2015 GREEN STRATEGIES GUIDE

Parts Cleaning

The Answers to Your Cleaning Questions May Surprise You

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Cleaning is a time consuming, expensive process for most rebuilders. According to *Engine Builder's* most recent Machine Shop Market Profile, rebuilders say they spend more than 15 percent of their total production time in cleaning.

Whether it is due to government regulation or recognition that some types of "traditional" cleaning aren't good for the environment and employee health, attention paid to the cleaning processes used in engine rebuilding facilities has sharpened. Safer, less toxic methods continue to gain a foothold in today's professional shops.

Every day, cleaning engine parts – whether they are small parts like fittings and fasteners, bigger parts like connecting rods and pistons, or even cylinder heads and engine blocks – requires more and more attention to the three E's: economics, efficiency and environmental awareness. But while shops may have the same ultimate goal – clean parts – the methods they can choose from may be very different.

What seems to be good enough isn't anymore, and although there isn't one system that will handle all your cleaning needs, the good news is that the systems available today can have a positive effect on shop efficiency, business economics and environmental impact.

The cost of equipment, chemicals, labor, maintenance and disposal costs can be significant, but cleaning expenses are an important cost of doing business. Doing it wrong can require even more expense in labor or parts replacement.

Cleaning Options: Soda Blasting

Many of today's small parts can be easily damaged by aggressive cleaning procedures such as shot blasting. However, cleaning parts by blasting the surface with sodium bicarbonate (baking soda) has become a popular alternative to other traditional blast media.

Being water soluble, and a relatively soft media (a hardness rating of only 2.5 on the Mohs scale), baking soda won't etch or work harden the surface of the parts that are being cleaned. It is very effective on aluminum, and can remove dirt, grease, oil and even paint. It's also an ideal cleaning material for removing carbon deposits from pistons. Soda can be used with either a dry blast cabinet or in slurry form with a vapor blast cabinet. You also do not have to prewash parts prior to soda blasting as you do if you're cleaning with glass beads or similar media. Soda is environmentally-friendly, too. It leaves no residue on parts, it's nontoxic, nonflammable and rinses right off.

Baking soda media is typically available in three sizes (small, large and extra large), and may be formulated with other additives to prevent clumping when used in humid environments. It can also be blended with aluminum oxide if a more aggressive cleaning action is required. Some shops also mix small-sized stainless steel shot with soda if they want a shot-peening effect while they are cleaning.

Because soda is so soft, it shatters when it hits the surface of the metal. This creates a lot of dust and means it can only be used once (unlike glass beads and steel shot that can be reused many times). To improve operator visibility, some dry blast cabinets have a controlled air flow pattern that helps keep dust away from the window.

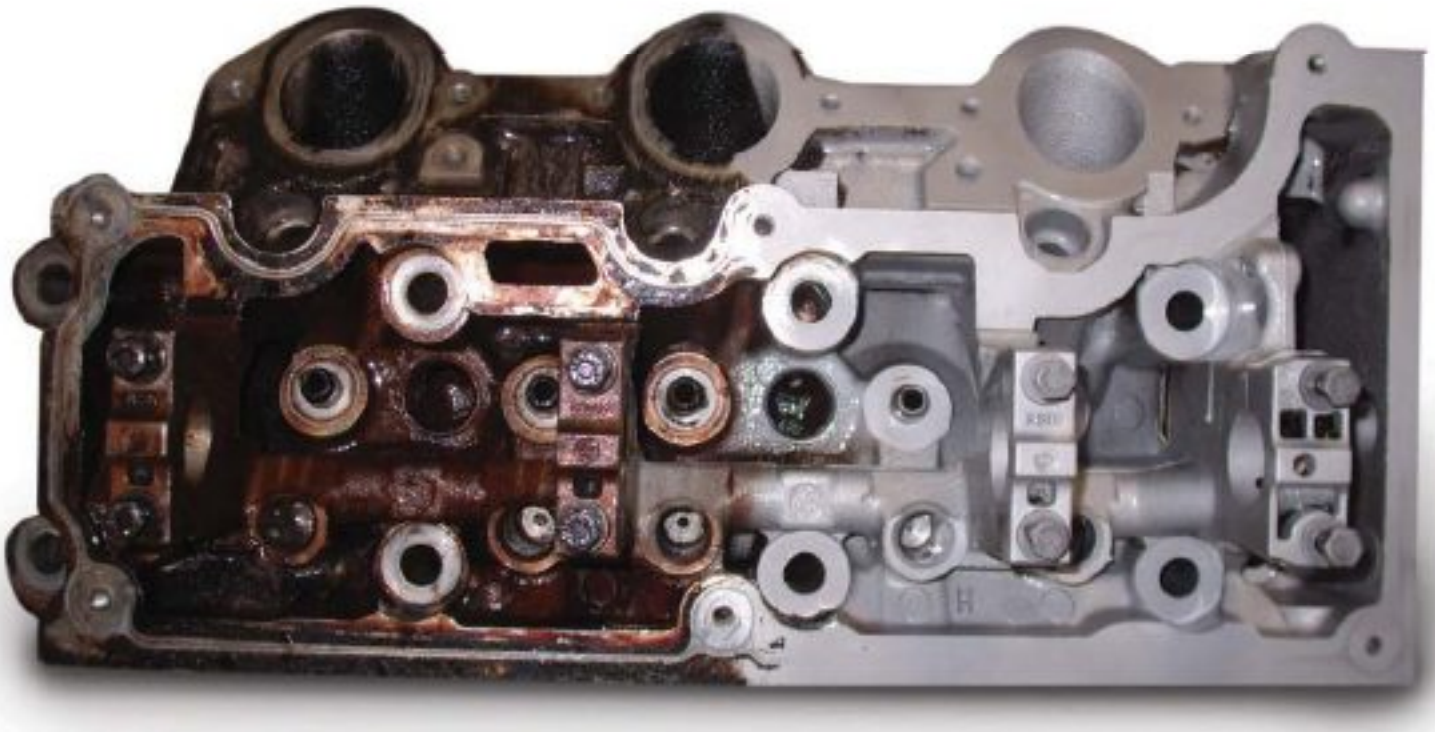
When used in a vapor blast system, soda is mixed with water and other ingredients to form a slurry. The slurry is pumped through a spray nozzle to clean the part, and is then recirculated allowing the material to be reused three or four times during the cleaning process. The slurry solution can be either used in a manually operated blast cabinet or in an automated system with multiple nozzles. The cleaning cycle is followed by a rinse cycle to remove all traces of the slurry.

