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Improvements in Transmission Control Center Alarm Management Practices

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2017 CIGRE Grid of the Future Symposium

Cleveland, Ohio, U.S.A.
22-25 October, 2017

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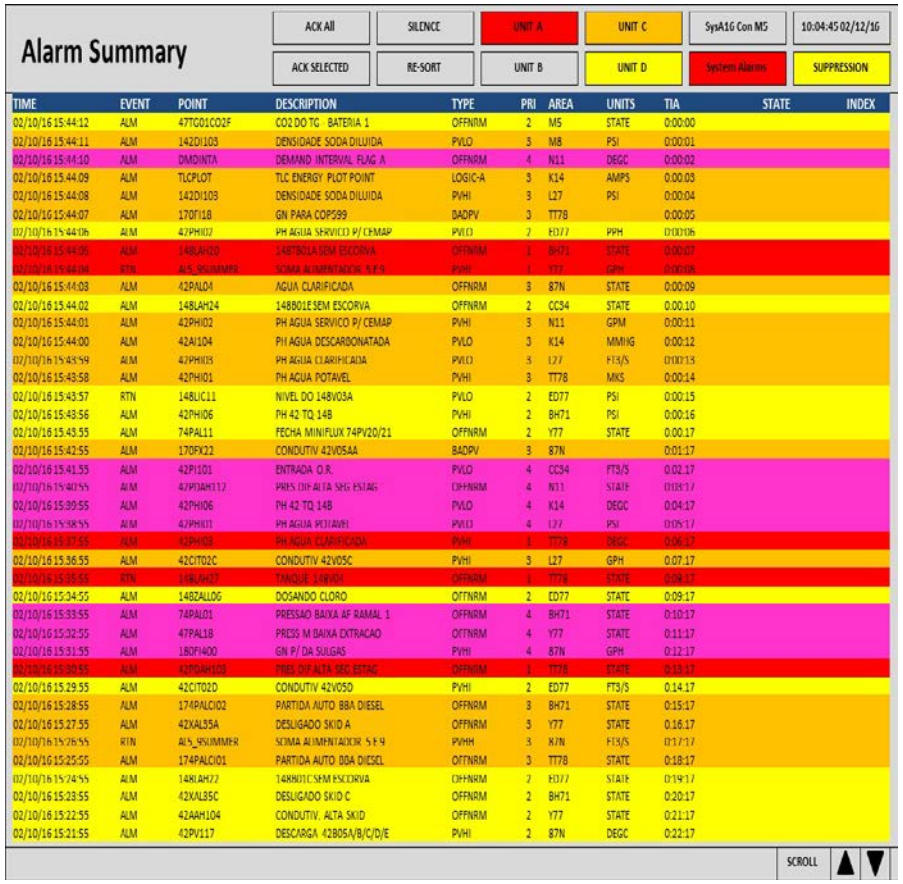
Alarm Management in Control Centers

- **Volume & complexity of alarms have been increasing**
- **Operators interested in better alarm management processes and tools**
- **EPRI R&D During 2014-2016:**
  - **2 Workshops, 2 Surveys, 3 Site Visits, Literature Search**
  - **Made observations and identified improvement opportunities**
  - **Prepared a guide to develop an Alarm Management Philosophy document**
  - **Initiated case studies (to address improvement opportunities)**



