The Case For Detailed Analysis in Air Pollution Monitoring

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In the field of air pollution monitoring and dust emissions measurement, deregulation threatens a trend towards over-simplification. Over-simplification encourages the use of instruments and techniques which may seem politically attractive, but which may unfortunately not provide the more useful information which enables plant operators to obtain critical "trending and recording" data to assist in process control, and hence offer the real benefits of monitoring. Here William Averdieck of PCME Ltd looks at the choices available to companies striving to meet Environmental Protection Act regulations, while keeping down the running costs of the bagfilter arrestment plants.

Dust emissions from bagfilter arrestment systems can be continuously indicatively monitored at different levels of sophistication – either by means of a straightforward alarm monitor ('alarm monitoring'), or by using a continuous monitor with trending and analysis functions ('performance monitoring').

Alarm monitoring is used for instant detection of baghouse failure. The plant operator is alerted to any problems by an audible alarm signal to which the monitor is connected.

With performance monitoring, plant operators can look at the dynamics of the system, and are in a position to be able to analyse and monitor the overall system performance. Trends can be established, enabling the process to be tuned in order to minimise emissions, and proof is provided on the performance of the dust arrestment plant.

The Advantages and Disadvantages of Alarm Monitoring

The key advantage of these straightforward instruments is their relatively low price. They are less sophisticated than performance monitors and, as a result, manufacturers need not apply the same degree of precision in their development. This clearly has the advantage of keeping the unit costs down. It does, however, lead to limitations in terms of the amount of information that is provided to plant operators. The maximum amount of information available from an alarm monitoring system is that there is a reliable indication when things go wrong – for example, if emissions suddenly increase as a result of a filter failure.

Of course, unlike periodic sampling, alarm monitoring alerts plant operators at the time of potential environment problems and also provides more information that can be gleaned by a visual assessment of the baghouse, particularly because dust concentrations below 100mg/m^3 cannot easily be seen with the naked eye. Visual assessment is subjective, unreliable and rarely practical to undertake on a regular basis.

Anticipating Filter Problems

One of the key disadvantages is that such a system will not enable plant operators to detect problems within their baghouses until they have become a significant issue – for example, when a torn bag causes damage to others surrounding it. This is because alarm monitors do not provide enough information to the operator – they simply specify what is happening at a certain point in time. Furthermore, their regulatory use depends on a manual log-book being kept, since no recording facility is provided.

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Location of the Problem

When a problem does make itself apparent, the only way to determine the location of the fault is to undertake a visual assessment of the status of the bags, which makes it necessary to shut down operations completely – which can be expensive. At best this process can be assisted by running fluorescent dust into each of the bags prior to an inspection of the top of the seals for traces of dust.

Such circumstances can result in the need for companies to replace their complete baghouse and, as many will have already experienced to their cost, this can run into thousands of pounds, with bag replacement costing anything between £1,000 and £10,000. But many operators will ask "Why should there be the need for more information when we simply want to monitor whether our arrestment plant is working or not?"

The Advantages and Disadvantages of Performance Monitoring

Performance monitoring allows plant operators to obtain significantly more information about the performance of their arrestment plant than a simple alarm system. At the very least they will be able to assess whether the plant is working properly, whether there is any deterioration in performance, or failure, and will detect large increases in emissions. In addition, operators will be able to record activity, and hence gather data in order to monitor performance trends.
The most sophisticated performance monitors now employ graphics to show and record the dynamics of dust emissions during the cleaning cycle of the bagfilter. The advantages of using graphics and a trending system mean that the plant operators can:

- Anticipate filter problems.
- Diagnose the location of any problem.
- Find out whether the complete filter system is working properly.
- Satisfy regulatory requirements by having a record.

Graphics also significantly reduce baghouse operating costs by ensuring the smooth running of the whole operation.

Anticipating Filter Problems

The cleaning cycle is the most rigorous part of the whole dust collector operation and when a bag is subjected to extreme conditions – resulting in a pulse of dust. With a graphical display, any variation in the performance of one bag row in relation to another, however small, is clearly shown (Figure 1). This enables plant operators to anticipate potential faults, often many weeks before they would normally have been detected by a simple alarm system.

Early detection enables a problem to be solved before extensive damage is caused; furthermore, by reducing the need for new bags, the operating costs of the bagfilter are dramatically reduced.

Location of the Problem

The graphical display informs the plant operator in which areas the bagfilter problem has occurred. In small or medium bag filter installations it highlights the exact row, while in larger installations it isolates several rows. The isolated rows can be tested by checking the dust around the filter seals, in order to determine the exact location of the problem.
The significant advantage here is that rather than replacing the complete baghouse, bag replacement will only be required in one localised area.

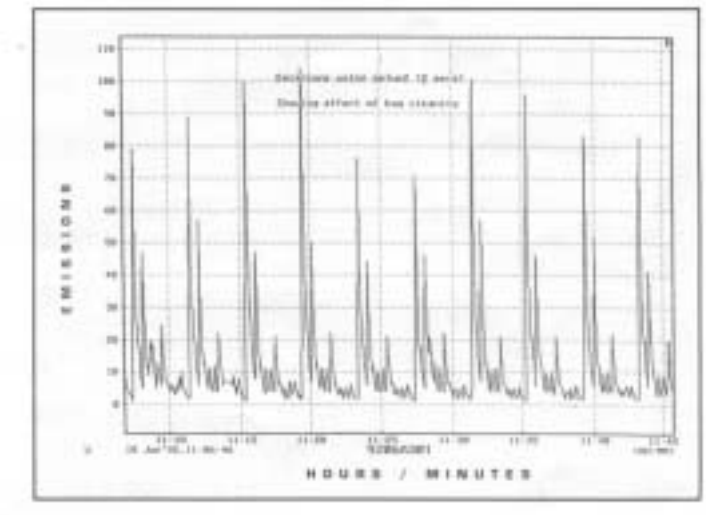

Figure 1. Broken bag detection: the emissions show the effect of bag cleaning

Checking Filter Performance

After the problem bag has been replaced, the plant operator can check that there is no fixed problem and that the seal is correct via the graphical display. Trends can then be monitored continuously in order to ensure that the whole baghouse continues to operate at its optimum level.

Satisfying Regulatory Requirements

From a regulatory standpoint, plant operators are provided with a physical record to show that their arrestment plant is working properly and this satisfies the requirement of the Environmental Protection Act 1990 in the UK; the information supplied is completely tamperproof.

Operational Experience

Process operators who are serious about minimising their emissions by monitoring information have tended to use performance monitoring. For example, in the UK the Department of Trade & Industry's DEMOS programme – which strives to demonstrate environmental 'best practice' – has used performance monitoring. In this instance a PCME DT770 performance monitor has been installed to monitor bagfilters supplied by Airmaster Engineering. This has been installed at Chamberlin Hill Ltd, an iron foundry in the West Midlands, as part of the DEMOS project.

Conclusion

The additional cost for performance monitoring with a graphical display and recording system, compared with a simple alarm monitor, is relatively small. This is emphasised when considering the significant benefits that they bring to a baghouse filter, including a reduction in running costs and reduced environmental impact.

The emission monitoring system installed to monitor bagfilters at an iron foundry