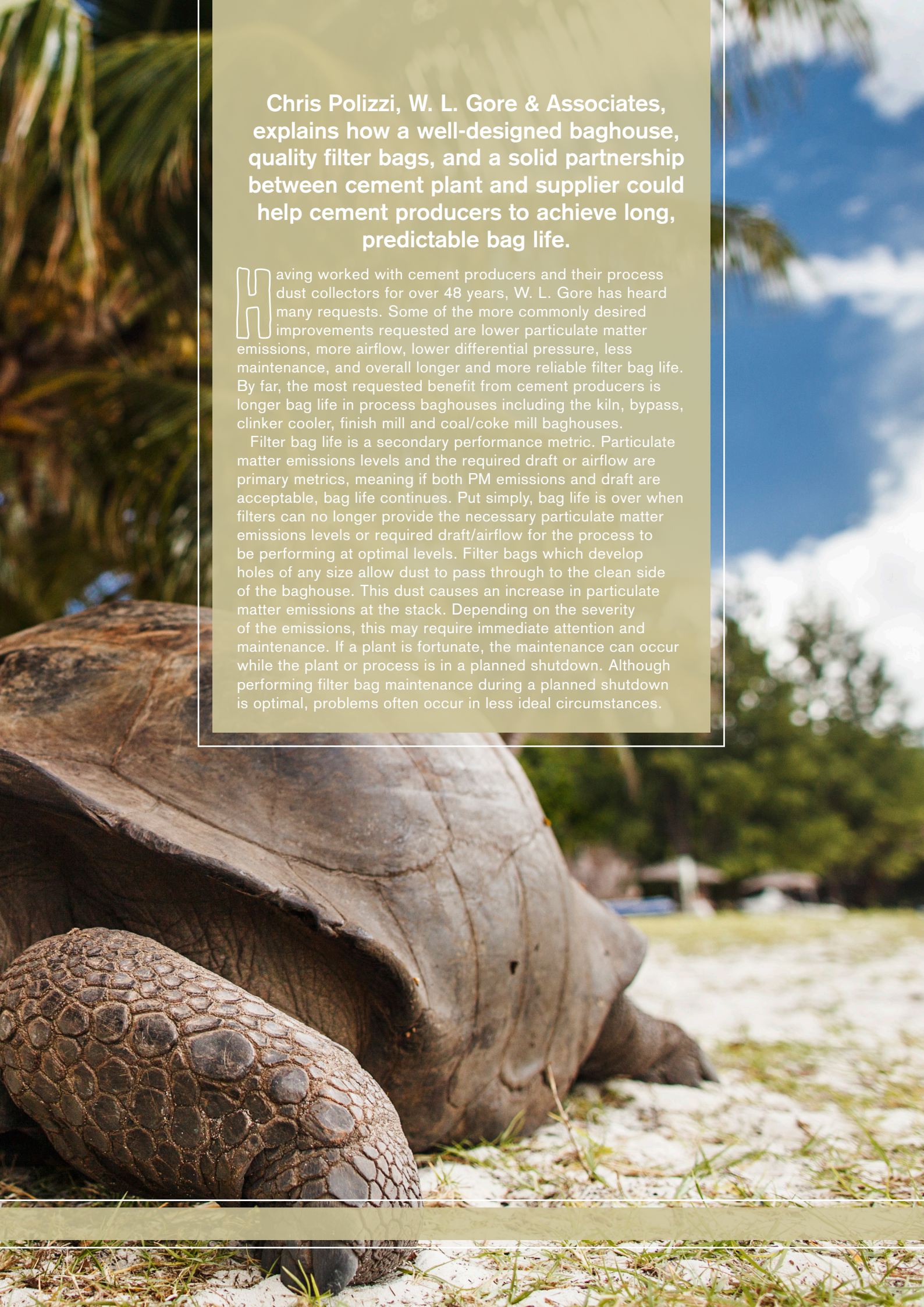

LOOKING
FOR LONGER
LIFE



Chris Polizzi, W. L. Gore & Associates, explains how a well-designed baghouse, quality filter bags, and a solid partnership between cement plant and supplier could help cement producers to achieve long, predictable bag life.

Having worked with cement producers and their process dust collectors for over 48 years, W. L. Gore has heard many requests. Some of the more commonly desired improvements requested are lower particulate matter emissions, more airflow, lower differential pressure, less maintenance, and overall longer and more reliable filter bag life. By far, the most requested benefit from cement producers is longer bag life in process baghouses including the kiln, bypass, clinker cooler, finish mill and coal/coke mill baghouses.