The slurry scrubs as it cleans, allowing faster, more effective cleaning. And unlike bead or shot blasting, it won't peen small cracks together that could hinder crack detection efforts later.

Cleaning Options: Aqueous Solutions

Often, machine shops and

Is non-destructive cleaning critical?



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When part specifications and surface tolerances cannot change, the only blasting abrasive to use is ARMEX. The gentle physical propriety of baking soda but yet aggressive cleaning ability is what makes ARMEX the only choice. Other blasting abrasives can remove surface materials damaging parts. Additionally, since ARMEX is also soluble it will never leave particles behind in critical passageways like other blasting abrasives which increase the risk of part failure when placed back into service. ARMEX for when non-destructive cleaning is critical.

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engine builders are tasked with the challenge of finding cleaning solutions that are both cost-effective and ecologically friendly. Concerns about solvents are many: volatile organic compounds (VOC) that contribute to smog formation may be toxic when inhaled; solvents evaporate quickly, making worker exposure difficult to control and monitor; and legal restrictions dictate how and where you can dispose of waste.

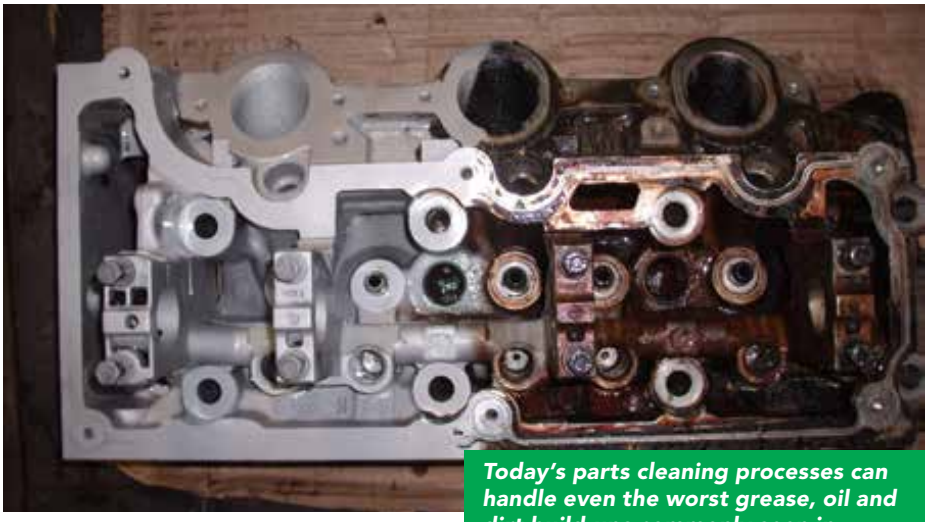
For these reasons, aqueous cleaning has gained a solid foothold in today's engine rebuilding facilities. There are many different aqueous solutions available for effective cleaning of cast-iron and aluminum parts, and according to the aqueous-cleaning equipment manufacturers, water-based detergents and washer systems clean just as effectively as solvents – provided the equipment and cleaning solutions are maintained properly.

