SED's Audit and Inspection Program for Electric Utility Substations

Charlotte TerKeurst, Program Manager

Wilson Tsai, Utilities Engineer

Electric Safety and Reliability Branch
Safety and Enforcement Division

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Overview

- Background of substation program
- General Order 174 adopted in 2012
- Substation audits/inspections started in 2013.
- A typical substation audit/inspection takes one week on-site, including travel, and covers one district of a large utility or perhaps all of smaller utility.
- Examples of GO 174 violations

Background of Substation Program

- OII opened after December 20, 2003 fire at PG&E's Mission substation.
- Settlement in the OII required PG&E to provide funds to support development of a Commission substation inspection program.
- D.12-10-029 in an OIR:
  - Adopted General Order 174, Rules for Electric Substations
  - Required utilities and SED to meet annually (2014-2016) to develop best practices for substation safety and inspections
  - Required SED to submit a report in second quarter of 2016

GO 174 Rules

- General Order 174 applies to all electric utilities, including investor owned and publicly owned utilities.
- Facilities subject to CAISO control and/or FERC reliability standards are exempt from GO 174.
- The rules are performance-based. Each utility must:
  - Establish, update and follow an inspection program
  - Inspect equipment as often as necessary
  - Specify, and meet, time intervals for inspections
  - Use qualified inspectors
  - Keep records of inspections and equipment condition
  - Report inspection activities to CPUC annually

Electric Substations Subject to GO 174

(excludes facilities subject to CAISO control and/or FERC reliability standards)

IOUs			Examples of POUs*	
PG&E	961		LADWP	190
SCE	576		SMUD	186
SDG&E	133		Imperial Irrigation District	93
PacifiCorp	47		Pasadena Water & Power	
Liberty Utilities	13		Trinity Public Utilities	
NV Energy	8		Lassen MUD	
Bear Valley Electric	3			

TOTAL over 2210 substations

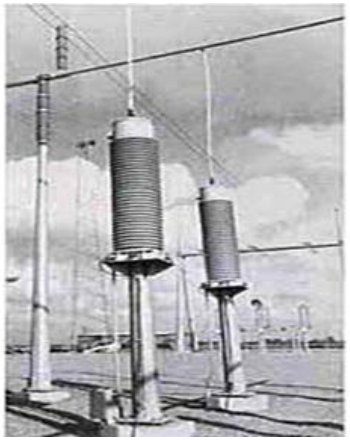
*About 60 publicly owned utilities are subject to GO 174; most have very few substations.

What is a Substation?

Substation: An assemblage of equipment, (e.g., switches, circuit breakers, buses, and transformers), under the control of qualified persons, through which electric energy is passed for the purpose of switching or modifying its characteristics. (GO 174.)

Equipment in Substations

- Busses, switchgear
- Capacitor banks
- Relays, circuit breakers
- Transformers
- Reactors
- Voltage regulators
- Insulators, bushings, surge arrestors
- Grounding system
- Metering, controls (SCADA), alarms
- Batteries
- Fire detection & suppression systems
- Support structures
- Buildings, perimeter fences, gates



Substation Audit – Records Review

- Review records
  - Ensure utility follows its own program
- Ensure utility procedures comply with GO 174
  - Meet accepted good practices
  - Include, at a minimum, all elements of GO 174
- Interview substation staff
- Review risk assessment and inspection philosophy with utility

Substation Inspections - Field

- May inspect up to about 20 substations, depending on size of utility or district
- Visual
  - Walk-downs looking for wear, dirty insulators, worn cabling, rust, checking fluid and voltage levels, alignment, leaks, etc.
  - Open equipment and measure, check for tolerances, cleanliness, loose or missing parts, torques, etc.
- Auditory
  - Listen for tell tale signs of problems
    - “Buzzing” insulators, rattling

Substation Inspection - Field

- Check records and review utility tests on equipment:
  - Meggering, DLRO resistance testing of circuit breakers
  - Regular relay testing or setting
  - Battery load testing
  - Transformer oil testing, turns ratio, power factor testing for transformers
  - Infrared testing, hi-pot, soak, partial discharge testing
  - Fall of potential, soil resistance testing
  - Predictive monitoring and inspections
  - Monitoring faults, load, trending
  - Condition based maintenance

SED Work after Audit/Inspection

- Submit additional data requests if needed
- Update database with audit findings
- Prepare audit report
- Prepare and send letter to utility with documentation of findings
- Utility responds within 30 days regarding remedial actions.
- SED closes the audit when satisfied with utility response.

Examples of GO 174 Violations

- Maintenance not performed by scheduled completion date
- Inspections not conducted as scheduled.
- Equipment not properly maintained, e.g., showing signs of rust, contamination, leakage
- Wildlife intrusion on substation equipment
- Bird’s nests obstructing equipment
- Equipment gauges unreadable or not working
- Damaged equipment

Questions?

For additional information: http://www.cpuc.ca.gov/esrb/

This presentation is dedicated to the memory of Ben Brinkman, who was the main architect of SED's substation safety program.