Busting Some Metal Cleaning Myths

Readers are likely familiar with “MythBusters,” a popular program shown on the Discovery Channel in which tech-savvy investigators explore, analyze, test, and evaluate urban legends, popular beliefs, and Internet rumors. The show I remember best addressed the myth that the quacking of a duck produces no echo.

While we don’t have testing facilities like the MythBusters’ to support this month’s column, we’ll consider five circumstances in which there is a widely held opinion among cleaning professionals—perhaps even a myth. We’ll used publicly available data to evaluate the veracity of these myths, and draw a conclusion about their veracity.

**MYTH #1: PRICES ARE CONFIDENTIAL**

I have believed—and have probably helped spread—this myth throughout my consulting career. The basic idea is that the supplier reserves the right to privately negotiate a discount from “retail” pricing with every customer, based on the customer’s individual situation.

While that “right” seems to make sense in theory, its practical application has always seemed less sensible, in that throughout the industry “retail” prices have traditionally been assumed to be confidential.

I’m currently writing a book covering the technology of cleaning solvents. In preparing that book, every supplier I’ve asked about “retail” pricing has either:

- Said that pricing information is confidential;
- Said they didn’t want pricing information published and wouldn’t reply with specific information;
- Said pricing was currently being reevaluated; or
- Provided a range of numbers that revealed little value.

Users can learn about pricing of commodity chemicals that are useful as cleaning agents, such as acetone, mineral spirits, isopropanol, soy-based solvents, or heptane. Subscription services, such as ICIS Chemical Business Americas (formerly known as Chemical Marketing Reporter, http://www.icispricing.com/) are useful, but most finishers don’t use enough mineral spirits to justify the cost of the subscription.

Recently, however, I discovered a publicly accessible source of prices of formulated cleaning agents—not commodity solvents. That source is a catalog published for U.S. Military bases by the Defense Logistics Agency (DLA): the DLA Environmental Products Catalog—FY 07, which can be downloaded as a PDF from the Internet (http://www.dscr.dla.mil/).

Products included are hydrocarbon-, aqueous-, semi-aqueous-, and solvent-based degreasing products. A few examples of specific prices for products of various types are shown in Table I.

<table>
<thead>
<tr>
<th>Name</th>
<th>Supplier</th>
<th>Package</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-CALIBER</td>
<td>INLAND</td>
<td>Gallon</td>
<td>$499.34</td>
</tr>
<tr>
<td>ATTACK</td>
<td>INTEGRATED CHEMISTRIES</td>
<td>Gallon</td>
<td>$675.51</td>
</tr>
<tr>
<td>BIO T 200A</td>
<td>BIOCHEM SYSTEMS</td>
<td>Gallon</td>
<td>$1,856.57</td>
</tr>
<tr>
<td>OS-10</td>
<td>DOW-CORNING</td>
<td>Pint</td>
<td>$14.57</td>
</tr>
<tr>
<td>VERTREL XF</td>
<td>DUPONT</td>
<td>Gallon</td>
<td>$1,155.58</td>
</tr>
</tbody>
</table>

*Note that these are not “retail” prices. They represent costs to U.S. government agencies for transfer from the Defense Supply Center (Richmond).

While the DLA has negotiated contracts based on use volumes not pertinent to individual finishing job shops. You should expect to pay more, though the U.S. government has been known, in years past, to pay $600 for hammers and toilet seats.

The DLA catalog busts the myth that all pricing information is confidential.

**MYTH #2: LOWER EXPOSURE LIMIT = MORE HAZARD**

The eight-hour exposure limit recommended by the ACGIH for benzene is...
0.5 ppm. Benzene is a known human carcinogen. That limit for n-propyl bromide (n-PB) is 10 ppm; Stoddard solvent is 100 ppm; acetone is 750 ppm. The equivalent for esters of dibasic acids (DBE) is 1.5 ppm, and for esters of lactic acid, between 1.5 and 5 ppm.

This information supports the belief (myth) that DBE must be another human carcinogen or at least a suspect human carcinogen, and use of acetone must be without toxic risk.

From Table II, it’s clear that exposure limits protect against both acute (short term) and chronic (long term) experience with hazards. Scientists who formulate exposure limits set them at levels that will protect a human without constraints or pre-existing debilitation in a daily eight-hour exposure to a recognized hazard.

Identification of that exposure limit is ACGIH’s only charter in this program. Comparison to other hazards manifested by other chemicals does not matter. In other words, benzene and DBE have similar exposure limits to mitigate two different risks: cancer and an itchy nose. But acetone is nearly without toxic risk!

**MYTH #3: THE PUMP CAN MAKE A DIFFERENCE IN AQUEOUS CLEANING SYSTEMS**

Successful application of an aqueous cleaning technology to a surface, using suitable hydraulic force, produces a mixture of soil in water. The mixture may be an emulsion or a two-phase brew.