Aqueous cleaning is fast, too. A typical wash and rinse cycle may only take 10 to 15 minutes compared to hours of soaking in caustic or a solvent tank. Automated spray washers and flow-through systems mean you can load the parts, push a button and walk away, eliminating the need for a lot of manual scrubbing and brushing. This frees up time for other tasks such as billable labor for machine work or assembly work and helps boost overall shop productivity and profitability.

Clean Water, Green Water?

With aqueous-based cleaning processes, choosing the "right" detergent and/or chemical for the application is very important. The same equipment may clean very differently when different detergents are used. Some cleaning products are formulated for specific types of applications like aluminum or cast iron, while others are "general-purpose" cleaners. The best advice here is to follow your equipment suppliers' recommendations for chemical usage.

Several manufacturers recommend using a milder or less aggressive cleaner on aluminum because some products designed for cleaning ferrous metals can etch or discolor aluminum making it difficult to achieve a bright like-new finish. Yes, this may mean you'll need to invest in separate processes for cast iron and aluminum cleaning, because, again, manufacturers say there isn't a universal solution for all applications.



Today's parts cleaning processes can handle even the worst grease, oil and dirt build-ups commonly seen in engine rebuilding. Photo courtesy of ARMEX.

Using different cleaning solutions for aluminum and cast iron can complicate the cleaning process, so some rebuilders set up separate cleaning lines for each type of metal. Many rebuilders also use different cleaning techniques for different metals, using a spray washer for aluminum and an oven for cleaning cast iron blocks and heads. Others may use an oven to bake off grease and oil, and a spray washer, rather than a shot blaster to clean off the scale and ash left by the oven. Spray washers also seem to be a popular choice for final cleaning to removing oils and residue after parts have been machined.

Some aqueous-cleaning equipment manufacturers sell their own brand of detergent and/or chemicals while others do not. Most equipment suppliers do provide a list of recommended products for their washers. Spray washers that operate at lower pressures and rely more on the surfactant action of the detergent to clean parts will be more sensitive to the type of cleaner used and the concentration of cleaner in the solution than equipment which operates at higher pressures and relies more on the force of the water to loosen and remove dirt.

For water to clean effectively, hotter is better – up to a point. The recommended temperature range will vary according to the type of equipment and chemicals used, and may range from 105° up to 190° F. Many spray washers operate best in the 140° to 180° F range. If the water temperature is too hot, though, water loss due to evaporation may become a problem requiring more make-up water to maintain the cleaning solution. Some equipment suppliers recommend a slightly lower water temperature when cleaning aluminum while others do not.

Maintenance includes adding make-up water as needed to compensate for water which is lost during cleaning operations and to evaporation, adding detergent and other chemicals such as rust inhibitors to maintain the proper balance in the solution, replacing or cleaning filters and oil skimmers as needed to slow the buildup of contaminants, and periodically removing sludge and other solid matter that accumulates in the bottom of the cleaning equipment.

The key to successfully cleaning parts with most aqueous-based processes is keeping the water clean. Clean water is especially important in spray washers because dirty water

can clog spray nozzles, reducing the overall cleaning effectiveness of the process. Spray washers and power washers depend mostly on the force of the water striking the surface to loosen and wash away dirt and grease, but many also rely on the detergent or other chemicals to complete the job.

Filters and skimmers can prolong the life of the solution, but cannot do so indefinitely unless other means are employed to treat and restore the solution. Disposal of any type of liquid cleaning process can be a challenge.

Dirty water poses fewer environmental dangers than solvents, but it depends on the contaminants that are in the water. Heavy metals such as lead, cadmium and chromium are the main concerns and can be minimized by removing bearings and plated parts prior to washing. But if the water contains significant amounts of these contaminants, it may have to be disposed of as hazardous waste. For this reason, wastewater should always be tested to determine what's in it and whether or not special handling is required.

New methods of wastewater processing have been developed that literally remove the waste product from the solution. The water is then typically clean enough to return to the cleaning equipment, recycled or disposed of in the sewer. The removed waste can often simply be landfilled, although depending on the chemicals remaining other methods of disposal may be more suitable.

Aqueous Cleaning Systems

• Manual system. In essence, this is a sink on a drum that recirculates a heated water-based solution. A filtered stream of 100° to 115° F aqueous cleaning solution flushes away dirt and oil as parts are cleaned with the familiar brush on the end of a hose.

Experts say many of these drum and sink tanks are also being converted to bio-remediation systems. A bio-remediation system is a water-based solution that contains microbes, which are live organisms that eat oil. Oil-eating microbes transform the grease and other gunk into water and carbon dioxide.

The process is relatively slow and it requires maintaining the water temperature within a certain range, usually no hotter than 110° to 120° F, and replenishing the microbes regularly.

• Immersion system. This is a less labor-intensive method in which parts are – simply enough – immersed in a cleaning solution. Within the immersion cleaner's tank a lift platform agitates up and down during the cleaning process. This type of system can also be used as a soak tank.

