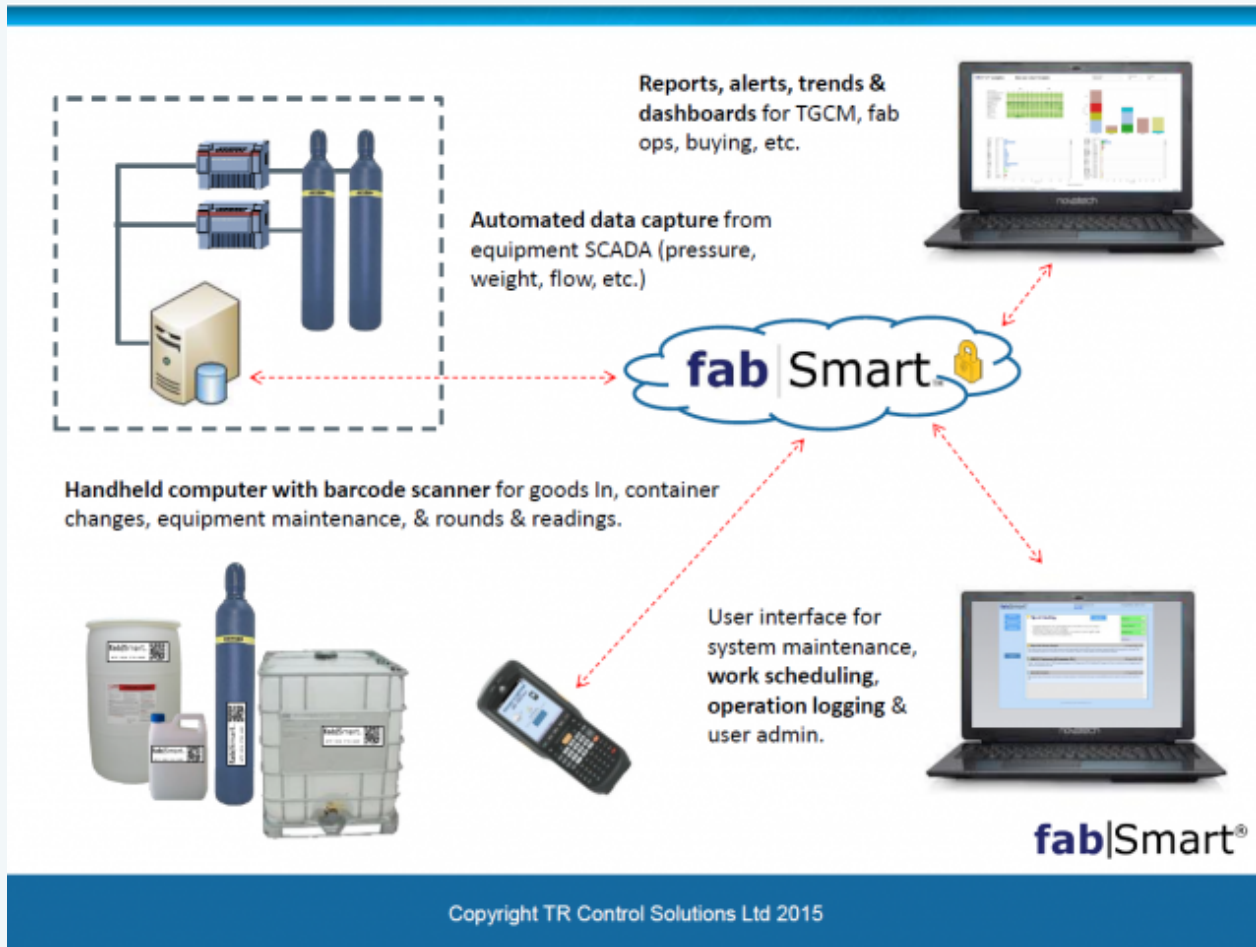


Effective TGCM to avoid tool downtime

The effective management of gases and chemicals in a semiconductor fab (or similar) is a key concern for operations.....



