2 SF6 leaks. (1) There is a SF6 leak from the shut off valve to the fitting on the interrupter. (2) There is a SF6 leak from the isolation valve inside the cabinet. Steven May 909-695-9107

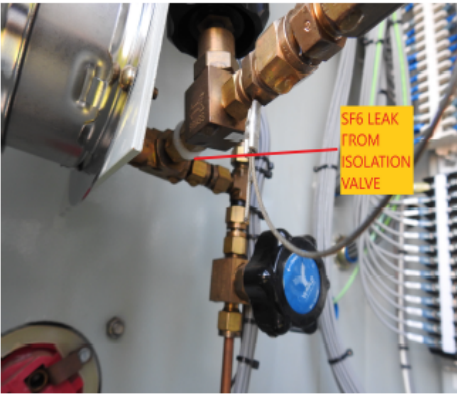
Object Part	0588	Gas
Damage	0040	Leaking
Cause of Damage		

Diagnosis/Results

Current Ductor Results:

After Ductor Results:

Repair Comments



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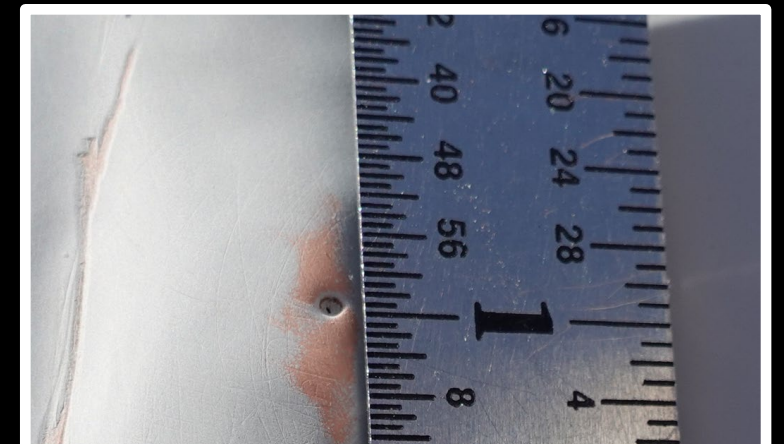
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LEAK MITIGATION PROGRAM

- Provides a formal process for leak mitigation work.
- Perform a comprehensive leak detection process on SF₆ GIE after all gas adding activities to ensure no leaks exist after installing the SF₆ gas.
- Timely replacement of SF₆-containing GIE when determined necessary to mitigate leakage.
- Procure and maintain readiness of required tools and materials needed to reliably perform leak detection activities for this program.
- What to do When a Leak is Located
- What to do When a Leak is NOT Located

**SOUTHERN CALIFORNIA EDISON
TRANSMISSION AND DISTRIBUTION**

**SC&M Maintenance and
Inspection Manual
(MIM)**



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GAS CART / TOOLS MAINTENANCE AND REPAIR

- A key part of our program that needs greater management is on-time gas cart and tooling inspections, maintenance and repairs.



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ONLINE MONITORING SYSTEMS FOR LEAK DETECTION

- Installed at GIS facilities
- Can detect incipient stages of leak development.