In addition to a lift platform, a recirculating pump can be added to provide more turbulence to the tank. This moves the cleaning solution around in a circle inside the tank, creating additional scrubbing action.

Immersion washers are very effective on intricate parts – those with blind holes, channels, etc. The agitation process forces the cleaning solution into all the tight areas of the engine part.

• Jet washer or cabinet washer. Essentially, this is an industrial-strength dishwasher. Jet washers use a pattern of spray nozzles that spray cleaning solution with detergents under some pressure (typically 40-60 psi) onto the parts.The combination of water pressure impinging against the surface, and the secondary action of the water and detergent dispersing and rinsing away the contaminants does an effective job on most automotive parts.

The disadvantage of the spray cabinet washer is actually the advantage of the immersion washer, experts explain. The jet washer's spray pattern cleans what it hits very well. But it can't get into tight areas – blind holes, for example – and if it can't get in there, it can't clean.

There are several different types of spray cabinets. Front loading cabinet washers typically have spray bars underneath the basket, on top of the basket and on the sides to provide full coverage of the spray. Another type of cabinet washer is the top-loading kind. The advantage to this design is that you can use an overhead crane to load it.

Spray washers or jet washers generally use V-jet nozzles and some type of stationary manifold system to direct water at parts sitting on a turntable inside a cabinet. On some washers, the parts are stationary and the nozzles rotate to vary the spray pattern.

High-pressure spray cabinets add increased cleaning capabilities. They require manual operation and blast out about 400-600 psi of pressure. This gives a high degree of impingement with an aqueous cleaning solution to clean even parts with blind, tight areas.

Spray washers and power washers come in a variety of sizes and configurations, with prices ranging from $6,000 up to $50,000 or more.

• Ultrasonic washers are very effective, used primarily for removing carbon and burned on oils. The process is particularly effective in cleaning blind holes and geometrically complex parts.

Ultrasonics is the science of sound waves above the frequency normally considered audible for humans (above 18 Kilohertz). When vibrations at these high frequencies are introduced into liquids, areas of extremely high vacuum and extremely high pressure are generated alternately at any given point in the liquid as the sound waves pass. Under the influence of a vacuum, the liquid is literally torn apart to create what is called a cavitation bubble. As positive pressure replaces the vacuum which formed the cavitation bubble, it collapses in implosion resulting in high pressure shock waves which do the work we ascribe to ultrasonics.

The result: Energetic disturbances generated by the implosions of countless cavitation bubbles. These perform the cleaning task by providing micro-agitation throughout the liquid volume.

When it comes to parts cleaning, the fact remains you have options. It will depend on what works best and what method you prefer. ■

Being Green Takes Some 'Engine'uity

By Greg Jones, Managing Editor
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You might not have even realized, but by being an engine builder/rebuilder alone, you're already contributing to making the environment a greener place. That's right, it takes less energy and less material to rebuild an engine than it does to build a brand new one. So since you're already being 'green,' why not go a few steps further?

In the engine building industry there are many things shops can do in order to decrease the size of that carbon footprint, all while becoming greener, more efficient, safer and saving some money. In the same breath however, you could be missing out on these advantages if you're ignoring the green trend.

"Green is obviously a trend, but the more green you go, the safer your shop can be, the less materials you'll have hauled off and disposed of, and the more efficient you'll become," says Robert McGraw, vice president and COO, AER Manufacturing, Inc. "You have to be conscious of being green, but it needs to make business sense for you."

You can't just be green for green's sake. Going green and utilizing these practices has to make sense for you and your shop.

"That's part of the reason why some guys don't do things that are green because they have always done things a certain way, and they think changing it will cost them money – but it's not, if they look at it the right way," McGraw says.

In fact, there are very few downsides to greening your shop. McGraw points out. The downsides to not greening your shop, however, are missed opportunities.

"You don't know what you're missing out on," he says. "You might be hanging out a bunch of money to have stuff hauled, but you don't need to because you could be using corncob to blast your material instead of some crazy toxic stuff. You could be leaving money on the table and it could be a win-win if you would have tried."

Take Jasper Engines & Transmissions for example. The company has implemented numerous green initiatives. In fact, energy usage at Jasper per drivetrain component was figured, and on average, only 1% of the energy is consumed in remanufacturing a drivetrain component in comparison to manufacturing the entire vehicle.

In tangible terms, that is an energy savings of nearly six tons of coal or 1,008 gallons of crude oil. Rather than replacing vehicles, Jasper-remanufactured engines, transmissions and differentials saved enough energy in 2007 to power an estimated 598,000 households, or every residence in a city the size of Washington, DC, for an entire year.

Reusable plastic pallets save you from having to haul used pallets to the landfill.

How can you argue with results like that? Obviously, production engine remanufacturers like Jasper and Dallas' AER, build at a different scale than the typical custom engine shop, but there are countless ways to green your shop.