Filter bag life is a secondary performance metric. Particulate matter emissions levels and the required draft or airflow are primary metrics, meaning if both PM emissions and draft are acceptable, bag life continues. Put simply, bag life is over when filters can no longer provide the necessary particulate matter emissions levels or required draft/airflow for the process to be performing at optimal levels. Filter bags which develop holes of any size allow dust to pass through to the clean side of the baghouse. This dust causes an increase in particulate matter emissions at the stack. Depending on the severity of the emissions, this may require immediate attention and maintenance. If a plant is fortunate, the maintenance can occur while the plant or process is in a planned shutdown. Although performing filter bag maintenance during a planned shutdown is optimal, problems often occur in less ideal circumstances.

A filter bag problem which causes an unplanned shut down or maintenance while the plant is running, is undesirable. Performing inspections and maintenance in a baghouse which is on-line presents a host of challenges and safety issues that need to be mitigated as best as possible. On-line baghouse maintenance equates to tackling conditions which may be extremely hot, have reduced oxygen levels, and be very dusty, resulting in potentially poor visibility, all whilst undertaking the strenuous activity of performing maintenance. For these reasons, knowing whether the current bag life in a kiln, bypass, cooler, finish mill or coal mill baghouse is short compared to what is reliably achievable is the first step at benchmarking performance.

View from the baghouse hopper looking upward at filter bag bottoms.

What bag life should be expected?

Many cement plant operators become accustomed to less than desirable short filter bag life. Performing systematic partial changeouts using lower priced and often lower quality filter bags, and conducting ongoing maintenance activities, becomes the norm. When asked why producers use this approach, it is often stated that they want predictability and they feel this is the only way to achieve it. However, there are other ways to achieve the exact same goal, with significantly less maintenance and a lower overall total cost of ownership in operating the baghouse.

Kiln baghouses (pulse jet)

In a modern cement plant with an in-line raw mill, both the mill and kiln gases are collected in one baghouse. It is most common for there to be cyclones after the raw mill and before the baghouse. These are often referred to as three fan systems and the main pollution control device is often a pulse jet cleaned baghouse. An overwhelming majority of these baghouses globally utilise fibreglass filters with a PTFE membrane and an overall weight of 750 g/m^2. There are the occasional plants which use a felted filter bag, and this is often the case after achieving short bag life with fibreglass. This is not because fibreglass is the non-optimal choice, but often because of limitations of a supplier's quality of glass, membrane, filter design or applications approach. In these pulse just kiln baghouses, any bag life of

Table 1. The minimum expected bag life that can be achieved in each of the main process baghouses in a cement plant when a high-performance filter bag is used in conjunction with optimal maintenance practices.

Process baghouse	Type of baghouse	Minimum expected life	Typical filter media
Kiln/mill baghouse	Pulse-jet	5 years	PTFE membrane on PTFE coated fibreglass (750 g/m^2).
Kiln/mill baghouse	Reverse-air	5 years	PTFE membrane on PTFE coated fibreglass (340 g/m^2) or PTFE membrane on acid resistant coated fibreglass (340 g/m^2).
Alkali bypass baghouse	Pulse-jet	5 years	PTFE membrane on PTFE coated fibreglass (750 g/m^2).
Clinker cooler baghouse	Pulse-jet	4 years	Aramid felt (475g/m^2) or PTFE membrane on PTFE coated fibreglass (750 g/m^2).
Finish mill baghouse	Pulse-jet	4 years	PTFE membrane on polyester felt (540 g/m^2) or PTFE membrane on acrylic felt (475 g/m^2).
Coal/coke mill baghouse	Pulse-jet	3 years	PTFE membrane on polyester felt (540 g/m^2) with antistatic capability or PTFE membrane on acrylic felt (475 g/m^2) with antistatic capability.

three years or less would be considered short; filter bags lasting four years would be acceptable. Lastly, filter bags lasting five years or longer can be considered examples of good bag life and can easily be expected and achieved with a good supplier. In fact, there are some pulse jet and reverse air kiln baghouses that have achieved bag lives of 10 years.

Kiln baghouse (reverse air)

Reverse air baghouses tend to be significantly larger in size due to a traditionally lower air to cloth ratio. There is often significant corrosion, and this affects the walls, the tubesheet, the thimbles if they are present, and the baghouse access doors. Even though reverse air baghouses are considered old technology, longer life should be expected in these systems. These baghouses commonly use a fibreglass fabric of either 340 g/m^2 or 475 g/m^2. The fibreglass can be finished with either an acid resistant or a PTFE finish and any of these combinations are available with or without a PTFE membrane on the filtration surface. Any bag life of four years or less would be considered short. A filter bag life from a traditional quality supplier should be around five years, however this is considered a mediocre life-span. Lastly, filter bags lasting six years or longer would be seen as having a good bag life – this should be an expectation.