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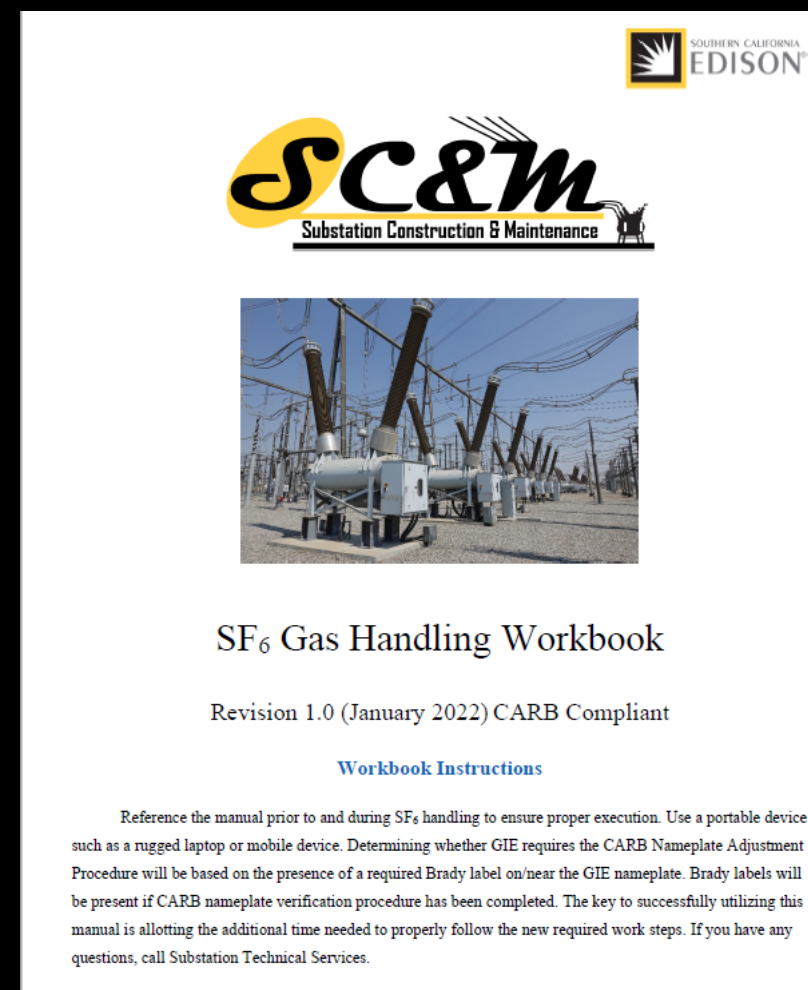
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DEVELOPED SF₆ GAS HANDLING WORKBOK

- Provides instructions to substation maintenance crews on most all aspects of SF₆ gas handling work methods



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CNC MACHINE CYLINDER MARKING

- Illegible and inaccurate cylinder Tare weight markings cause data errors.
- Increase in cylinder marking legibility and accuracy is achieved using CNC machine.



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ESTABLISHED SF₆ CYLINDER HUB

- Provides centralized location for delivery and shipment of SF₆ cylinders into and out of SCE inventory.
- Allows for stringent quality control and inspections to look out for poor cylinder health, illegible stampings, inaccurate tare weights, and helps ensure high purity of delivered SF₆.
- Also provides a point to facilitate SF₆ Gas Cart maintenance



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REDUCTION IN GAS HANDLING EMISSIONS RISK

- Reducing gas handling by elimination of certain activities and equipment can also help prevent emissions risk when performing gas transfer through pumps and equipment as well as prevents emissions risk due to worker error.
- **Example**- no cylinder to cylinder gas transfers are allowed in the field, only at our SF₆ Gas Cylinder Hub in Westminster, where experience and transactional data can be concentrated for higher quality and accuracy.
- **Example**- Removed onboard storage cylinders within gas carts to prevent the need to disconnect/reconnect, remove, weigh, inventory and hydro test these difficult to access cylinders.
- **Example**- CB diagnostic testing such as radiography allows thorough evaluation of the internal health of GIE without removing SF₆.



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SF₆ GIE EXPEDITED REPLACEMENT WITH ALTERNATIVE TECHNOLOGIES

- Utilizes historical data of repairs and SF₆ top ups to identify chronic leaking GIE that should be replaced.
- GIE can be replacement on an emergent basis or scheduled as a planned future project (within 5Y).
- Opportunities to streamline the replacement process for faster project completions. Many replacements are similar to like for like for engineering with minimal engineering requirements and almost no BG civil/conduit/grounding design work required in most cases
- Installation of new larger vacuum CB's is a big win.



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CHALLENGES

1. Data Quality surrounding large volume of GIE to be accurately reported
2. Emissions Reductions
3. Phase-Out
4. Costs and budgets
5. Training

1. Engaging internal stakeholders including Data Quality teams and Data Stewards to constantly improve data quality
2. Programs highlighted in this slide deck
3. Phase-out road map developed, working on specifics around 2025 date
4. Resource planning to support program needs and forecasting change management cost
5. Developing various trainings across the organization

OPPORTUNITIES



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**This concludes our
presentation**

Thank you



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