"One of the things we use are reusable plastic pallets," McGraw says. "You just wash them off and reuse them rather then having them hauled off to the landfill."

Another thing AER does, which is a really good green initiative is evaporate all of its fluids.

"If you have anything with a water base in it such as soak tanks or mop water, we evaporate the water from it and then have someone haul off the sludge," McGraw says. "The water evaporation really makes sense. The ROI can be figured out on how much you have hauled off and how much that evaporation system is going to cost you. That's a system that would be useful in a lot of midsized shops. I save a ton of money on those because they have to haul away 10% of what they would if it had the water in it."

Evaporators are used for any water-based cleaners – mop water, floor-scrubbing machines, soak tanks, etc. Jasper uses a different technique, but does so with similar intentions.

Jasper has implemented bioremediation as a means to clean the water used throughout its remanufacturing process. This process allows an enzyme to break down contaminates into a form which microbes can consume. The microbes naturally transform hydrocarbons (oil, fuel and solvents) into carbon dioxide and water.

If you're looking to continuously improve and become greener, many of the regulations that are in place can help you green your facility.

"Following guidelines from external auditors helps you make sure you're doing what you're supposed to be doing in your everyday operations," McGraw says.

Aside from regulations, one of the easiest green things to do is reuse and recycle. Purchase reusable or recyclable products whenever you can. Reduce or eliminate the hazardous materials that you use. According to the Department of Public Works in Santa Cruz, CA, materials that have the potential to be recycled include the following: oil, coolants, cleaning solvents, oily rags, and metal chips. Recycling is not only good for the environment it is good for business. Often times, it is cheaper to recycle and you may even be able to get a return on your recycled goods.

According to the EPA, oil is one of the best recyclable/reusable materials found in engine shops, and can be used again and again. An estimated 380 million gallons of used oil is recycled each year. Oil can be reconditioned, refined or processed and burned for energy recovery. Now, you'll have to have it hauled off to contribute to this cause, but to do so, make sure you keep used oil in containers or tanks and label them accordingly. Make sure these containers or tanks don't leak, rust or deteriorate.

Metal is another common material. At Jasper, when drivetrain cores are disassembled, all non-usable metal and aluminum parts (4,057 tons annually) are sent out for reclamation. In addition, many of the new parts that go into Jasper products come in cardboard packaging, which the company recycles to the tune of 73 tons annually.

Another easy step to take is changing the type of materials you use in cleaning and blasting processes.

"A lot of the materials used in cleaning processes from dirty engines are going toward greener solvents," McGraw says. "These are not only green, but safer. You can also look at different blast materials."

Jasper has also changed its cleaning process. Coal slag or Armex (baking soda) blasting agents have taken the place of many solvents used by the company during the core cleaning process. Other examples for green blasting are corncob, walnut shells, as well as glass bead and aluminum oxide, which are recyclable.

If energy saving is important to you, or if you're looking for another simple green idea, the type of lighting in your shop is a place to start.

Motion detection lighting has been introduced throughout the production facility at Jasper. Sensors detect movement, which activates the bulbs, illuminating the area. This reduces electricity use and the bulbs are biodegradable.

Other lighting ideas include implementing dimmers and/or timers to save energy and changing out incandescent bulbs for Compact Florescent (CFLs) or LED bulbs. CFLs are those swirly bulbs that look like soft-serve ice cream cones. Economically speaking, they cost a bit more than an incandescent, but use about a quarter as much energy and last many times longer (usually around 10,000 hours). It is estimated that a CFL pays for its higher price after about 500 hours of use. After that, it's money in your pocket.

LEDs, or light emitting diodes, are a technology that allows for extremely energy efficient and extremely long-lasting light bulbs. LEDs cost a bit more than even CFLs, but use even less energy and last even longer. An LED light bulb can reduce energy consumption by 80-90% and last around 100,000 hours.

Blasting materials such as Armex are green, and safe, ways to clean engine parts.

For those shops that do some machining, there are steps you can take too to become greener, such as using oil-based metal working fluids versus those that contain chlorinated compounds.

According to the Department of Public Works in Santa Cruz, CA, most metal working fluids that contain chlorinated compounds are hazardous. Once spent, these metal working fluids must be labeled as hazardous waste, are more expensive to haul off and cannot be recycled as used oil. Fluids that do not contain chlorinated compounds can become chlorinated by contaminants entering the sump of a machine where the fluid is stored. Contaminants can result from additives such as tapping fluids, biocides, lubricating oils, machined plastics, paint, and cleaning or degreasing products used in machine maintenance. Ensure that these additives and cleaning products do not contain chlorinated compounds.

Periodically cleaning out the metal working fluid sumps and trenches will keep them free of solid matter that can hamper fluid flow. Solid materials provide excellent areas for microbe growth and may clog fluid delivery lines. Disinfect sumps and trenches when metal working fluid is removed.

