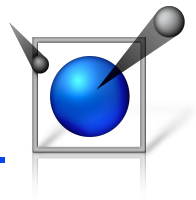


Oak Ridge National Laboratory SNS

Alarms Philosophy

NEUTRON SCIENCES



Kay Kasemir, Karen S. White, Oak Ridge, TN 37831, U.S.A. TUP022



Abstract

An effective alarm system consists of a mechanism to monitor control points and generate alarm notifications, tools for operators to view, hear, acknowledge and handle alarms and a good configuration. Despite the availability of numerous fully featured tools, accelerator alarm systems continue to be disappointing to operations, frequently to the point of alarms being permanently silenced or totally ignored. This is often due to configurations that produce an excessive number of alarms or fail to communicate the required operator response. Most accelerator controls systems do a good job of monitoring specified points and generating notifications when parameters exceed predefined limits. In some cases, improved tools can help, but more often, poor configuration is the root cause of ineffective alarm systems. A SNS, we have invested considerable effort in generating appropriate configurations using a rigorous set of rules based on best practices in the industrial process controls community. This paper will discuss our alarm configuration philosophy and operator response to our new system.

Background

Three different alarm systems have been tried at SNS – all failed to meet operator expectations

Technical issues varied

All had poor configuration

Alarm systems for accelerators often fail to satisfy operations expectations

It is not uncommon for operators to turn the alarm system off, or completely ignore it due to:

Flood of alarms

Alarms without enough information

Confusing alarms

More often, the problem is with the configuration rather than the tools

By defining guidelines for an alarm conditions and applying the rules across all subsystems, we can

Eliminate alarm floods and nuisance alarms

Keep the number of alarms to a manageable level

Ensure conditions that require an action are attended to in a timely fashion

Alarms Philosophy

A guide for the development, implementation, use and modification of alarms; defines the basis for alarm:

Selection – Alarms are:

Properly chosen and implemented

Relevant, clear, easy to understand

Accompanied by guidelines for required actions

Presented at a manageable rate

Implementation and Responsibilities

Triggered by EPICS Process Variables (PVs)

Generated by Alarm Server

Displayed by Alarm GUI

Indication, Annunciation and Response

All alarms are displayed

High priority alarms are also annunciated

All alarms require operator response including acknowledgement

Alarms include description, severity, time, status, PV trigger, guidance, related displays, and other documentation

Prioritization

Configuration Hierarchy

Area, System, Subsystem, PV

Rationalization

Consistent method to determine and prioritize alarms based on impact, consequences and required response time

Because alarms are not used for personnel or machine protection, accelerator downtime is the most significant impact

Design Considerations

Prevent multiple notices of same problem

Benefits of dynamic configuration

Aim to prevent failures, not for notification after the failure

System Performance – Analyze alarm trends and address

Most frequently alarming

Longest lasting alarms

Stale alarms

Alarm PV: CF_CU:TWR2_TW_Trouble:Sts

Purpose of Alarm
Indicates insufficient tower water problem, either low or elevated temperature or pump failure. Flow (5500gpm) and temperature limits are fixed in the PLC. For changes see contacts listed below.

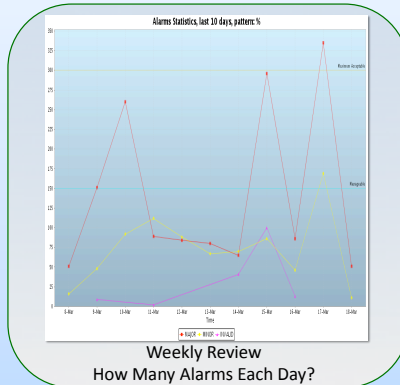
Operator Guidance
Look at tower water pump screen. There should be 3 pumps running. If not, attempt turn-on via operator screen.
If that fails, turn them on manually at C.O.B. Fail fails, call contacts listed below.

Failure Consequence
MAJOR consequence: Beam will be off for 12 hours, cold box will top...
TODO: List the top 3 critical items and response times in each case to avoid shutdown.

Operator Response Time Available
Usually less than 5 minutes in order to prevent further temperature increase.
TODO: Response time depends on beam power: How should this be factored into response?

Contacts
Water System Mechanical Engineers: Greg Hry, Jerry Ferguson; Control System Contact: Frank Bentley

Rationalization



Alarms Why?

Alarms are used to notify operators to perform required actions to prevent or mitigate undesirable consequences. The lack of useful alarms is often cited as a contributing factor to unplanned accelerator downtime.

Alarms Who?

Who are Alarms for?

Operators

Who determines Alarm configurations?

Team: System Expert, Operator and Controls Expert

Who configures Alarms?

Controls Expert and/or Operator

Alarms What?

What is an alarm system?

A mechanism for alerting operators of an off normal condition that **require a response**. System includes alarm generation, notification, logging and configuration and management tools.

Alarms When?

When should alarm notification occur?

Alarm conditions must be communicated as soon as possible to allow the operator time to execute the proper response.

Conditions should be selected that allow notification of the operator while intervention is still possible, not when it is too late.

Rate should be manageable (<150/day)

Alarms Where?

Where are alarms displayed and announced?

The central control room. They are also logged for later analysis and review.

Alarms How?

Alarm conditions are detected by the control system, transmitted to the operator and logged. A detailed discussion how the new SNS alarm handling system works is available in reference [2].

Alarms NOT!

Interlocks for personnel or machine protection to alert the operator that a normal operation has completed.

System experts for routine monitoring
Information only (they require an action)
Machine status summary
Maintenance scheduling

References

- [1] B. Hollifield, E. Habibi, "Alarm Management: Seven Effective Methods for Optimum Performance", ISA, 2007
- [2] Kay Kasemir, Xihui Chen, "Best Ever Alarm System Toolkit", TUO001,, Proceedings of ICALPECS 2009