Manufacturing electronic devices is clearly a very complex task. Creating tiny electronic circuits on wafers of silicon using gases and chemicals, in multiple process steps, performed by highly sophisticated machines operated by highly skilled personnel, in a closely controlled, extremely clean environment, is a highly challenging technological feat with many opportunities for defects to occur.

To produce silicon wafers economically, in order to meet the world's growing appetite for mass produced electronic products, scientists and engineers work tirelessly to avoid issues that can slowdown or interrupt the supply of devices to the market. When issues occur they use sophisticated analysis techniques to track down the cause in order to eliminate a recurrence.

Avoiding the use of expired material

The speciality gases and chemicals used in the silicon wafer manufacturing process are ultra-pure and subject to stringent specifications. As many of these materials deteriorate over time they are supplied with an expiration date beyond which they should not be used. If they are used however and they have deteriorated below the required specification they may cause process excursions and result in tool downtime, scrap wafers and ultimately affect the desired output of the facility.

Given the already highly complex challenges involved in silicon wafer manufacturing, it would seem obvious that avoiding the (unapproved) use of expired material and thus potentially introducing manufacturing issues, is a no brainer. Semiconductor fabs are often very large facilities and the gases and chemicals may be supplied from hundreds of use points, in many locations, around the fab. These materials are often very hazardous so they need to be handled very carefully and a continuous supply is necessary to avoid any interruptions to production, so it's usually a multi-shift 24/7/365 operation.

Three important things are required, to avoid the unplanned use of expired material: clear visibility of material on-site and in-use, accurate predictions of the rate of material usage in relation to expiration dates, and early and repeated notifications of shelf life expiry events.

Avoiding supply interruptions

Whilst using expired material is obviously to be avoided (for the reasons described above), the unexpected downtime that may be caused when cylinders of gas or containers of chemicals have to be replaced because the shelf life has been reached, can also be highly detrimental to fab productivity.

Whilst it may not be possible to completely eliminate the downtime needed to accommodate these forced replenishments, their occurrence may be minimised with sufficient visibility of usage and expiry dates and repeated notifications of impending expiry, as described previously.

Avoiding material stock-outs

Some of the speciality gases and chemicals used in fabs have long lead times (sometimes because of a worldwide shortage in supply), some are very expensive and most have a shelf life as described above. Unless very close monitoring of usage rates, material availability and expiration dates is performed, stock-outs can occur which can result in an interruption to supply, downtime and reduced production throughput, which of course, given the objective of maximum output, is highly undesirable.

As with avoiding the use of expired material, visibility and early notifications are required to minimise the occurrence of stock-outs. Speciality gases in particular are often dispensed from multiple 'use points' in a fab and a picture of the total (across all use points) mass usage per day, week & month, derived from cylinder pressure or weigh scale readings, provides an

important metric to help avoid stock-outs. Notification of unexpected variations in usage provide the visibility required to ensure that replenishment stock is available when required. Couple this mass usage data with metrics on production activity and procurement budgets e.g. wafer turns and material forecasts and further metrics can be used to help avoid highly disruptive stock-outs.

The right tool for the job

It is not unusual to find hard pressed managers and technicians in multi-billion dollar silicon wafer fabs, struggling to manage a continuous supply of speciality gases and chemicals, using spreadsheets, emails and 'a wing and a prayer'. In terms of IT sophistication, gases and chemicals management is often a 'Cinderella' operation, which seems very surprising when one considers the potential for problems to occur and the efforts made elsewhere, to avoid disruptions to the output of the fab.

It doesn't have to be like this however, off-the-shelf solutions like [fab|Smart](#) & [fab|Smarter](#) have been developed, are in use and are having a very positive impact on the performance of this key area in semiconductor manufacturing.

If you'd like to learn more contact us [here](#)



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