No matter how big or small the benefit of going green may be to your shop, every little bit counts and can go a long way to improving business and the environment. Future ecological challenges will be greatly reduced if consumers are driven by environmentally conscientious decisions. But in order for that to happen, businesses such as engine shops need to start going green. ■

Engine Shops Are Cleaning Up

By Greg Jones, Managing Editor
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We all know the shop can be a dirty place. Parts and tools scattered throughout, and dirt, grease, oil and sludge threatening to make things even dirtier. But we're engine builders and we live to get a little grease on our hands, right? While this is true, there is no harm in keeping your shop clean. In fact, there are numerous benefits to keeping your shop organized and cleaning up fluids and spills in the proper ways.

Some of you might be questioning why keeping a clean and organized shop is helpful, but it makes a direct impact on efficiency, morale, the environment and most importantly, the customer.

"If a customer walks into your shop and it's a mess, that reflects poorly on you," says Robert McGraw, vice president and COO of AER Manufacturing, Inc. "You might be the best guy in the world, but we use our shop as a sales tool. When I have people in my shop it is marketing. If I could just get you here and you saw my place, you'd want me to build your engine."

Keeping the shop clean goes hand-in-hand with guys taking ownership of their area and where they work.

"I think a lot of guys would say that the area they work in and the way they keep their stations is a reflection of them," McGraw says. "Guys here at AER take pride and ownership in their area and making sure their machines are wiped down. I think that would filter down at any shop. Nobody takes care of stuff that they don't have some ownership in."

Ownership is the key here. Your employees, and you, must take ownership of keeping the shop clean and in order.

"Organization is going to come through with being efficient," McGraw says. "Walking all over your shop looking for a tool is not efficient. If you have everything where it needs to be at the right time, you're going to get that job turned around a lot faster and be able to move on to your next job, and that's important. You also need to make sure you have the right stuff on hand, the right equipment and that it's maintained properly, and make sure you're not running out of something you need. That organization is going to come back in your tack times."

Being organized is just half of what it ultimately takes to run a cleaner shop. The other half is properly cleaning up spills and disposing of hazardous materials. If your shop is tuned up and running smoothly, you will help protect the area's water resources by keeping pollutants such as heavy metals, antifreeze, oil and gas wastes out of storm drains and sanitary sewers.

"Proper cleaning techniques have to do with each material and what the regulations are for disposing of it," McGraw says. "That's the law. Just because you didn't know how to properly dispose of a material doesn't help you. If you dump stuff down your drains that you shouldn't, ignorance is not a defense. It's not like the old days that I hear of where you might put oil in a ditch, cover it up and drive away."

The old days and ways are certainly in the rearview mirror. Shop owners these days need to follow the regulations in place to dispose of hazardous materials and clean up spills. One way to comply is by running a dry shop.

According to Michigan Department of Environmental Quality, minimizing the liquids you discharge will help you comply with the requirements. Cut down on the liquids you create by cleaning up spills immediately and by using dry clean up practices instead of a mop or hose. To discourage washing down floors and outside paved areas consider removing unnecessary hoses.

Dry clean up methods could involve using a shop vacuum, dedicated mops, sweeping, and/or using rags or dry absorbents. Once the dry clean up is complete, floor and paved areas may be mopped.

If mopping is used to clean shop floors you should spot clean any spilled oil or fluids using absorbents or rags. Spills are not cleaned up until the absorbent is picked up and disposed of properly. According to the Napa County Department of Environmental Management, mop water should not be poured into the paved areas, street, gutter, or storm drain.

Similar practices should be also used for non-fluid materials

from grinding, shaving and sanding. Never discharge these wastes to the storm drain or sanitary sewer. The Department of Public Works in Santa Cruz County, CA says to first sweep the floor, then collect all metal filings, dust and paint chips and dispose of properly. Do not wet mop the floor in machining areas until all metal particles have been removed. Mop the floor using a bucket of non-corrosive cleaner and water diluted as specified on the label. If possible, only spot mop the area that requires cleaning.

If an oil spill can be cleaned up with three or fewer shop rags, use the shop rags to clean up the oil and launder the rags off-site. If it is a larger spill, use a hydrophobic mop and designated oil mop bucket to soak up the oil and ultimately place it into a "used oil only" waste container for recycling. This will save the costs of disposing of absorbent pads or kitty litter as hazardous waste.

The same goes for cleaning solutions used for engines or parts. These should never go into the sanitary sewer system without adequate treatment. Most facilities have these solutions hauled off-site as hazardous waste because of the permits necessary for on-site treatment.

Ultimately, the best spill control is prevention. Napa County says you should minimize the distance between waste collection points and storage areas. Contain and cover all solid and liquid wastes – especially during transfer.