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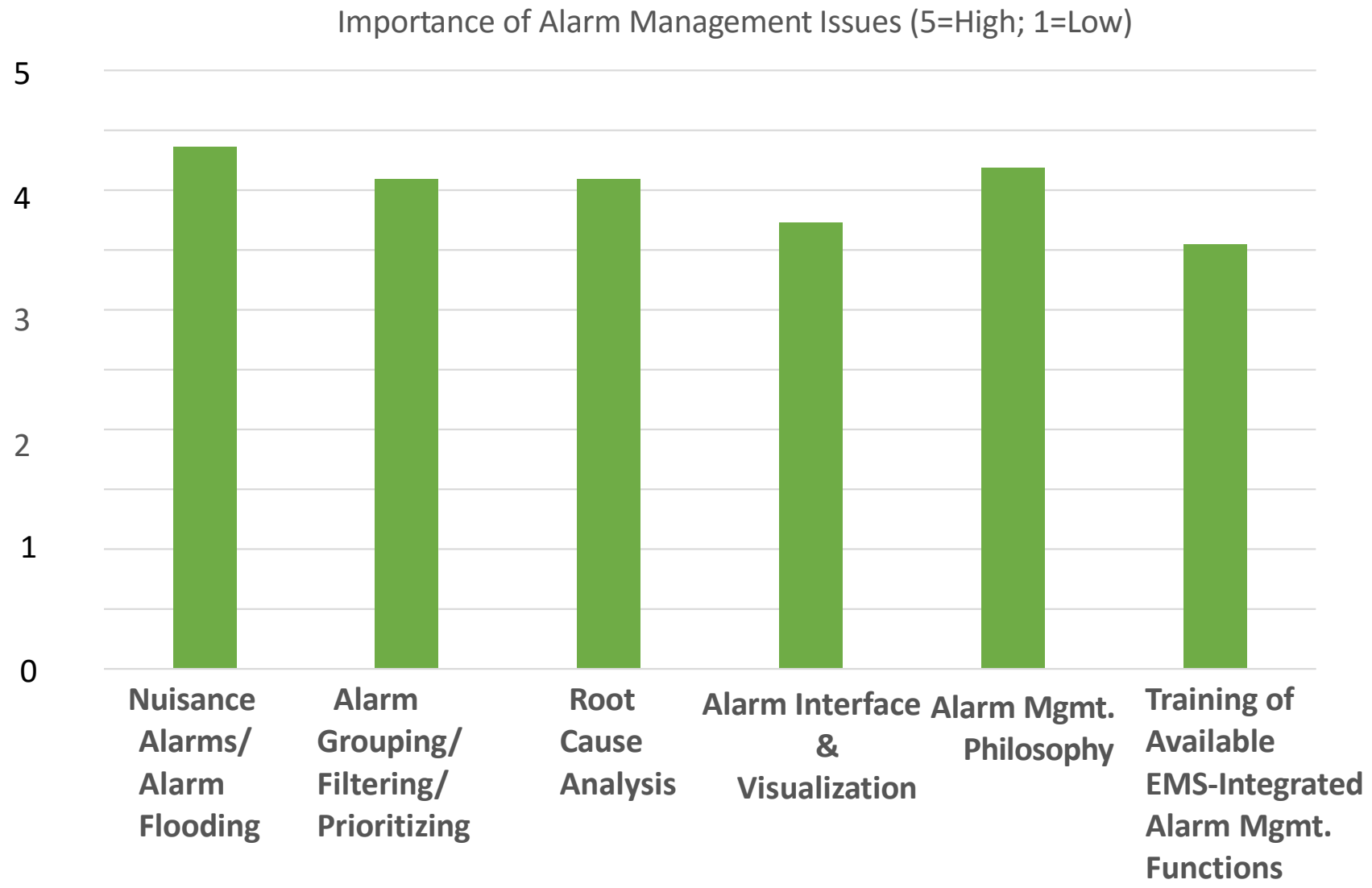
Aug. 2015 Alarm Management Workshop and Follow-Up Survey



Transmission Control Center Alarm Management Practices – Observations and Improvement Opportunities

