

WHITE PAPER

Enhancing Water Industry Operations Through Strategic Alarm Management

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Executive summary

The water and wastewater industry stands at the threshold of profound digital transformation. Yet the industry grapples with its own unique complexities, rooted in legacy systems, and bound by stringent regulatory obligations. Nevertheless, the imperatives of urbanization, climate change, regulatory scrutiny, and a global skills deficit demand a resolution only possible through digitalization.

Amid this landscape, effective alarm management emerges as a linchpin in the journey towards digital transformation. As water companies amass vast troves of data and wrestle with ever-mounting compliance requirements, the imperative for robust alarm management is evident. Alarms are the first line of defence in the safe operation of utilities, but mismanaged they can be the direct cause of errors, regulatory penalties, and reputational damage.

A litany of avoidable issues—nuisance alarms, alarm floods, operator cognitive overload, and subpar prioritization—can all threaten operational efficiency. Here, modern alarm management software steps in as a comprehensive solution, eliminating nuisance alarms, streamlining priorities, and unleashing the power of data analysis, real-time visualization, and automated reporting.

Importantly, the journey towards improved alarm management need not be undertaken alone. By collaborating with a reputable alarm management software provider, water utilities can benefit from external expertise, tools, and ongoing support. Moreover, by addressing the daily challenges of nuisance alarms and analyzing patterns, companies can lay the foundation for a tailored and efficient alarm management philosophy that improves customer services and shareholder value.

Alarm management shouldn't be considered a standalone initiative; it forms a fundamental early step in a comprehensive digital transformation strategy. Companies that promptly adopt capable, modern alarm management software as an integral part of their digitalization journey can swiftly realize significant returns on investment while laying the foundation for comprehensive facility operations.



Background

Water and wastewater companies around the world are in transition. Like any industrial organization, they stand to benefit greatly from digitalization but due to their nature, size, and their legacy equipment and systems, true digital transformation is a complex process.

Complex, but vital. Water companies face several sizeable challenges to meeting their obligations to a variety of stakeholders. Providing clean drinking water and effective wastewater disposal to growing and increasingly urbanized populations places a huge pressure on (often) aging infrastructure. Add in the pressures of an already stringent regulation framework hardening to improve standards to protect customers and the environment, the impact of climate change making weather events more common and severe, and a global skills shortage, and it would be easy to think that we have a recipe for disaster.

By unleashing the full potential of data, through a strategic digital transformation approach, water companies can not only meet the challenges of today, but be well-placed to grow through the challenges of tomorrow, improving shareholder value and service standards at the same time.

Operational water and wastewater companies already create a huge amount of data, and rationalization of that data is vital to their digital journey. As a heavily regulated industry, where failure to meet compliance standards results in heavy fines and reputational damage, alarm management is vital to governance. This complex, data-driven area of the business is among the first that should be addressed in any digitalization approach, and can prove a very effective launchpad for taking control of data throughout the organization. Water companies that implement effective alarm management practices also illuminate additional optimization opportunities by gaining deeper insights into the condition of their assets, facilitating quicker and more efficient responses to incidents when they arise.

Alarms are critical to the safe and effective operation of water and wastewater companies. Control rooms work around the clock, and an average large water utility receives some 240,000 alarms a year from its SCADA systems – more when there are major weather events. If alarms are not handled correctly and the result is an issue with tap water quality or a sewage discharge, regulators impose penalties. But managing so many alarms places a huge pressure on staff and as water companies start to digitalize, operators must be aware of relevant alarms in the system they oversee as well as many of the systems that theirs is connected to. For most operators, dealing with alarms is taking more time away from their core responsibilities, and, importantly, reducing their cognitive bandwidth to add value from an operational point of view. This, in the era of digital transformation, runs in direct contradiction to the strategic advantages of implementing emerging technology, where a primary benefit should ordinarily be a productivity premium per head of staff.



Put simply, digital transformation, well applied, gives operators and managers the tools and insight to perform tasks and improve efficiency, but without due consideration of alarm management, these benefits are fundamentally undermined.

Operators in utility companies will not be surprised to hear that as much as 80% of the alarm load that comes in from their SCADA systems are nuisance alarms. Nuisance alarms are caused by incorrectly prioritized alarms, misconfigured alarms, weather conditions resulting in alarm floods, or power failures. An excessive volume of nuisance alarms presents a risk to the business. When an operator is exposed to a volume of alarms higher than they can manage, the risk of missing important alarms increases.

Poor alarm prioritization is often the result of the original configuration by SCADA vendors who align the priority of alarms to their own understanding of what is/was important. This means that alarm priorities do not necessarily reflect their importance to the process or its operation in a water and wastewater company. In order to deliver clean drinking water and remove wastage, companies within the water and wastewater industry have a network of assets spread across large geographical areas. Many of these sites are typically unmanned and require visits from engineering when incidents occur. As a consequence, the remoteness of the sites should be factored into the priority of alarms along with other important aspects including potential impact to the environment, the cost of engineer callouts, the time needed to resolve the issue and the impact to the process.

