The importance and role of MoC in alarm rationalisation.

Why do we need a Management of Change process?

It is widely recognised throughout the process industries that making changes to assets can be prone to error; and indeed, some plant accidents and incidents have been attributed to poorly executed or unapproved changes.

Making any change no matter how large or small is an inherently risky business; unless the associated risks are comprehensively evaluated and documented within a structured, well defined management of change (MoC) process.

In the same way it is necessary to manage change throughout any construction project, it is essential to manage change when making modifications to your alarms and alarm systems. Alarms within your alarm system are one level of mitigation against the potential for any safety, environmental, financial or product quality incidents on your plant.

On any process plant, one inappropriately modified alarm could be responsible for an incident which attracts regulatory attention, or results in a significant loss of production or generating capacity.

A robust management of change process must not only allow you to manage and track any changes you may make; but should also incorporate checks and balances to ensure the changes are appropriate and safe, and must include appropriate levels of review and authorisation within its structure.

As we can see in Figure 1, management of change is a fundamental process within the alarm management lifecycle as defined in the relevant standards and guidance. In reality, it not only covers the processes from alarm identification through to implementation, but is also valid and necessary in the operation and maintenance phases when alarm modifications may be required due to process or plant changes, and indeed is relevant when considering an alarm philosophy which may need to be updated as systems are modified, upgraded or replaced.

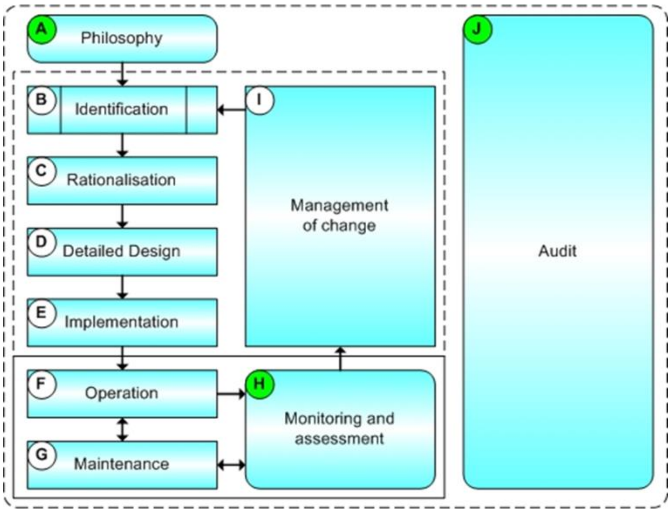

Figure 1 - Alarm Management Lifecycle

It is therefore reasonable to conclude that management of change is applicable to the whole alarm management lifecycle, throughout the life of your system; and don't forget, when developing an alarm philosophy in compliance with the alarm management standards, a section detailing management of change is ***required*** content.

Alarm rationalisation, what is it?

Alarm rationalisation is the arduous but necessary process of reviewing every alarm in your system for its suitability. This is valid for both greenfield and existing installations. Unnecessary alarms greatly reduce the effectiveness of operators, and further compromise the operators' ability to address critical alarms which can be extremely costly.

During an alarm rationalisation project, every alarm state, (High, LoLo, Bad PV, Status etc.), should be reviewed to determine if it meets the criteria for a good alarm as defined in your alarm philosophy. If it does not, it should either be demoted to an event, or removed entirely from the alarm population. If an alarm is to be kept, then setpoints, priority and deadbands etc., should be reviewed and modified where necessary; and we should also document the appropriate response to the alarm, the consequence of failure to respond to the alarm and many other related attributes.

If we consider that during an alarm rationalisation project, we could be making some tens of thousands of changes to our alarms and associated parameters; it becomes obvious that it is ***absolutely essential*** that we manage those changes using a robust, structured and auditable MoC process.

What are we going to manage?

For any alarm system, we need to manage all the information associated with our alarms, such as tag name, descriptor, priority, deadband etc. In addition, we will also need to manage all the ancillary information such as possible cause(s) of the alarm, operator action(s), consequence of failure to respond etc. We may also choose to collate and manage other information such as P&ID references, cause and effects references, instrument type and location, computerised maintenance management system (CMMS) cross references etc. But where should we keep all this information?

What and where is our Master Alarm Database?

Considering the points above, it can be seen that we need to store and manage a huge amount of information. On many plants, our 'alarm database' is actually a collection of spreadsheets, each of which holds different data in differing numbers of rows and columns and disparate formats. Some data, such as alarm setpoints, may even be available only in a textual format within operational manuals.

