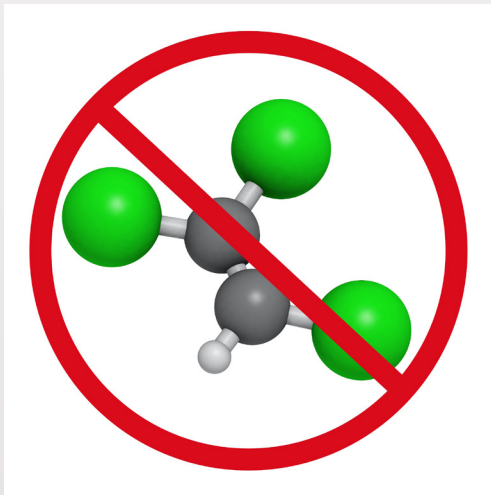


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Metal Parts Cleaning: The Environmentally Progressive Way

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The use of TCE is under tight scrutiny from environmental regulators.

Environmentally progressive cleaning fluids are gaining popularity within the metal working industry. The metal cleaning fluids we use to clean and dry machined parts have changed tremendously over the past forty years. Early on, many metal working shops used chlorofluorocarbon (CFC) and hydrofluorocarbon (HCFC)-based solvents to clean. These included CFC-113, 1,1,1-trichloroethane, HCFC-141b and HCFC-225. The solvents were good at removing grease, oils and other industrial soils from parts. But they had a drawback. They were ozone depleters. In the early 1980's scientists concerned with how the use of these solvents contributed to the expanding hole in the Earth's protective ozone layer designated them as having a high ODP (Ozone Depleting Potential).

In 1989, the Montreal Protocol, an international, collaborative treaty devised to protect the ozone layer, went into effect. The purpose of the treaty is to phase out the production and use of substances that cause ozone depletion. That included many metal parts cleaners that were in use at the time, including CFC and HCFC-based versions. By the mid-1990's the rapid phase-down of CFC and HCFC-based cleaners was well under way. Their use was highly regulated and ultimately banned for metal cleaning altogether.

Choosing Another Way

At that point, many metal fabricators and machine shops shifted to aqueous or water-based cleaning systems. Others stayed with their vapor degreasing methods. But they opted for more environmentally friendly chlorinated and brominated solvents for cleaning instead. These included Trichloroethylene (TCE) and n-propyl bromide (nPB). But today, those alternative methods and solvents are also under scrutiny themselves.

Water-based cleaning, also known as aqueous cleaning, was once considered better for the environment. Yet, that theory is now questioned. Aqueous cleaning uses valuable non-renewable natural resources. For instance, it requires a great deal of energy to heat the water to cleaning temperature. It also consumes power to clean the parts and to apply heat and air to get them dry. Aqueous cleaning also uses vast amounts of clean water. In addition, it produces dirty wastewater that requires careful chemical treatments before disposal. All which have an impact on the environment.

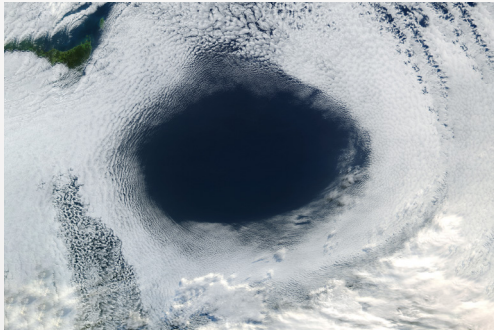
Plus, water cleaning poses some parts cleaning challenges. In some instances, it is difficult to get the water to dry completely. This is especially true with parts with blind holes and small crevices. Leftover moisture causes corrosion to form or leaves unwanted stains and spots behind.

Choosing a Better Solvent

The companies that continued using vapor degreasing to clean their parts, opted for better solvents. They replaced the CFC and HCFC-based cleaning fluids with high-solvency chlorinated and brominated solvents. Companies used Trichloroethylene (TCE) and n-propyl bromide (nPB) in their existing equipment. Those replacements, once considered ideal alternatives, are now proving to be problematic. Both TCE and nPB have air and ground water quality concerns. They are also suspected of being harmful to plants, fish and animals.



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CFC and HCFC-based cleaning solvents deplete the Earth's ozone layer.