Due to the size and geographical spread of operations, the water and wastewater industry is left with large scale alarm configuration issues which can seem like a daunting and time-consuming task to rectify.

Issue	Cause	Consequences
High Alarm Load	■ Weather events ■ Increased automation ■ Increased digitalization ■ Compliance requirements for reporting or monitoring	■ Operators accept alarms without review ■ Poor decision making in response to alarms ■ Critical/High priority alarms may be masked ■ Failures and fines
Alarm Floods	■ Weather events ■ Poor alarm rationalization ■ Inadequate alarm philosophy	■ Distraction causing delayed response ■ Incorrect responses to the incidents
Nuisance Alarms	■ Poor alarm rationalisation ■ Inadequate alarm philosophy	■ Alarms regularly 'defeated' ■ Alarms not acknowledged ■ Alarm system becomes ignored
Operator Cognitive Overload	■ Too many, poorly rationalized alarms ■ Insufficient staffing (or skills deficit) ■ Inadequate alarm philosophy	■ Operators with reduced situational awareness ■ Mistakes causing failures, quality issues, reputation loss, fines etc. ■ Poor staff retention and time lost to sickness/stress related illness

Alarm Management Software

The use of alarm management software for the water industry can completely transform alarm management and deliver considerable value. Modern alarm management software can deliver a range of benefits to water companies, such as the removal of nuisance alarms, the rationalization of alarms, the provision of insight from alarm data analysis, real-time alarm data visualization and automated reporting, and the maintenance of historian functions for sequence of events (SOE) and continuous improvement benefits.

Modern, cutting-edge alarm management software is potentially cloud-based, but can equally be a hybrid or on-premise system, and works on four basic principles – those of alarm data collection, alarm data rationalization, alarm data analysis, and alarm data visualization. It covers three important levels of alarm management – collation and consolidation, analysis, and historian functions.



The foundation software level collects alarm and event messages from multiple disparate systems and consolidates them into an industry standard SQL database. An easy to use yet powerful web-based client is used to view, search, and filter the messages in a unified view of alarm and event data. Functionality built into such software allows simple export of information, the ability to conduct frequency analysis to quickly find problem areas, and the power to recognise important alarms and events and configure set responses – such as automated emails to certain personnel and/or third parties.

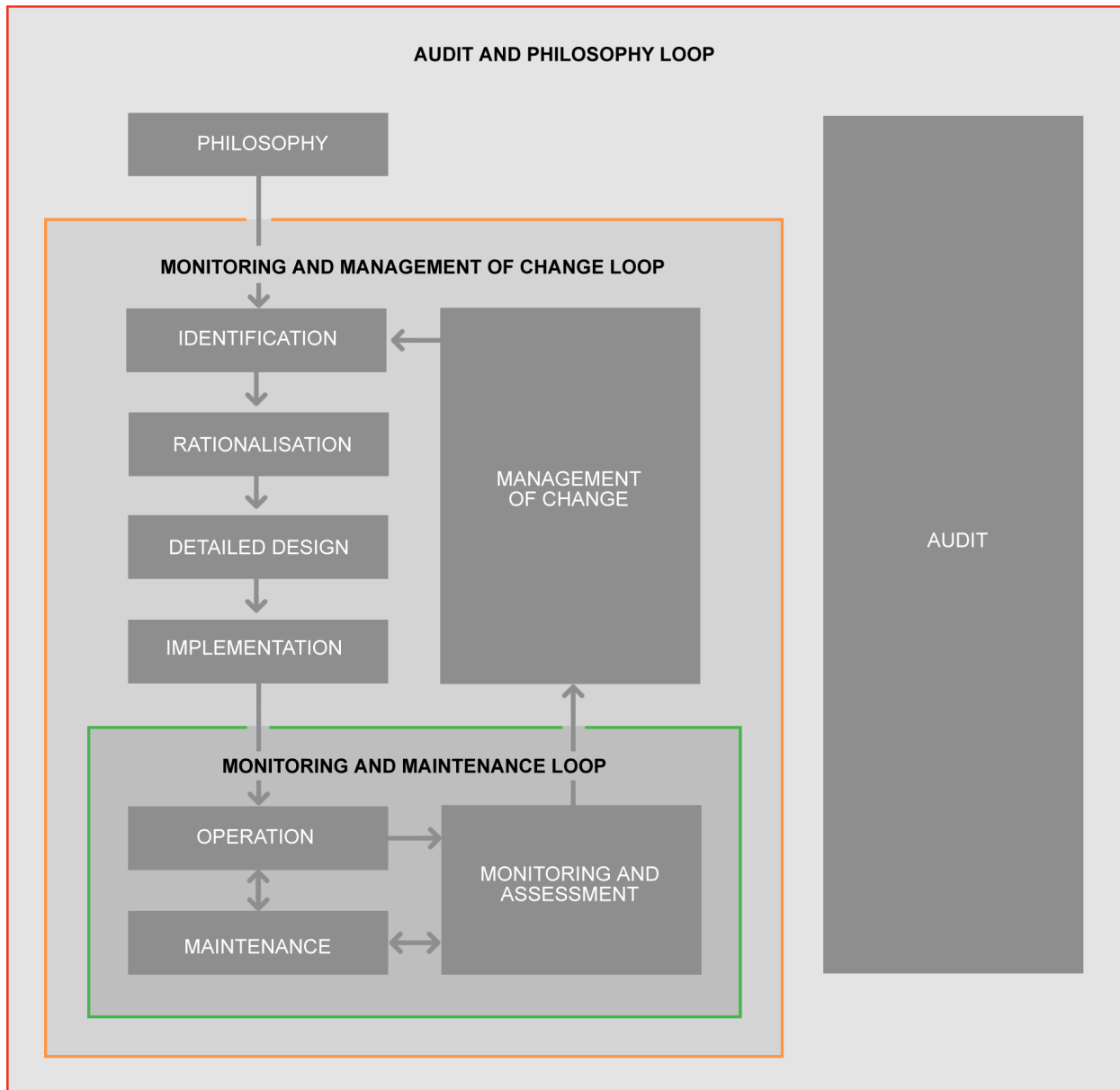
The next level is to add analysis software, which enables reporting to the relevant standards and guidelines and automates much of what is possible at the foundation level, including enabling KPI-based presentations via inbuilt dashboards.