In some cases, these spreadsheets are "on the network somewhere", or "Bill has it on his PC, he's been working on it". Often, there's a trip and alarm register that was "started a few years ago, but needs updating". It is very often the case that plant personnel know they should have a single, centralised, up to date list of alarms, perhaps including trip points and interlock settings, but no-one has the time to collate all the sources of information. It's out there somewhere; but when it's looked for, it isn't there.

Somehow, all these data need to be brought together into a single, dedicated repository which is easily accessed and robustly managed. This repository is more often known as a Master Alarm Database, and is defined in the alarm management standards as '*authorized list of rationalized alarms and associated attributes*'. Without a Master Alarm Database containing all our alarms, it will be impossible to adequately manage our alarm systems.

For most process plants, the starting point for any Master Alarm Database is simply a complete control system configuration dump. Whilst this may not deliver a database of all alarms, for example, those associated with standalone ESD or F&G packages, it will generate a complete list of all alarms which could be presented to the operator through the control system HMI, whether or not they are documented or known about.

Let's use a spreadsheet?

Q: When is a database not a database? A: When it is a spreadsheet.

Many 'alarm databases' are held as spreadsheets because most people are comfortable with using a spreadsheet, they are 'easy' to use and the learning curve is not as steep as trying to understand the vagaries of a database. In a spreadsheet, you can 'add another column'. With a database, you must consider the design and interactions of your tables.

Spreadsheets undoubtedly have their place in the office environment, but, they have been fundamentally designed as ***data analysis*** tools. Yes, they have some database functionality included; but unlike databases, they have not been designed as ***data management*** tools and this is what we need.

Consider a real control system consisting of 15,000 tags. The control system exports all the configuration data as a spreadsheet with 260 possible parameters for each tag. This gives a total of **3,900,000** cells, not all of which will contain any data. Each analogue tag has seven possible alarm states, (HiHiHi, HiHi, High, Low, LoLo, LoLoLo and Bad PV). Each alarm state requires at least a further nine columns to document the cause of the alarm, type of alarm (safety, environmental or commercial), operator action, review team, review date etc. That is a further (7 * 9 * 15,000) **945,000** cells. So far, we now have a spreadsheet of **4,845,000** cells and we have not yet started to consider instrument type, location, P&ID reference etc. In reality, you may be trying to manage and maintain a spreadsheet consisting of considerably more than **5,000,000** cells of data.

Quite apart from the size of the spreadsheet; as you add and store more data (tags, parameters and ancillary information), your spreadsheet becomes slower and more unwieldy. Also, only one person can edit data in your spreadsheet at any one time. With a properly designed database; multiple, concurrent users can access and edit the database, although individual records are locked to individual users as they are updated.

Once data are changed in a cell in a spreadsheet, the previous data are lost. There is no audit trail. How do you identify the one change made in 5,000,000 cells when you need to? If you wish to keep track of the original values as well as those modified; you either keep another version of the spreadsheet, or add an ‘original values’ tab to the existing spreadsheet. Oops, you now potentially have **10,000,000** cells or more to manage!!

What if we want to copy data from one alarm to many? Easy, I hear you say. Copy the data then paste into your selected cells. What happens if you want to replicate some data, but not from consecutive columns. You have to perform multiple copies from one alarm to the others. And how many times have you copied data and pasted to a range of filtered rows, only to find at a later date that much of the data hasn’t been transferred? Why? Because the last person to use the spreadsheet, filtered the data for their own purposes and saved the spreadsheet with the filter still active and you didn’t notice. Don’t say you haven’t done this. The author has! This particular problem wouldn’t happen if you were using a database.

There are so many other drawbacks to using a spreadsheet, such as how do you create an alarm response manual from your modified data, export a list of modifications for review or re-import back into your control system? Yes, these things can be achieved and the author has done so when there were no alternatives, (the client did not possess any database software or dedicated tools). However, creation of bespoke user forms and software to manage these tasks is neither simple nor quick, and who will be responsible for maintaining the code and fixing any bugs?

So, can we use a spreadsheet as our Master Alarm Database? Yes we can, but it will be a logistical nightmare. Is a spreadsheet the most appropriate tool for a Master Alarm Database, **most definitely NOT**.

What does all this mean?

