Alarm System Guidelines

Kay Kasemir
ORNL/SNS
kasmirk@ornl.gov

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Alarm System Components

Configuration

Alarm Server, …

Control System

User Interface
Levels Of Complexity

• Use the Alarm System
  – Control Room operator

• Configure the Alarm System
  – Certain operators, IOC engineers

• Alarm System Setup
  – CSS maintainer for site

• Coming up with a good configuration
  – Everybody
Creating a good Alarm Configuration

Alarm Philosophy

Goal:

Help operators take correct actions

- Alarms with guidance, related displays
- Manageable alarm rate (<150/day)
- Operators will respond to every alarm
  (corollary to manageable rate)
What’s a valid alarm?

- **DOES IT REQUIRE IMMEDIATE OPERATOR ACTION?**
  - What action? Alarm guidance!
    - Not “make elog entry”, “tell next shift”, …
  - Consequence of not reacting?
  - How much time to react?
How are alarms added?

• Alarm triggers: PVs on IOCs
  – But more than just setting HIGH, HIHI, HSV, HHSV
  – HYST is good idea
  – Dynamic limits, enable based on machine state,...

  Requires thought, communication, documentation

• Added to alarm server with
  – Guidance: How to respond
  – Related screen: Reason for alarm (limits, ...), link to screens mentioned in guidance
  – Link to rationalization info (wiki)
Example: Elevated Temp/Press/Res.Err./…

• Immediate action required?
  – Do something to prevent interlock trip

• Impact, Consequence?
  – Beam off: Reset & OK, 5 minutes?
  – Cryo cold box trip: Off for a day?

• Time to respond?
  – 10 minutes to prevent interlock?

• MINOR? MAJOR?

• Guidance: “Open Valve 47 a bit, …”

• Related Displays: Screen that shows Temp, Valve, …
Avoid Multiple Alarm Levels

- Analog PVs for Temp/Press/Res.Err./…:
  - Easy to set LOLO, LOW, HIGH, HIHI

- Consider:
  - Do they require significantly different operator actions?
  - Will there be a lot of time after the HIGH to react before a follow-up HIHI alarm?

- In most cases, HIGH & HIHI only double the alarm traffic
  - Set only HSV to generate single, early alarm
  - Adding HHSV alarm assuming that the first one is ignored only worsens the problem
Bad Example: Old SNS ‘MEBT’ Alarms

• Each amplifier trip: \( \geq 3 \) ~identical alarms, no guidance

• Rethought w/ subsystem engineer, IOC programmer and operators: 1 better alarm
Alarms for Redundant Pumps

Klystron Building Overview

- Power System
  - KL-T-SS1 WATTS 410000.00 W
  - KL-T-SS2 WATTS 315350.00 W
  - KL-T-SS3 WATTS 437100.00 W
  - KL-T-SS4 WATTS 341100.00 W

- Process Waste
  - Comp Air Hdr 123.5 PSIG

- RFQ, DTL Circulator Loads
  - Temp 86.9 F

- KL HVAC 1
  - KL Bldg Temp 68.4 F
  - KL Bldg Humidity 1 45.7 % RH
  - Smoke Detected

- KL HVAC 2
  - KL Bldg Temp 70.1 F
  - KL Bldg Humidity 2 43.7 % RH
  - Smoke Detected

- KL HVAC 3
  - KL Bldg Temp 3 70.8 F
  - KL Bldg Humidity 3 34.9 % RH

- KL HVAC 4
  - KL Bldg Temp 4 71.7 F
  - KL Bldg Humidity 4 37.8 % RH
  - Smoke Detected

- KL HVAC 5
  - KL Bldg Temp 5 68.0 F
  - KL Bldg Humidity 5 46.0 % RH
  - Smoke Detected

- KL HVAC 6
  - Bidg Press East 0.2 in H2O
  - Bidg Press West -0.0 in H2O

- Klystrons, Circulators Blue Box
  - Circulating Loop 1.9 Mohm
  - Temp 87.1 F
  - Cond 1.8 Mohm
  - Polishing Loop

- Klystrons, Circulators Circulating Loop
  - 2.1 Mohm
  - Temp 92.4 F
  - Cond 1.8 Mohm
  - Polishing Loop

- Klystrons, Circulators Circulating Loop
  - 1.9 Mohm
  - Temp 91.7 F
  - Cond 1.9 Mohm
  - Polishing Loop

- Klystrons, Circulators Circulating Loop
  - 2.0 Mohm
  - Temp 85.1 F
  - Cond 2.5 Mohm
  - Polishing Loop

- Klystron Glycol
- DI Water P-KL-4
- DI Water P-KL-3
- DI Water P-KL-2
- DI Water P-KL-1
- DI Water P-KL-1-14
- DI Water P-KL-1-15
- DI Water P-KL-1-16
- KL-OCL 1-14
- KL-OCL 1-15
- KL-OCL 1-16
- KL-SCL 1-14
- KL-SCL 1-15
- KL-SCL 1-16
Alarm Generation: Redundant Pumps the wrong way

• Control System
  – Pump1 on/off status
  – Pump2 on/off status

• Simple Config setting: Pump Off => Alarm:
  – It’s normal for the ‘backup’ to be off
  – Both running is usually bad as well
    • Except during tests or switchover
  – During maintenance, both can be off
Redundant Pumps

• Control System
  – Pump1 on/off status
  – Pump2 on/off status
  – Number of running pumps
  – Configurable number of desired pumps

• Alarm System: Running == Desired?
  – … with delay to handle tests, switchover

• Same applies to devices that are only needed on-demand
Review: How Many alarms in last week?

Top 10 in last 24 h?
Summary

- **Easy to use**
  - Check alarms in Table, Tree, Panel
  - Fix it: Read Guidance, use Display Links
  - ✓ Acknowledge

- **Configuration**
  - Can be changed online
  - Operators can update guidance or add better display links

- **Alarm System Setup**
  - Somewhat Involved, but only once

- **Coming up with a good configuration**
  - Hard