The third level – the Master Alarm Database - provides a comprehensive capability to manage and track alarm configuration changes to the plant alarm assets in a single common repository. Importantly it also offers the capacity to compare live parameters with historic recordings so the state of alarm management can be understood on a continuum over time, and best performance levels can be laid against current ones to understand the overall health of both the plant's assets and the alarm management philosophy.

How to get started with Alarm Management

There are two kinds of water utility when it comes to alarm management – those with Alarm Management Software (AMS) and those without. Having AMS often means that many of the tools required to improve alarm management already exist within the business. For organizations still experiencing issues such as those outlined in the above table, it also means that they are not being used correctly, or some of the supporting systems or practices are insufficient or poorly designed.

The Alarm Management Lifecycle



Since those organizations with underperforming AMS will be covered in the following explainer (and most, if they are having issues, will need to take all the steps below), it's worth walking through how to start an AMS journey from scratch.

There is one common starting point for alarm management for water utilities, and that is the realization that the abundance of annunciated alarms is putting your enterprise at risk of one of the following:

- Operator mistakes due to overwhelm or poorly organized alarms
- Operator productivity reductions due to time spent managing alarms
- Potential breaches of regulatory consent caused by failure to act on certain alarms in the correct way
- Unnecessary discharge of pollutants causing environmental damage and associated regulatory penalization

A good, and not uncommon example of a company experiencing this situation, would be where an alarm technician has to deal with minimum alarm rates of between 20 and 40 alarms per 10 minutes for more than two days. No-one is capable of dealing effectively with sustained alarm rates such as that for extended periods of time and the alarm system in that example is effectively unusable.

What To Do

Step one. Get an Alarm Management Benchmark Assessment Report done. A benchmark assessment report will return an overall summary and a detailed assessment of the performance of alarm systems in the organization. It will also assess the processes, procedures and practices currently in place for the management of alarms and offer a consolidated list of recommendations for action to improve the management of alarms on site.

In the UK and EU, for example, a strong benchmark assessment will be based on a comparison of the requirements mandated in the current alarm management standards IEC 62682 and ISA 18.2 and the principles and recommendations contained in the EEMUA 191 guidelines, against the assessor's findings. Recommendations will then be identified in the report as to where gaps need to be closed to ensure compliance with the standards or where improvements not required for compliance could be made which would be beneficial to the management of alarms on site.

A benchmark assessment of this type is no small undertaking, it can take a week or more and will likely involve various structured interviews, desktop documentation reviews, questionnaires and detailed analysis of available alarm data. However, the results could help completely revolutionise a company's approach to management and maintenance of assets and set them on a path to the effective management of data required to undertake a digital transformation.

Step two. Implement the recommendations of the alarm management benchmark assessment report. The recommendations will be unique to the organization in question and detail the correct approach to undertaking the work required – they should be listed as mandatory, advisory and suggested.