In order to manage alarms and alarm systems on our site, it is essential that we have both a robust management of change process and a comprehensive, fully populated Master Alarm Database.

Use your head, use a database

Ok, we’ve realised that we need to use a database and not a spreadsheet as the foundation of our Master Alarm Database. Do we create our own in-house tool, or purchase a third party tool such as *MAC Solutions’ Guardian*?

In-house sounds like an excellent option.

- We won’t have to raise a purchase order for expensive software
- We can tailor our database to our individual requirements

Before you go any further, **STOP**; and think.

- Who is going to create our database?

- How long will it take before it’s ready for use?
- Who will maintain the code and fix bugs as they become apparent?
- Will they understand exactly what our needs and requiremetns are?

Whilst creating your own internal, bespoke tool may seem like the ideal option, doing so is fraught with difficulty. Who will carry out the work? Most IT departments do not employ staff to write bespoke applications. Bill could do it, he’s good with IT, but he’s a mechanical engineer and quite busy with those failing compressors right now!!

Creating a Master Alarm Database tool is not a straightforward task. It is not just a list of alarms. There are many elements you must consider before you decide to create your own tool, not least of which is the need for you to create a comprehensive user requirement specification (URS), without which, your tool will fail to meet your needs. For example, some of the things you need to consider are:

How do you:

- Import the data from your control system into your Master Alarm Database?
- Export the modified data back out and into your control system?
- Use your tool to carry out reviews and alarm rationalisation projects?
- Use your tool to determine the priority of your alarms?
  - Is there a ‘priority wizard’ embedded in your tool?

Does your tool:

- Allow / simply the creation of your Alarm Response Manual?
  - The information is all in there.
- Allow you to carry out multiple rationalisations on multiple systems?
- Allow you to track progress of your rationalistion projects?
- Display the distribution of alarm priorities and comapare to to your target?

Don’t forget about ongoing support for your tool. With the best will in the world, most internal tools are created by enthusiastic people who have a modicum of knowledge. But the code they write is often messy, uncommented and undocumented, and in most cases, not robust. Consider what will happen when the tool crashes and the person who wrote it is in a different role or has left the company. Who then will have the time or ability to resolve the problems you are experiencing? Most certainly, it will NOT be your IT department!

Does Guardian meet your requirements?

If you are serious about alarm management and wish to comply with the standards; as stated earlier, managing change is a requirement. Also, we can only truly manage our alarms if we have a dedicated Master Alarm Database where all our data resides.

Guardian has been designed to integrate a Master Alarm Database and a set of alarm rationalisation tools with comprehensive management of change functionality, into a single powerful application to help you meet your alarm management challenges.

It is flexible enough to adapt to your management of change requirements and includes a fully managed workflow. Each user can be allocated one or more roles (owner, approver or reviewer) tailored to the projects with which they are involved.

Guardian includes revision control for every tag in the database and the ability to revert to earlier authorised revisions is included, as is the facility to review, sign, approve or reject any changes; all of which are documented in the comprehensive audit trail.

Guardian allows the creation of multiple Master Alarm Databases with no limitation to the number of tags included, so that multiple disparate assets can be managed within the one tool. In order to manage the data, Guardian supports the import and export of data in multiple standard, (including control system specific), formats. All data can be imported and exported in machine readable formats thus negating the requirement for any manual modifications.

To complement the Master Alarm Database and make Guardian into a truly versatile alarm management tool, a set of rationalisation tools is incorporated, including bulk edit and copy facilities and prioritisation wizards to help you determine alarm priority based on recognised methodolgies and those included in your Alarm Philosophy. Once all the tags have been reviewed and approved as part of a rationalisation project, an Alarm Response Manual can be generated from the data held within the tool.

As management of change is at the core of Guardian, it is essential to be able to be confident in the integrity of your data. Guardian includes functionality to allow comparison of your live system and Master Alarm Database and importantly, allows comparison of your rationalised alarm configuration by comparing the modified control system configuration with the generated modifications. Any discrepancies are highlighted which can then be resolved.

Recognising that the security of your data is paramount, careful consideration has been given to the operational aspects of Guardian, key features of which are:

- No loss or corruption of data due to unexpected browser termination when modifying information
- Utilisation of a digital signature, to provide a tamper evident database design to ensure the integrity of your data

So in answer to your question, does Guardian meet your requirements for alarm management, alarm rationalisation and management of change?

Absolutely, YES.

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