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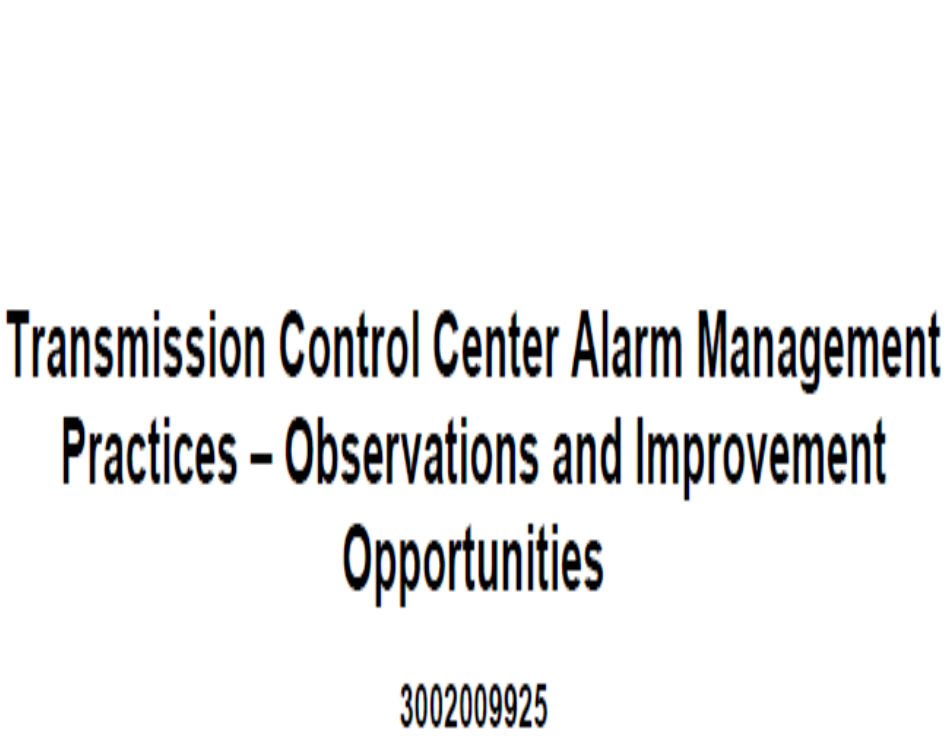

- 3002009925 – Free to public
- 30-Page report published in March 2017
- Contents: Chapter 17 of 3002008274 published in November 2016

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Improvement Suggestions

1. Develop and adopt an Alarm Philosophy Document
2. Segregate TCC alarm data. Isolate “true alarms.”
3. Assign alarm priorities based on accepted practices
4. Ongoing: Monitor alarm system performance using accepted key performance indices (KPIs)
5. Identify and resolve the most frequent and nuisance alarms
6. Develop new higher level graphics

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Definition of An “Alarm”

- IEC/ISA: An alarm is “a visible and audible notification to the operator, of an equipment malfunction, process deviation, or abnormal condition requiring a timely operator response.”
  - An intentional interruption to the operator
  - ***Reserved*** only for notification of situations that require the operator to take action
  - Timely Response: Immediate to within 30 minutes

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Observation: TCC Alarm System

- TCC “alarms” currently consist of scrolling data strings on operator consoles that can be segregated into 3 categorizes:
  1. Alarm - actionable in immediate timeframe
  2. System Status Information - for operators’ situational awareness
  3. Pass Through Information - that does not require any operator awareness or action (meant for equipment personnel).

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Improvement Suggestion: Segregation of Alarm Data

1. TCC Alarm System
   - A separate EMS window to display “true alarms”
2. System Status Indication System
   - A different EMS window to display system status notifications (used for situational awareness)
3. Pass-Through Information
   - Transmit directly to the interested staff (e.g. equipment SMEs)

This does not require EMS replacement or even upgrade.

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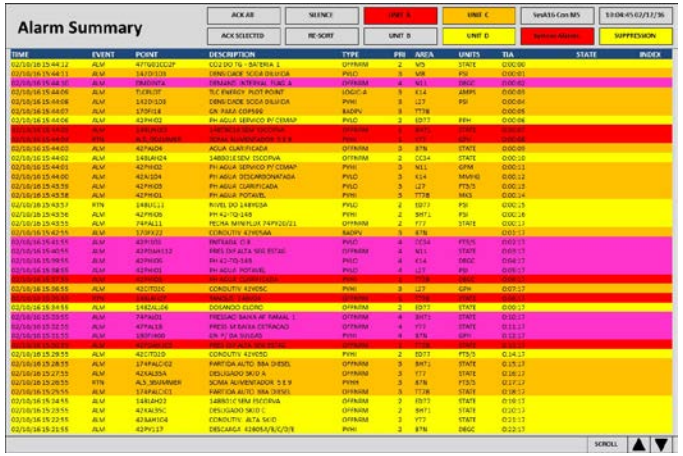
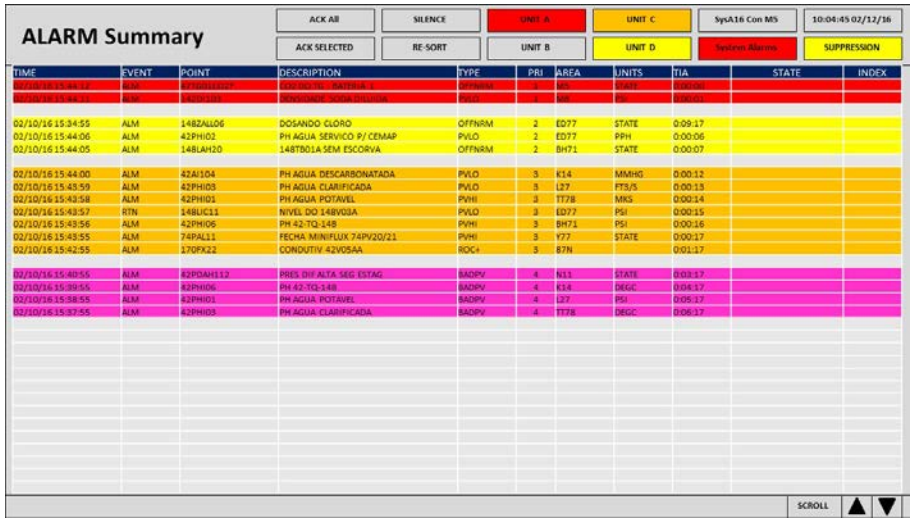
EMS Segregation:

Now:



To Be:

The EMS ALARM SYSTEM



The EMS STATUS INDICATION SYSTEM

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Philosophy Document

- **A Comprehensive Set of Guideline for**
  - Alarm development, implementation, maintenance, treatment and modification
  - Roles & Responsibilities
- **Consistent and Optimum Basis for**
  - Alarm selection; Priority determination; Configuration
- **Basis for Performance Monitoring**
  - KPIs; Nuisance Alarm Resolution

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Case Study 1: Baselining Alarm System Performance

- Purpose: Benchmark the performance of TCC alarm management system

- Scope:
  - Analyze historical data of at least 8 weeks
  - Measure performance using KPIs
  - Identify frequent and/or nuisance alarms
  - Identify chattering alarms
  - Identify alarm floods
  - Review the priority criteria

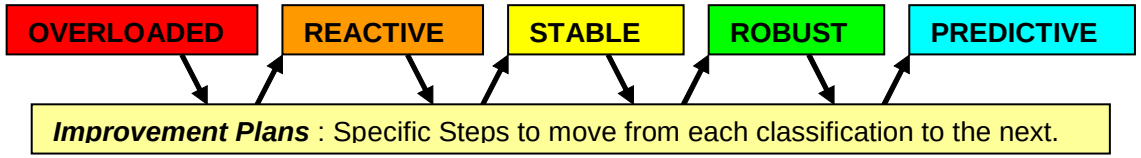

Figure 3-1 Alarm System Performance Levels

- Metrics (Targets) – IEC/ISA
  - 150 alarms / day (acceptable); 300 alarms / day (maximum manageable)
  - Priority Distribution: 1 (5%); 2 (15%); 3 (80%)