Recommendations will cover most or all of the following areas:

- Overall governance advice
- Design of alarms and alarm systems
- Regulatory and corporate compliance
- Alarm testing
- Operational use of alarms
- Alarm prioritization
- Nuisance alarms
- Shelved and standing (stale) alarms
- Change management
- Training and competence

How To Do It

Importantly, getting control of alarms is not something a water utility company needs to do alone. Nor must said company bring such expertise in house. In fact, until and unless your alarm systems are simple enough to be operated by your staff efficiently and safely, they are not fit for purpose.

As described, bringing in the right help should start with a comprehensive alarm management benchmarking report. From here, the right alarm management software company will be able to help a water utility to make sense of their existing plant, introduce the software, training, and ongoing servitized support required for the safe and effective management of the system.

For companies undertaking this process without the assistance of a reputable AMS provider, the starting point should be a review of your alarm philosophy document. The alarm philosophy document sets out the principles required for designing, implementing, and maintaining an alarm system. It acts as a reference for all personnel involved in the alarm management process and it aims to provide a common understanding of how alarms should be designed, implemented, and managed. It also helps to ensure that alarms are used effectively and efficiently, helping safeguard the operator from being overloaded with alarms.

Your alarm philosophy document should be reviewed to ensure that it is relevant to your site, to your operations and to ensure it is up to date with the latest revision of the alarm management standards and guidelines. If you do not already have an alarm philosophy document, it is strongly recommended you put one in place as it will underpin any future alarm management activities.



After reviewing your alarm philosophy document, you can begin to manage your alarms. The starting point should always be dealing with the day-to-day nuisance alarms. By generating a weekly, or perhaps fortnightly report of the most frequent alarms you can identify potential nuisance alarms and take action to remove them – perhaps by addressing maintenance issues or resetting the parameters which trigger them. It's amazing what this simple process can do to reduce the overall alarm load on your operators.

The next step might be to start to look for patterns in the reports and match those patterns to what else is happening in the environment. It could be, for example, that particular weather patterns are causing alarm frequency spikes, alternatively, other circumstantial events might be to blame, such as an unidentified problem with a pump causing issues under certain load conditions, or when certain parts of a remote system are operating.

In fact the potential reasons for alarm frequency spikes are almost endless, but by recognising the changes in alarm frequency, it is possible to analyze potential causes and organise appropriate remedial action. It's worth noting here that a fully automated AMS system will offer a much richer data set for such analysis, and this plays into the type of data management that digital transformation is best known for. These first two steps set the operator on a course towards taking their system from its default settings – or well-intended parameters set when the system was commissioned, and on towards a bespoke system, tuned to the requirements of your operation, and further fine tuned by the realities of operation. In alarm management parlance, this is known as documentation and rationalization of alarms.

The benefit of undertaking these simple steps should not be underestimated, but for those companies tackling alarm management as part of a digital transformation approach, it's good to have the support of alarm management professionals who can not only streamline this process and offer the benefit of their experience but can also help you fully realise the full benefits of alarm management software.



Modern water and wastewater companies that operate without AMS do so at considerable risk to their sustainability. For most water companies though, alarm management should be seen as a low hanging fruit at the start of their digitalization journey.

A true digital transformation project that will have rapid return on investment and underpin new approaches to operating and maintaining facilities. Tackling alarm management is as simple as recognizing the issue and bringing in the right help.

Conclusions

In summary, this white paper underscores the crucial role of strategic alarm management in the ongoing digital transformation of the water and wastewater sector. Despite the industry's unique challenges, including legacy systems and stringent regulations, the need for digitalization is more apparent than ever. Urbanization, climate change, regulatory scrutiny, and a skills deficit emphasise the urgency of harnessing data through digital transformation.

Effective alarm management is central to ensuring operational safety and efficiency while navigating compliance requirements. Mismanaged alarms can result in errors, penalties, and harm to reputation, yet avoidable pitfalls such as nuisance alarms and alarm floods are negated by the effective implementation of modern alarm management software.

Collaboration with alarm management software providers is essential, providing external expertise, tools, and support. By addressing daily challenges and recognizing patterns, organizations can establish an efficient alarm management philosophy, enhancing customer service and shareholder value.

Tackling alarm management need not be undertaken in isolation. With the right guidance and cooperation, it becomes a catalyst for broader digital transformation. Water utilities embarking on this journey can unlock numerous benefits, enhance operational efficiency, and set new industry standards in the digital era.



Is alarm management software a part of your digital transformation strategy? If it's not, it might be time to take the brakes off and consider what 'alarm management without limits' could do for you.

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About the author

James Fox is Product Manager for ProcessVue. He has worked in the alarm management arena for over 20 years in both technical and commercial disciplines. Prior to his current role within the ProcessVue team he held positions at Honeywell, Matrikon and IMAC.



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