

Benchmarking Your Alarm System

Introduction

If you were challenged to describe the effectiveness of your alarm system performance or governance during a regulatory or corporate audit, could you do so?

Understanding how well you manage your alarms and alarm systems; is fundamental to being able to demonstrate not only your compliance to standards and regulatory obligations, but also what improvements have been made. This is particularly important should you be so unfortunate as to be in the spotlight of regulatory scrutiny.

What is benchmarking?

It is often quoted; that you cannot manage, improve or control what you do not measure, so what kind of 'measurement' is appropriate to our alarm systems?

Before we embark on any alarm improvement process; in order to be able to identify exactly how we measure up, we need to carry out some form of baseline assessment. It is this assessment that is often described as a 'benchmark'.

If we look at some definitions in the alarm management standard IEC 62682¹, we find the following:

3.1.35 Audit: "*comprehensive assessment that includes the evaluation of alarm system performance and the effectiveness of the work practices used to administer the alarm system*".

3.1.37 Benchmark: "*initial audit of an alarm system designed to specifically identify problem areas for the purpose of formulating plans*".

Furthermore, in IEC 62682, it is stated in clause 18.2.1, "*An initial audit or benchmark should be made against a set of documented practices' (e.g., the practices listed in this standard)*".

If we consider the definitions above, it is obvious that a benchmark assessment is not simply a numerical analysis of the number and rate of alarms being presented to the operators. A benchmark assessment should employ a holistic approach where every aspect of alarm management is thoroughly examined and compared against legislative, regulatory and corporate obligations, the requirements of standards and industry best practice.

All in all, a thorough benchmark assessment represents a significant undertaking. It is a process which requires preparation, detailed examination of all alarm management aspects, and subsequently, the compilation of a thorough report providing a gap analysis between requirements and realities with recommendations for actions required to close the gaps.

Why should I carry out a benchmark?

Having identified what a benchmark assessment is, you may well ask, '***Why do I need one? I know where our deficiencies lie***'. If only that were the case!

Guidelines for effective alarm management have been available since 1999 (EEMUA 191²) and in 2009, ISA³ published an alarm management standard – 18.2-2009; however, tragic and fatal accidents involving poor alarm management are still occurring (Deepwater Horizon 2010).

Regulatory bodies are increasing pressure on industry to focus on alarms and alarm systems regardless of the maturity of your system. This is even more evident following the recent publication of the IEC 62682 alarm management standard, and the Seveso III European directive which is enacted in the UK through the COMAH 2015 regulations.

Consider the following situation uncovered by the author during a benchmark assessment.

Note: Site personnel were adamant that they had no problems with alarms in regard to any of their regulatory submissions:

Pharmaceutical site:

FDA⁴ regulated, top tier COMAH⁵ site with an environmental permit.

- In the COMAH report, credit was taken for alarms during LOPA⁶ studies which reduced the SIL⁷ requirements on tank farm protective systems.
- To comply with FDA requirements, it was a necessary to check and test specific alarms prior to the commencement of any new campaign of product.
- From the environmental permit, a number of alarms were identified which were fundamental to the monitoring of point source emissions.

On this site; alarms were not only **routinely ignored**, but were in many cases **muted**, and **no periodic testing** of any alarms was carried out. Clearly, the site was significantly in breach of all its regulatory obligations.

In the event of any incident or regulatory audit, how would site personnel have explained or justified these serious deficiencies? At best, the site would have been served with an improvement notice from one or more of the regulatory bodies.

This, unfortunately, is not an uncommon situation; and was encountered to a lesser extent on a number of occasions by the author whilst conducting numerous benchmark assessments.

Can you absolutely guarantee that you do not have a similar situation on your site?

Industry standards and guidelines

Since the first edition of the EEMUA 191 alarm management guidelines were published in 1999, a number of standards have emerged, these being ISA 18.2 and IEC 62682 (BS EN 62682). These standards, the content of which are substantially the same, were developed from the EEMUA 191 guidelines.

For auditing (a fundamental part of the alarm management lifecycle) and benchmarking your system, clause 18 in each of the standards mandates what you shall do, but not how. Examples and suggestions of good practice, however, are contained in the EEMUA 191 guidelines.

