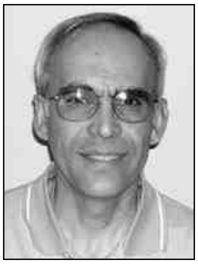

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Practical Considerations for Determining Cleaning Costs

The uncertain economy and daily bumps we encounter should help us focus on rational, practical considerations with regards to the cost of doing business. There are many subsections or portions of a business that are due a good looking over. By using a practical approach to confirm various operating parameters, better ways of doing things are identified. The benefits include improved quality, better production throughput, reduced costs and hopefully easing the demand on the waste treatment system, to name a few. It is especially in these challenging times that we need to determine how to be better, safer and faster. As an example, let us consider the first step in most process cycles, cleaning. This is a big step, in fact the most important step in any line operation.

The Cleaner

The concentrate may be an emulsifying or displacement type. With an emulsifying cleaner, oily soils are held or encapsulated at the operating temperature. On cooling there may be some release of these oils. A displacement type cleaner tends to displace oils from the substrate surface. Since most oils are less dense than water, they will float on the bath surface. In either case released oily soils can be removed by mechanical devices and filters. By regularly removing these soils, these contaminants are removed, thereby minimizing their effect to age the cleaner bath. This is a simple means of extending the service life of the cleaner bath, extending times between dumping. It naturally has the effect of maintaining a higher degree of cleaning efficiency. By considering these two types of cleaners, maybe it is time to determine if displacement cleaning offers an advantage to emulsifying cleaning.

We have three types of cleaners with which to work. These are powder, liquid and additives. Powder cleaners have been a staple of the industry for many decades. They continue to be heavily used and offer a wide variety of dependable formulations, tackling all types of cleaning demands. Liquid cleaners are formulated as equivalents to powders, offering some additional benefits. Some of these benefits include significantly less sludging (a plus when considering F-008 regulations and the cost to ship sludge) and easier, safer makeup. As well, the concentrate is assured of being 100% blended throughout. The liquid can be metered and the solution continually analyzed by conductivity measurement (SPC and NADCAP benefits). For larger volume users, liquid cleaners may be supplied in returnable totes, eliminating the disposal of empty drums.

A third cleaning option is the use of additives in combination with generic liquid caustic soda (usually 50% strength). This is primarily applied to the cleaning of steel. An additive concentrate, typically liquid, is added in a specific ratio with liquid caustic soda in the soak cleaner, and a different ratio for both in the electrocleaner.

Branching off the traditional stand-alone soak and electrocleaners, we may consider a dual-functioning cleaner. A combination soak and electrocleaner can be set up in one tank, or in separate process tanks where a rinse in between can be eliminated. The benefits here are: simplifying inventory of products, omitting a rinse (conservation of water) and having a dual function in one process tank (saving on heating and maintenance). In fact, the previous description of additive and liquid caustic soda can fall into this cost savings category, offering an extra savings. Use of generic liquid caustic soda reduces cost of chemicals used.

This discussion of cleaner types may find a logical fit. Or perhaps the system in place is right, but the examples given may give enlightenment to implementing improvements. Remember that for any consideration of change, due diligence in the form of proper prescreening is important.

Analysis

It cannot be overemphasized as to how important analytical control is and should be for a cleaner. The most common analysis has been the neutralization titration with standard acid solution to an indicator-induced solution color change. It is hard to improve on this method, as most cleaners contain complex wetter and surfactant systems. It can be very difficult and cost prohibitive to try analyzing on such a broad or complete level. The operation continues with cleaner bath analysis by titration (or test kit), maintenance adds and rolling along until dump time. Should the operator be fixed to dumping the cleaner after a determined quantity of cleaner has already been added? This is sort of reminiscent of dumping after the maintenance additions are double the initial makeup quantity. Are we certain the cleaner bath is actually "shot"? Maybe it still has 25% or some other viable figure of service life left. This is where some fairly simple, additional analysis can help to determine the dump cycle more sensibly. Here are two suggestions.

- Fill a graduate cylinder with the heated cleaner. Let it cool. Measure how much oil has split. Carefully track a new bath makeup. Note the oil displacement when the cleaner is dumped. Repeat for the next cleaner bath and keep operating past the oil split level for the previously dumped cleaner. All the while, also analyze by titration for the product, making the required additions. Coincident with the analysis, perform the oil split determination. It may be found that the cleaner had been dumped too soon.

• Immerse a clean steel panel in a sample of the cleaner at operating temperature, time and concentration. Rinse and observe for any water breaks on the panel. If there are water breaks, add perhaps 10 to 20% of the initial makeup to the sample. Repeat the cleaning step and water break test on a new panel. If there is no water break, dip the rinsed panel in dilute acid (*e.g.*, 5% hydrochloric or sulfuric), then rinse again. If a water break is observed, repeat the suggested add of cleaner, and repeat the sequence of rinse and acid dip, followed by a rinse. If these steps confirm no water breaks, the cleaner can be expected to continue production operation. The optional cleaner addition is made as per the results of the described test.

The analysis portion is meant to be an aid to help ensure satisfactory cleaning. In this regard, the operator may obtain additional useful data to determine dump cycles more accurately. The ability to extend the bath service life reduces costs in these practical ways: less down time (offset cutting production, reduce labor to change cleaner baths with maintenance), possibly consume less cleaner and ease demand on the waste treatment system (less cost for treatment additives). Better ongoing cleaning results in fewer rejects that would have to be scrapped or re-worked. In either case, the production time lost and labor involved with rejects will add an additional cost.

Calculate cost

Many of you may recall Larry Durney, who contributed much to practical metal finishing. To me, Larry was a great source of knowledge, who always challenged me to work things out in a practical, sensible manner. An example is a system of calculating cleaning costs. I would like to pass along one of Larry's many valuable tips. An approach to determining cleaning costs can be given by the following equation:

$$C = \frac{S}{P \times D} + \frac{M}{P \times D} + \frac{R}{P} + \frac{W}{P \times D}$$

KEY:

C = production standard (*e.g.*, the cost to clean 1,000 ft^2 of parts).
S = the cost of chemicals, including makeup and maintenance.
M = the cost of dumping a cleaner and replacing it with a new makeup.
R = the cost to rework rejects or scrap parts.
W = the cost for waste treatment of the dumped cleaner.
P = daily production of parts in units (ft^2, etc.)
D = number of working days the cleaner is used in production during its service life.

Fact or Fiction?

Continued from page 15.

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Corrections to the March 2009 issue

Although it was quickly corrected online, there are a few of you who may have read the March 2009 issue of *P&SF* before April 3. In the paper by Donohue, *et al.*, there were two mislabeled figure captions:

On page 42, Figure 5, parts a and b were reversed, and the caption should read:
"XSTEM and EDX interface analysis of (a) argon glow-treated and (b) HIPIMS steel coupons."

On page 43, Figure 8, parts a and b were reversed, and the caption should read:
"Plots of Me-DLC and C-DLC Raman spectra: (a) visible light and (b) UV."

With apologies to the authors, *P&SF* regrets the errors.