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**How often should emergency power systems be functionally tested?**

**How old is your UPS?**

# CRITICAL OPERATIONS POWER SYSTEMS FAILURES AND PREVENTATIVE MEASURES

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**May 20, 2014**





# OUTLINE

- **WHAT ARE CRITICAL OPERATIONS POWER SYSTEMS (COPS)?**
- **HOW DO THEY FAIL?**
- **CASE STUDY**
- **LESSONS LEARNED**
- **PREVENTATIVE MEASURES**



# WHAT ARE COPS?

**Critical Operations Power Systems (COPS) are power systems which support critical loads that in the event of a failure,**

1. **Would** prevent Tacoma Power from meeting NERC/WECC standards for ***adequate and reliable backup power*** (NERC BAL-005-0.2b-R15)
2. **May** have an impact on Tacoma Power's ability to maintain operation of the Bulk Electric System (BES)
3. **Would** have a significant impact on Tacoma Power's business operations and continuity (e.g. SAP, network file shares, virtual computing environment, etc.)

The Balancing Authority **shall provide** adequate and reliable backup power supplies and **shall periodically test** these supplies at the Balancing Authority's control center and other critical locations to **ensure continuous operation of AGC and vital data recording equipment** during loss of the normal power supply.



# WHAT ARE COPS?

## NEC Article 708

- First appeared in 2008 edition
- Addresses homeland security issues for facilities that are **mission critical**.
- Identification of systems is determined by municipal, state, federal, or other codes by any governmental agency having jurisdiction or facility engineering documentation establishing the necessity for such a system.



# WHAT ARE COPS?

## Uptime Institute

Critical **site** infrastructure, not just power systems, supporting data centers.

- **Tier I – Basic Site Infrastructure** [28.8 / 99.67%]
- **Tier II – Redundant Capacity Components** [22.0 / 99.75%]
- **Tier III – Concurrently Maintainable** [1.6 / 99.98%]
- **Tier IV – Fault Tolerant** [0.8 / 99.99%]



# WHAT ARE COPS?

## Common electrical equipment including,

- Engine Generators
- Automatic Transfer Switches
- Uninterruptible Power Supplies
- Inverters
- Rectifiers/Chargers
- Batteries
- Panelboards
- Circuit Breakers
- Wiring



# COPS FAILURES

- **Overheating** – failure of equipment cooling fans, building cooling
- **Components in-service beyond expected life** – UPS DC/AC capacitors, batteries
- **Hardware Failures** – logic control boards, solid-state trip units, electrolytic capacitors, power supplies
- **Physical Damage** – equipment housing, component breakage due to shock, impact or mechanical cycling
- **Chemical Damage** – corrosion
- **Operator Error** – while performing maintenance or functional system tests