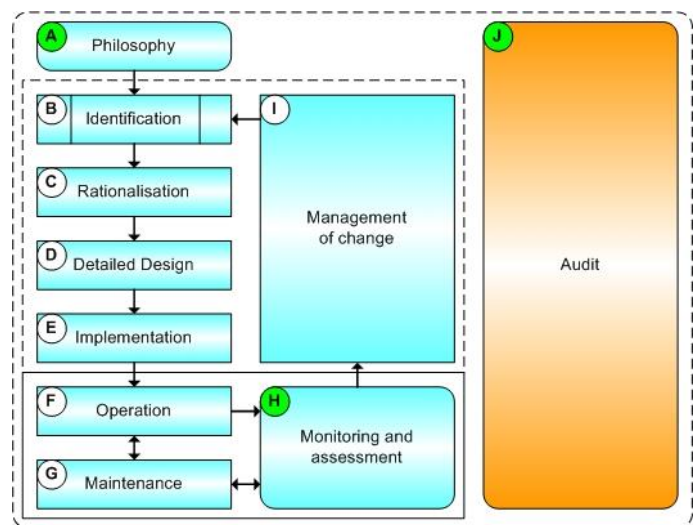


Figure 1 - The Alarm Management Lifecycle

What constitutes a good benchmark assessment is very much down to the assessor or your company's own procedure, but there are a number of requirements mandated in the standards and some important aspects that you should consider for inclusion in yours, such as:

- Structured interviews
- Statistical analysis of the alarm rates and KPIs
- Comprehensive review of procedures and processes
- Thorough review of all legislative, regulatory and corporate obligations
- Observation

How do I do it and what tools do I need?

The secret to achieving an effective benchmark assessment is in the planning and preparation. Ensure you communicate fully with everyone you wish to involve to make sure they understand what you are trying to achieve and why.

Engage your senior management and get their commitment. They need to understand that this is just the beginning of an alarm improvement process which may involve a significant investment in both time and money.

The tools you require are an agenda, a set of pre prepared questionnaires, (examples of some of these are available in the EEMUA 191 guidelines), alarm management analysis software, writing materials and most importantly; your eyes and ears. Your agenda should be fluid and you may have to adjust it according to the prevailing operational requirements.

Structured interviews:

Your operations personnel are crucial to the safe and effective operation of your asset. Experienced operators know exactly what the real problems are and can tell you a lot of what needs to be done. However, you must be able to gain their confidence in order for them to open up. They may be reticent about revealing anything if they believe there may be adverse repercussions. It is essential when engaging with operators during the interview process, that you ensure they understand that the exercise is NOT being used to evaluate their competence; but to identify where alarm systems and the management of those systems falls short in supporting them with their jobs.

Each interview will take around 60-90 minutes and should be conducted at the operator's place of work. The pre prepared questionnaires should be used as an aid memoire. It is ok, in fact desirable, to deviate from the set questions when the interviewee is happy to give you the benefit of their wisdom. Make sure you have plenty space for supplementary notes, but be prepared to limit off piste conversations if necessary!

Interview as many operators as is possible in the time you have available, ensuring they are from different shifts, and keep your eyes and ears open at all times.

Statistical analysis of the alarm rates and KPIs:

The ideal scenario is that you already have some form of alarm monitoring, measuring and analysis software from which you can extract the necessary information and data. You may have standalone software for which you need to extract raw alarm and event data direct from the alarm system, or worst case, you have to create your own tool in Microsoft Access or Excel (not recommended).

Whatever tools you employ, you will need to obtain at least a month's worth of data to be able to generate any meaningful results. This should cover periods of normal steady state running and if possible, some periods of upset.

You should identify as a minimum, the average and peak alarm rates, top 10 most frequent alarms (bad actors), and the alarm priority distribution. Other useful indicators are the number of standing (stale) and shelved alarms. These figures should be compared against the site targets, or against those given in the standards where no targets have been defined.

Ideally, you should obtain data which include events. Although the focus of a benchmark is identify alarm problems, it is often very revealing to look at the event data, time permitting.

Comprehensive review of procedures and processes:

As part of the benchmark assessment, a thorough review of all procedures and practices should be undertaken. We should be able to demonstrate compliance to the relevant standards and current best practices. Compare the documented procedures with anecdotal evidence and your own findings and observations. For example:

- Does your site have an Alarm Philosophy and if so, does it meet the requirements mandated in the alarm management standards?
- Are the roles and responsibilities for the management of alarms and alarm systems clearly defined and documented?
- Look at how, for example, alarms are 'disabled' or 'shelved'. Does the practice you observe conform to the documented procedure, if one exists?

You should also review any basic design guidelines your site uses, how alarms and alarm systems are managed, training and competence, management of change etc.