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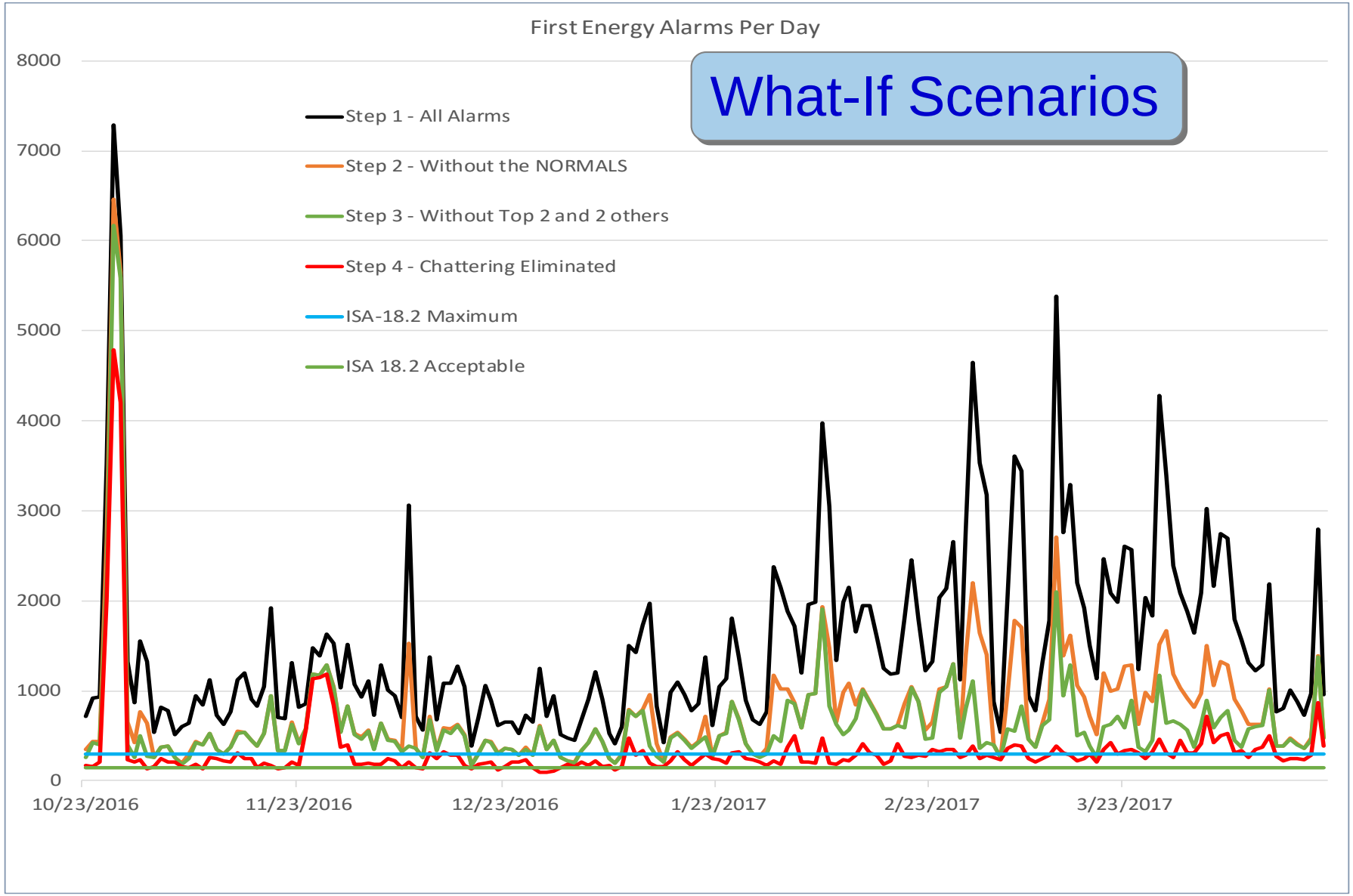
Baselining Analysis of FirstEnergy Alarm Data

- **Data for one Switching Desk in our Western Area**
  - 6 Months of Data (181 Days)
  - 275,565 Alarms received during the period
- **Alarms per day (Target: 150-300)**
  - Average: 786. Peak: 6467. Minimum: 170
- **Alarm Flooding (10 or more alarms in 10 minute period)**
  - 26.3% of the time
- **Top Ten most frequent Specific Alarms**
  - One device at one substation accounted for 11.4% (34,502) of all alarms
  - A transformer alarm accounted for 9% (24,772) of all alarms
- **Most Frequent Alarm Types**
  - Communication Non Critical -18.8%
  - All Voltage Alarms -18.1%
  - Other Communication Alarms - 17.1%

Baselining Analysis of FirstEnergy Alarm Data



Lessons Learned

- **Large percentage of alarms created by a few points**
- **We are asking Operators to decide which alarms to ignore, rather than only providing actionable alarms because of volume**
- **Cleaning up a few items can make a huge difference in number of alarms received**

Next Steps

- **Address Chattering Alarms**
  - 20% of alarms from two points
- **Evaluate the Need for return to normal as an alarm**
  - Almost 50% of alarms are return to normal
- **Are there better way to address certain alarms**
  - Voltage Monitoring
  - Door Alarms
- **Segregate Current Alarms**
  - Alarms
  - Situational Awareness Information
  - Pass Through Equipment Information
- **Develop Overall Alarm Philosophy**

Questions
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