Clinker cooler baghouses (pulse jet)

Pulse jet baghouses are an extremely common type of baghouse for clinker cooler applications. Frequently, aramid filters, sometimes referred to as Nomex®, which is DuPont's tradename for its version of aramid fibre filter media, are used in these applications. Aramid fibres are thermally stable up to 204˚C (400˚F) which often makes them a reasonable choice. A kiln ring formation is undesirable. When they form and constrict kiln material flow, they eventually break either naturally or through plant intervention. Once the kiln ring breaks, a kiln push occurs, sending a surge of hot gases toward the clinker cooler baghouse. These short but high temperature incidents compromise aramid felt fibres, causing them to become more brittle, resulting in a felt with increased stiffness. For this reason, filters can wear out or develop holes in three years or less. With the use of fibreglass fabric filters (750 g/m^2) with a membrane, a five-year bag life or longer should be expected.

Finish mill baghouses (pulse jet)

Finish mill baghouses are one of the few baghouses that directly collect product at a cement plant. Consistently high airflow is essential for the stability of operation of the entire mill circuit. In these pulse jet baghouses, some plants achieve one-year bag life or less and over time this becomes the norm. Plant maintenance teams often do not realise that with the correct choice of filter media and by partnering with the supplier to set up the cleaning system optimally and performing preventative maintenance instead of reactive maintenance, reliable confident bag life of four years or greater should be the expectation.

Coal/coke mill baghouse (pulse jet)

As with a finish mill baghouse, the coal/coke mill circuit works best with a consistently stable airflow and differential pressure. Due to the contamination aspects and combustible nature of the dust, performing maintenance reactively in coal mill baghouses increases worker risks. Expecting good long life in these baghouses is not a huge leap of faith. Achieving consistent three-year reliable bag life while achieving low differential pressure and particulate emissions is very reasonable. Bag life of one or even two years in the baghouses represents significant opportunities for improvement.

Expect longer bag life

By selecting a supplier with a proven long-term performance track record of meeting and exceeding their performance warranties, cement producers can expect significantly longer bag life than previously achieved. Table 1 shows the minimum expected bag life that can be achieved in each of the main process baghouses in a cement plant when a high-performance filter bag is used in conjunction with optimal maintenance practices.

A warning on warranties

When considering a supplier for filter bags in one of the main process baghouses, the purchase prices can be significant due to the size of these baghouses. Often, in an attempt to mitigate financial risk with these purchases, cement producers will request written performance warranties which almost always include filter bag life and filterable particulate emissions. Essentially all suppliers will offer some form of written warranty, as without it, there would be no chance of winning the business. It is becoming more common for filter media suppliers to fail to meet the warranted performance life. The end user is left paying for a prorated price of the filter bags, the freight and logistics costs to get replacement filter bags to the site, the labour cost to remove the failed filters, the clean up of the baghouse and

the installation of the new filter bags. This all assumes the replacement can occur during a scheduled downtime of the plant. If not, the costs become catastrophic.

For example, a cement producer recently purchased from a different supplier than they had in the past for their 7000 tpd cement facility's kiln baghouse. Like with their previous supplier, the new, less expensive filters came with a five-year bag life warranty. It was natural to believe if two filter suppliers were both offering a five-year warranty, it was reasonable to choose the less expensive option and believe it would be best for the plant. After one year, the filters failed and needed to be replaced. Although the supplier provided a complete replacement set free of charge, the plant had to pay for the freight and logistics as well as the labour cost to replace the over 5000 filter bags. The replacement set started up, and also began to have failures within the first year. As a result, the plant was forced to replace the entire set of replacement filters again by the end of the second year. The supplier would not provide any additional remedies after that. Following the failure of two sets of filters bags within two years, despite having a five-year warranty, the plant returned to their previous supplier of filters with a track record of delivering on the performance the plant expected.

Achieving long, predictable bag life is not only possible, it should be an expected and realistic goal. It takes a combination of a reasonably well-designed baghouse, quality filter bags from a supplier with a track record for delivering reliable performance, and a partnership between the plant and the supplier. By implementing a solution such as this, cement producers will not only eliminate unplanned shutdowns, they will be able to optimise their kiln feed rates, reduce energy costs, and confidently remain below their regulatory emissions limits. Altogether, this not only reduces the overall reactive maintenance in the baghouse, it helps decrease the total cost of ownership of operating the baghouse and ventilation system. ■

About the author

Chris Polizzi is a Chemical Engineer and joined the W. L .Gore team in 1994. He has worked in the cement air pollution control industry for 27 years. As an application engineer, in addition to implementing baghouse solutions, he has written many technical papers/articles which have been presented at conferences and published in global publications.