Thorough review of all legislative, regulatory and corporate obligations:

It is essential that we ensure compliance with all the legislative, regulatory and corporate requirements we are subject to. It is therefore important to review all the relevant documentation to determine if there are any references to alarms or alarm systems within our regulatory submissions, where alarms have been included as mitigation against particular scenarios. If alarms are referenced within this documentation, then the priority of some of the identified recommendations is likely to change.

For example, your site does not currently test alarms.

- If there are no references to alarms in the relevant submissions, then any recommendation to test alarms may simply be a 'suggested improvement'.
- If however, alarms are used as a layer of protection as in the earlier example; then periodic proof testing of the associated alarms would become a 'mandatory' recommendation.

Observation:

Your eyes and ears are the most important tools you have. While everyone knows what a procedure mandates, do they follow the procedure or do something different? Simply watching what happens can tell you a lot about how alarms are managed. When conducting the operator interviews, observe; you may be told one thing whilst another is actually being done. How do the operators really respond to alarms?

Sit in during a shift handover or morning meeting, just watch and make notes. How are alarms dealt with, if at all? How are any problems or changes to alarms communicated to the process teams?

While you're looking around, does the control room seem an appropriate place of work, or is it more akin to a thoroughfare or meeting room? Does the operator seem overburdened with ancillary tasks? What about the lighting and general ergonomics of the control room, do these help or hinder the operator with their duties? Perhaps there would be a benefit in carrying out a full human factors control room assessment.

After the benchmark assessment is complete.

Once you have interviewed, measured, reviewed and observed; it is important to document your findings and formulate improvement plans. Ideally, your report should provide a gap analysis between your findings and any requirements necessary to provide compliance with legislative, regulatory or corporate obligations and the requirements mandated in the relevant standards. However, the standards you need to comply with may not be limited to alarm management. For example, if your alarm system performs a safety role, then you may have to manage your system in accordance with IEC 61511⁸.

Structure your report such that each section deals with a separate facet of alarm management, such as regulatory compliance, alarm system design, training and competence etc. For each section, make individual recommendations for improvements based on the identified gaps.

Just as important as identifying areas of concern, ensure that you highlight and praise any areas of best practice or excellence. Also include in your report, suggestions for improvement which although not essential to ensure the necessary compliances, will prove a benefit to alarm management on your site.

Prioritise your recommendations. For example, you may wish to categorise actions required to ensure compliance with standards and regulatory obligations as 'mandatory'.

Highlight any 'quick wins' you may identify and mark these for immediate action. Seeing early positive changes happen can be a great motivator to everyone else; "this time, we are going to make a difference"!

Don't be afraid to tackle 'cultural' issues. There are often situations where custom and practice has become endemic, and compliance to procedures is patchy, if not non-existent. If these issues are not tackled, then no matter what processes and procedures you put in place for improvement; if the general culture of 'we do things this way, as we always have' remains, your improvement initiative is doomed to failure. Ensure the reasons for any non-compliance are well understood. It may simply be that the procedure is inappropriate or outdated!

Most importantly, publish your report and act upon the recommendations!

Benchmarking, are there any benefits?

The answer to this is YES.

Apart from identifying and recommending actions to close any legislative, regulatory or corporate compliance gaps, by implementing your report's recommendations, you can see other benefits such as:

- Increased safety and environmental performance
- Improved alarm system effectiveness
- Reduced Operator stress
- Fewer plant trips
- Improved productivity

Finally

Don't forget, periodic auditing of your management of alarms is a requirement in IEC 62682 and is a fundamental part of the alarm management lifecycle shown in figure 1. Carrying out regular audits will demonstrate to regulatory, corporate or third party auditors not only your compliance to standards, but also your commitment to improvement.

Remember, continual auditing need not mean a full benchmark assessment every six months! You can choose to target specific areas on a regular, rolling basis, in accordance with your current internal auditing process. However, ensure you address all facets of alarm management within your defined audit cycle.

¹ IEC 62682 – Management of alarms systems for the process industries

² EMUA 191 – Engineering Equipment and Materials Users Association, publication no. 191

³ ISA – International Society of Automation

⁴ FDA – Food and Drug Administration

⁵ COMAH – Control Of Major Accident Hazards

⁶ LOPA – Layer Of Protection Analysis

⁷ SIL – Safety Integrity Level

⁸ IEC 61511 – Functional safety – Safety instrumented systems for the process industry sector

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