The next stage of operation is to separate the small volume of soil from the large volume of water. This is typically done using gravitational or centrifugal force and some sort of skimmer or other oil-collection device. Particle (droplet) size of the soil/oil material is the variable most significantly affecting performance of the separator. Ease of separation is often a function of the square of the droplet size.

This is where pump design can be significant. The vanes of a centrifugal pump, rotating at 3,600 revolutions per minute, will chop large droplets into small ones, thus making the oil separa-
tion job much more difficult. A low-cost, compressed-air-driven piston pump is often a better choice because it accomplishes transfer of the oil-water mixture without changing the droplet size. One drawback to these pumps is their noise level.

This confirms the myth that the design of a water transfer pump can affect performance of an aqueous cleaning system.

**MYTH #4: NO FLASH POINT = NO FIRE**

Many users believe that the flash point test is the definitive evaluation of whether or not a chemical can be ignited (catch fire).

But there are at least four measures of ignition potential in common use:

- **Flash point (ASTM D56),**
- **Flammability limits (ASTM WK5917),**
- **Autoignition point (ASTM E659-78),**
- **Fire point (ASTM D1310-01).**

The latter two are seldom used to characterize cleaning chemicals because:

1. temperatures at which a chemical self-ignites aren’t found in practice, and
2. no safety regulations depend upon values of fire point as they do with values of flash point.

Flash point and lower and upper flammability limits (UEL and UEL respectively) do measure ignition potential. But they simulate use in different environments. The former represents liquid use in an open tank (TAG open cup) or a closed storage tank (TAG closed cup), and the latter represents a vapor cloud. In a flash point tester, a few cc of liquid are heated below an ignition source; in a flammability tester, five liters of vapor at 25 °C are present with a high-energy ignition source.

In other words, as in industrial applications, a fire can be started in more than one way. Some test examples are in Table III. Certainly, a chemical cannot manifest a result in the flash point test but does so in a flammability test.

**Ignition in a flammability tester, but not in a flash point tester, busts the myth that a flash point test is the definitive proof of potential for fire.**

**MYTH #5: LOW EVAPORATION = LOW VOC**

A prominent solvent cleaning product is portrayed in its MSDS as a "...Hydro-treated hydrocarbon compound. Non-photochemically reactive."

The supplier’s representative notes that "...it is not VOC exempt, even...

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**Table III: Flash Point and Flammability Results**

<table>
<thead>
<tr>
<th>Flash Point °F</th>
<th>Solvent</th>
<th>UEL, V%</th>
<th>LEL, V%</th>
</tr>
</thead>
<tbody>
<tr>
<td>False</td>
<td>N-PROPYL BROMIDE</td>
<td>4.6, 13.8</td>
<td></td>
</tr>
<tr>
<td>False</td>
<td>METHYLENE CHLORIDE</td>
<td>13.0, 22.0</td>
<td></td>
</tr>
<tr>
<td>False</td>
<td>TRICHLOROETHYLENE</td>
<td>7.0, 11.0</td>
<td></td>
</tr>
</tbody>
</table>
though the vapor pressure is under 1 mm Hg.”

The U.S. EPA’s standard for negligible photochemical reactivity is that the maximum incremental reactivity (MIR) parameter is less than that of ethane, or 0.31. Evaporation rate or vapor pressure do not appear in that specification for being non-photochemically reactive.

This supplier’s product description does not appear on the U.S. EPA’s list of VOC-exempt chemicals. The claim “non-photochemically reactive” appears to be without basis.

Study of the U.S. EPA’s policies busts the myth that evaporation has anything to do with VOC exemption in the U.S.

This column has been an attempt to communicate the importance of facts in managing cleaning technology, or any effort, for that matter. If readers have busted myths about use of cleaning technology, or want to inquire whether a situation is a myth or fact, please contact the author—or MythBusters.

REFERENCES
1. The answer is YES, but the echo can’t be detected because its sound signature is nearly identical to that of the original sound.
   “MythBusters” uses the word “swallowed” to describe the fate of the sound echo.
2. American Congress of Government Hygienists (ACGIH) is the “referee” or “last resort” organization setting exposure limits.
3. These solvents, such as dimethyl adipate, are very useful for cleaning polymeric residues.
4. Not all experiments support the outcome above. There are legitimate, published scientific studies that support the contention that these solvents have flash point values of 75°F, -25°F, and 90°F from top to bottom in Table II. The reason for this discontinuity is that these solvents contain both fuel (hydrogen and carbon atoms) and a fire suppressant (the halogen atom).
5. Note that the situation is reversed in Europe. Vapor pressure is all that matters. Exemption is generally provided if the vapor chemical pressure is less than 0.075 mm Hg. In Europe, MIR and atmospheric reactivity have no “cred.”