These concerns resulted in the establishment of REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) legislation. The purpose of the new regulations was to discourage TCE and nPB use. REACH is a European Union regulation, established in 2006. It controls the production and use of chemical substances within the European Union. Currently, TCE has a carcinogen classification. It has not been available for vapor degreaser cleaning in Europe, without special authorization and stringent controls on factory emissions, since 2016. And under EU REACH regulations, nPB needs special permission for use in Europe after July 2020.

Global Warming Potential

Besides ODP, metal fabricators and machine shops must also consider a cleaner's GWP or Global Warming Potential. The GWP of a cleaning fluid is the amount of greenhouse gas that it emits and that gets trapped in the high atmosphere. Trapped greenhouse gases in the atmosphere absorb infrared radiation. The more they absorb over a long period of time, the more they may contribute to global warming. So, besides low ODP (Ozone Depleting Potential), many manufacturers are also demanding cleaning fluids with a low GWP.

Innovating Environmentally Progressive Solutions

As a result, cleaning fluid manufacturers are innovating new metal cleaning fluids to meet the challenge. Emerging regulations are the incentive for them to formulate groundbreaking fluids that feature both a minimal ODP and a low GWP to meet strict regional air quality regulations and reduce greenhouse gas effects.

Many of the new metal cleaning fluids feature HFO (hydrofluoroolefin) technology. They offer improved environmental properties without compromising performance. The fluids are safe, nonflammable and environmentally progressive fluids. They have a low GWP of usually 3 or less. By comparison, the old HCFC solvents had average GWP ratings in the thousands. Plus, the new fluids boast ODP ratings of zero. This allows them to follow the air quality emissions regulations of the EU.

But What About Cleaning Performance?

It's a common misconception that replacing an older solvent with more environmentally progressive cleaning fluids always involves a performance trade-off. When used in a vapor degreaser, environmentally progressive metal cleaning fluids perform at their peak. They have high solvency. That means they have the strong cleaning power needed for industrial metal cleaning. They clean a wide range of non-polar or organic contaminants. This includes machining and stamping oils and thick grease and wax as well as baked-on resins, corrosion protection agents and esters. They also dissolve soils like drawing compounds, spinning lubricants, buffing compounds and fingerprints.

The new fluids also have high density. This allows the fluids to get under insoluble particulate to lift it off the parts surface. They work well at removing metal chips and shavings. They are also effective for cleaning dust, dirt, soot, surfactants, stearates, fibers and polishing pastes.

Although strong, the new cleaning fluids have good materials compatibility. Most



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When used in a vapor degreaser, environmentally progressive metal cleaning fluids perform at their peak.

clean a variety of substrates. They effectively clean stainless steel, copper, brass, aluminum, nylon, polyester and polyethylene without damage.

Another benefit is low surface tension. This allows the cleaning fluid to get into, and out of, blind holes and other tight openings in the parts without leaving residue behind. Plus, the fluids are chemically and thermally stable so they don't go acid with use. This reduces safety risks and helps cut fluid maintenance costs.

Environmentally Progressive Fluids for Now and the Future

Many metal fabricating companies need high-performing metal cleaning fluids to help support their long-term business success. But the fluids must also follow increasing environmental laws regulating their use and disposal. Growing numbers of regulatory agencies across the EU and the rest of the planet are passing new cleaning fluid legislation. They are also enforcing those laws more rigorously to reduce any negative impact to the environment.

It makes sense for metal fabricating companies to upgrade from their less planet-friendly metal cleaning solvents to more environmentally progressive alternatives. By changing now, companies will prepare to not only meet their metal cleaning needs for today but will also equip themselves to comply with emerging, long-term regulations well into the future.

When it comes to parts cleaning, there are many new cleaning fluids available. They not only clean exceptionally well but are also safer for the planet. They help manufacturers operate in the most environmentally-sound ways while still allowing them to produce high-quality parts to keep their company successful. Plus, they comply with evolving REACH regulations.

For companies looking for help in selecting and using environmentally progressive metal cleaning fluids, they must work with a partner. A partner that has both cleaning fluid and vapor degreasing expertise. Based on specific parts make-up and the contamination encountered, they can recommend the best fluids and metal cleaning methods that will work best.

About the Author:

Venesia Hurtubise is a Technical Chemist at MicroCare which offers precision cleaning solutions. She has been in the industry more than 6 years and holds a MS in Green Chemistry from Imperial College. Hurtubise researches, develops and tests cleaning-related products that are used on a daily basis in precision cleaning and medical applications.

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