Also be sure to purchase and maintain absorbent materials in accordance with local regulations and procedures for containment and cleanup of different spills, and make sure they are easily accessible anywhere in the shop. Saturated absorbents generally must be disposed of as hazardous waste.

When changing vehicle fluids indoors make sure you do it only on floors constructed of non-porous materials. Avoid working over asphalt and dirt floors – surfaces that absorb vehicle fluids. If vehicle fluids must be removed outdoors, always use a drip pan. Prevent spills from reaching the street or storm drain by working over an absorbent mat and covering nearby storm drains.

Transfer fluids drained from vehicles to a designated waste storage area as soon as possible. Drain pans and other open containers of fluids should not be left unattended unless they are covered and within secondary containment.

Store waste containers of antifreeze and oil within secondary containment as well. Antifreeze and waste oil should be stored separately and recycled, or disposed of as hazardous waste. Never pour vehicle fluids or other hazardous wastes into sinks, toilets, floor drains, outside storm drains, or in the garbage. These substances should be kept in designated storage areas until recycled or safely disposed of. Use a licensed service to haul and recycle or dispose of wastes.

One of the best things you can do for continued success keeping a clean shop is to train all employees upon hiring and annually thereafter, on personal safety, chemical management and proper methods for handling and disposing of waste.

Make sure that all employees understand storm water discharge prohibitions, wastewater discharge requirements, and best management practices. Labeling drains by paint/stencil to indicate whether they flow to an on-site treatment device or to a storm drain is also helpful. Labels are not necessary for plumbing fixtures directly connected to the sanitary sewer.

If you'd like to become more efficient, raise employee morale, help make the environment better, and even gain customers, be sure to practice these organization and cleaning tips in your shop. ■

Today's Aqueous Cleaning Solutions

Engine Builders Find 'Clean' and 'Green' can Both Be Possible

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With engine building shops actively looking for ways to increase productivity, protect their workers and meet environmental regulations that protect the planet, aqueous cleaners offer a "greener" cleaning solution to many of the most difficult cleaning challenges.

When you want the straight answers you have to go straight to the source, and Engine Builder magazine spoke with Danny Thomas, ArmaKleen Regional Sales Support Manager – East; Derek Bryer, ArmaKleen Regional Sales Support Manager – Central; and Randall Seeley, ArmaKleen Regional Sales Support Manager – West; to get their "down and dirty" opinions about today's cleaning needs and the whether "clean" and "green" can ever be used in the same sentence.

Engines and their internal components are, by their very nature and existence, dirty – but to properly rebuild them, engine builders must spend a large percentage of their time getting them back to a pristine condition. Which parts and components are engine builders and machine shops most likely to clean — which are the most difficult?

"There is typically an overall cleaning of the engine prior to 'teardown,'" explains Thomas. "They wash engine blocks, heads and internal components. There are also peripheral items such as turbo units that are also cleaned; but the most difficult parts to clean are the heads and blocks."

Bryer explains that the difficulty in cleaning is partly due to environment and partly due to enhancements. "Baked-on carbon on cylinder heads as well as some epoxy coatings on parts are the most difficult to clean," he says, explaining that some of the specialized coatings intended for wear resistance or lubrication require additional effort.

"It seems as if all the metal engine parts from blocks, heads, pistons and all other internal parts are cleaned before inspection and rebuild," says Seeley, acknowledging that effort at the beginning can lessen work at the end. "Transmission housings, other internal parts and turbos are cleaned before rebuilding, but cleaning the heads is the most difficult and time consuming challenge."

There's been almost no end to the changes that engine builders and their supplier partners have faced over the past decade with relation to environmental and health concerns. Luckily, technology advancements have allowed progressive operations to remain ahead of the curve.

"More environmentally friendly chemicals (low VOC's and non-flammable) are readily available," explains ArmaKleen's Thomas. "Labor savings through automated cleaning systems such as spray cabinets, automated agitation and ultrasonics are more prevalent."

New materials require new chemistry, Thomas continues. Aluminum alloy components make up more than half of the parts being remanufactured today, he says, and many of these lighter alloys aren't able to withstand the aggressive nature of yesterday's cleaning procedures. "Nondestructive cleaning saves time, money and minimizes damage to machined surfaces," he explains.

"New metal alloys continue to be developed and the standard steel parts are not as common as they were in the past," agrees Bryer. "Today's parts are lighter in weight and harder to clean aggressively without damaging the part, also more expensive."

Seeley says many of the newest concerns he hears are how to clean parts without damaging them and trend toward environmentally friendly (automated) cleaning methods that save labor. "The major changes have been going away from manual solvent cleaning to automated aqueous cleaning processes such as spray-washers and Ultrasonics," he says. "In blasting applications, changes to softer media such as sodium bi-carbonate have improved substrate preservation and ensure no particles are left behind in the critical passageways."

Obviously, significant attention has been and continues to be paid to safety – but what does "safe" really mean? How much safer (for the environment, employees and/or engine parts) are today's technologies? According to all three ArmaKleen sales support managers, the answer is dramatic.