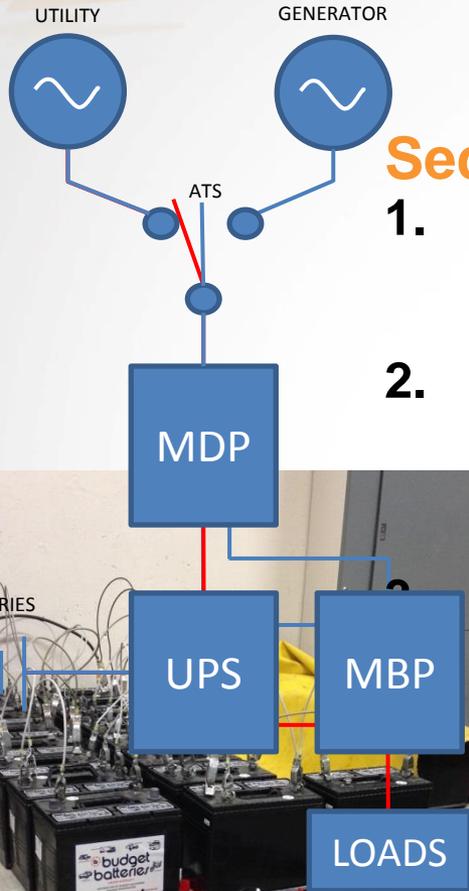


# CASE STUDY – LOSS OF POWER TO CONTROL CENTER

## NHA Operational Excellence Event Report

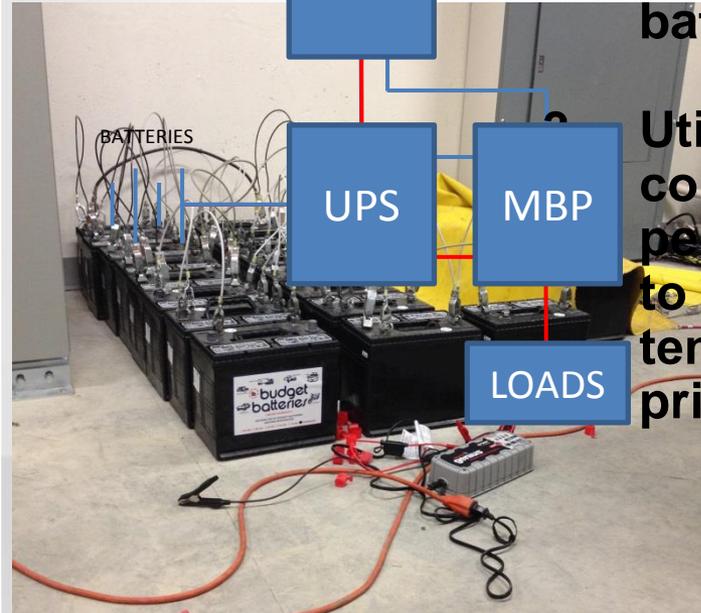
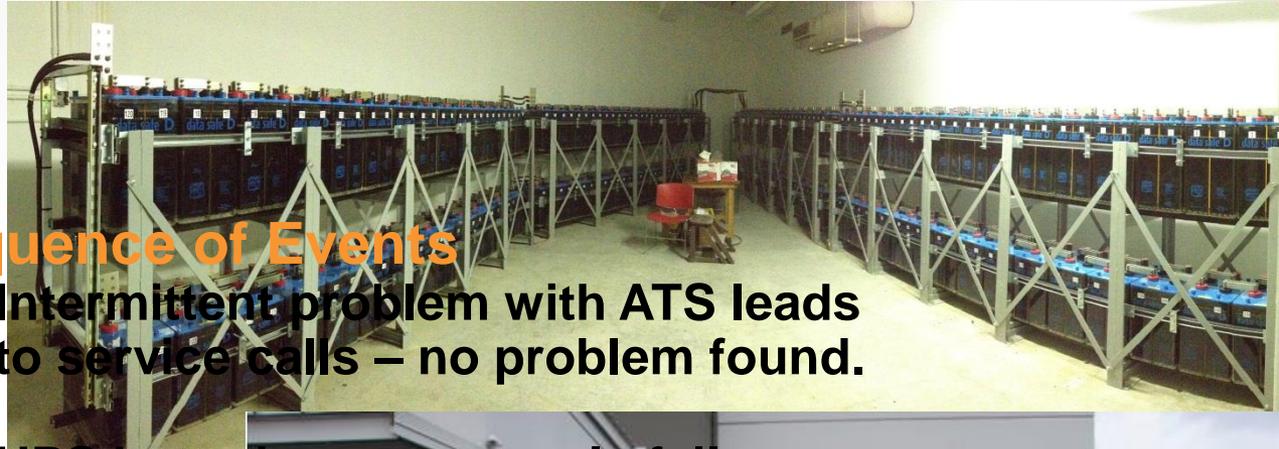
1. Part I – Report of Events
2. Part II – Cause Analysis
3. Part III – Corrective Action Plan
4. Part IV – Lessons Learned & Recommendations

# CASE STUDY – LOSS OF POWER TO CONTROL CENTER



## Sequence of Events

1. Intermittent problem with ATS leads to service calls – no problem found.
  2. UPS batteries prematurely fail (thermal runaway) and a temporary battery bank is connected.
- Utility breaker trips and ATS fails to connect to generator... maintenance personnel respond and are unable to connect to generator or utility... temporary UPS batteries deplete... primary control center goes dark.





# LESSONS LEARNED

## Inspection, Testing & Maintenance (ITM)

- Establish a preventive maintenance schedule.
- Document ITM procedures and results.

## System Ownership

- Assign overall power system ownership.

## Operator Training

- SOPs periodically reviewed
- Operator refresher training



# PREVENTATIVE MEASURES – COPS OVERSIGHT PROGRAM

1. System Ownership
2. Roles and Responsibilities
3. System Documentation
4. Equipment Inspection, Testing and Maintenance
5. Functional System Testing
6. Personnel Training

# QUESTIONS?

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