"It's much safer today," assures Bryer. "Environmentally safe cleaning methods are not only effective but they reduce the long-term chronic effects on health that you would get from solvents and past cleaning methods."

Thomas agrees. "By utilizing aqueous cleaning products the employees are no longer exposed to the volatile organic compounds (VOCs) associated with harsh solvents."

Out west, the dangers of VOCs have been well documented. California has been on the leading edge of regulations regarding employee and environmental safety. "The automated processes used today are much safer for employees as their exposure to solvents has been considerably decreased," explains Seeley who says this isn't only a concern for the worker using the cleaning solution. "The flammable nature of having solvent around in the plant has largely disappeared."

So has safer technology meant performance tradeoffs? All of our interview subjects say the benefits far outweigh any downsides.

"No, the use of automated aqueous cleaning processes is more efficient and they are being integrated into the lean manufacturing process," explains Seeley. "These aqueous systems do a better job of production cleaning and they are safer for the environment and the employees working around them. Blasting with softer media has also become more prevalent."

Bryer concurs. "Safer technology and non-hazardous cleaning methods are just as good as or better than older harmful methods of cleaning. Used in the correct way and using the correct product for your process is essential on having a successful cleaning process," he says.

"If the appropriate machine, aqueous chemistry and adequate heat are utilized the cleaning performance is typically better than cleaning with unheated solvent," agrees Thomas.

Simply put, says Seeley, the need for safer cleaning alternatives becomes less an option and more a requirement. "As softer substrates (aluminum alloys) are becoming a dominant percentage of the remanufacturing marketplace, nondestructive cleaning is becoming more critical and necessary," he says.

Realize, however, that it's unlikely that you'll find a "one-size-fits-all" solution to the cleaning question.

"Oh, absolutely not," says Thomas. "Many factors determine the appropriate cleaning solution (soils, substrate, part geometry, production rates, budget, local environmental regulations, etc.)"

Bryer understands the hope – but is quick to quash it. "Frankly, I wish there was but the answer is definitely no. Although it can work across several aspects of cleaning, the cleaning methods should be specific to what the end user needs."

Just as no two shops are exactly alike no cleaning situations are carbon copies of each other, says Seeley. Therefore, each situation is different. "No, each shop has its own special needs concerning soils, substrates, through-puts, and environmental/worker safety regulations."

If you've been doing things the "same old way," you may not even know what you don't know about today's better alternatives. What questions should engine builders and machine shops expect to have answered when researching cleaning methods?

According to Thomas, here are the basics:

- Is the cleaning solution classified as hazardous or non-hazardous?
- What is the expected cleaning cycle time or throughput?
- Will the parts require hand "touch up" cleaning?
- What is the anticipated labor savings or payback for automating the cleaning?
- How long will the solution last before needing to be changed?
- What are the costs associated with the disposal?

In addition, says Bryer, shops

should understand how the cleaners and the parts will interact. "They must know what impact the type of cleaners they are seeking will have on the type of substrates they are working with. They should also find out what process they need to have when cleaning the parts."

Seeley suggests asking your supplier to clarify these questions: What is the most efficient from a time standpoint to get the parts cleaned? What is the most cost-efficient and dependable cleaning equipment and chemistry for the job? How is the waste, clean-out and recharging of the system going to be handled? What are the waste-reporting requirements? What are the worker-safety issues to consider?

With so much to learn, some engine builders may ask whether "safe" cleaning can possibly mean "clean" cleaning?

"Of course 'safe cleaning' should mean 'clean cleaning!'" says Seeley. "The new automated systems do a better job of cleaning the soils and the cleaning chemistries do a better job of providing rust protection without leaving a solvent residue on the surface. These new systems also significantly reduce labor, making the rebuilding process more efficient while providing better worker-safety conditions and hazardous materials handling."

Thomas and Breyer both agree. "As technology has improved on both the equipment and chemistry front, businesses today utilizing the latest technologies are experiencing safer and cleaner cleaning," Breyer explains. "Absolutely yes, 'safe' cleaning can mean 'clean' cleaning."

So moving forward, how do we get there? What new products, technologies or regulations may we expect to see?

"You can count on in the future having high VOC cleaners eliminated," say Breyer. "The direction will be toward aqueous or no VOC non-Haz methods of cleaning."

Thomas echoes that prediction. "New aqueous formulations that are more effective on soils without damaging the substrates, harming the environment or reducing worker safety," are in EVERY engine builder's future.

The horizon isn't very far away, says Seeley. "New products such as 'slurry type' or 'vapor blasting' cleaning systems are currently being developed and perfected. These new systems actually clean and blast in the same step with minimal impact on the environment while limiting worker exposure," he explains.

Safer AND cleaner? Sounds like a combination this industry – and the environment – can live with. ■