FIRE SAFETY IN THE SHOP OR…

Smokey the Bear meets Red Green

Ed Pretty

The other day, a friend and I were discussing all kinds of issues associated with shops in general: machine placement, floor area needed for this or that machine and so on. The conversation eventually led to shop safety and ultimately to various fire hazards that can be present in a home shop. After discussing a few things that were old hat to me but had never occurred to him, my friend suggested that I write an article on fire safety. My first thought was "Why bother writing about something that is just common sense?", but then if some of this stuff is news to him then it may be to others. With that I decided to write this piece in the hope that even the smallest bit of information might save someone's shop (and themselves) from disaster.

So far, in over 30 years as a professional firefighter, I have had lots of opportunity to see good old Mr. Murphy at work. Trust me, if you can imagine it, it has happened. Over the years, I have attended fires in both commercial and home shops. Sometimes accidents happen and sometimes people are just plain stupid. In all cases, the loss to the owner, whether great or small in someone else's eyes is devastating.

I could keep this article short and sweet by stating the obvious, advising everyone to put up "No Smoking" signs and advising everyone to get an extinguisher and calling it quits, but I think the majority of you have figured that one out. The not-so-obvious is usually what trips someone up in these enlightened times and that is what I will discuss here.

"SOURCES OF IGNITION"

In the fire biz, we talk about "sources of ignition". Sometimes they are obvious to the eye, yet invisible to the mind – like pilot lights. Sometimes they are insidiously subtle – like static arc. We all like to sharpen our tools with grinders that make a shower of sparks. Some of us have cutting and welding equipment in the same area (uh, just ignore the first 10 feet of my shop as you walk in, OK). At one time or another most of us have used Watco Oil or some similar product (Similar? How?): this is the famous "oily rag" situation explained. I'll discuss them all.

Sparks from grinding and welding are visually pretty obvious, but consider how close your grinder set-up is to the lathe or other producers of large amounts of bone dry, finely divided, highly flammable, organic (stuff that burns) material. Those little buggers tend to go a lot further than you may think. If you don't believe me, grind a tool in the dark and watch the shower. If distance is a problem, try a deflector (a.k.a. piece of plywood) or turn the grinder toward the wall. The real solution is to keep the shavings cleaned up (ya, right). Common sense says to sweep up and dispose of suspect shavings outside before leaving the shop.

There are sparks and then there are sparks: static discharge can produce some dandies. Many of us have vacuum systems to assist us in the "cleanliness-next-to-Godliness" thing. To be installed properly, such a system must have metal ducting that is both bonded and grounded, but for ease of installation (not necessarily cheaper) we often use PVC pipe. All that air rushing by tends to create an electrical charge on those things that it passes over – or through. Metal conducts electricity nicely and therefore tends to shuck off any electrons that happen along right away. If the system is grounded they find their way harmlessly to terra firma. Plastic, on the other hand doesn't conduct well at all, so those same electrons tend to build up until there is bunch of them. They still want to get to terra firma but with no easy path, they finally take the big leap all together (strength in numbers). This can result in a pretty spectacular arc and, voila!, one of these pesky ignition sources is born.

There is one thing to keep in mind when sparks are involved. At work we maintain a "fire watch" for 2 hours after a fire is deemed to be completely extinguished: as professionals, "rekindle" is not in our language. That time period was chosen because it usually takes about that long for a small ignition source to progress to a noticeable fire. Thanks to welders in sawmills, we usually get to go play about two hours after they have done their thing if they have not done their spark chasing after wrap up. So if you are doing "hot work" where sparks are being produced, maybe consider taking another peek before turning in for the night.

DUST EXPLOSIONS

While in the general area of shop cleanliness, let's talk about dust (we're talking sanding dust here). This stuff is even more finely divided, bone dry, highly flammable, organic (stuff that burns) material. When suspended in air, this stuff starts to act more like a flammable gas than a flammable solid. Explode? You bet – and if it doesn't explode it can burn real fast over a large area. Picture the concrete grain elevators that live along the shoreline in North Vancouver. In the early 70's a series of dust explosions resulted in a final blast that took the tops off of four that stood side by side. That's a little larger scale than most of our shops, but the same principle applies. It is common to have a smaller initial explosion – kind of a "whoof" – that stirs up the dust laying everywhere, creating a perfect atmosphere for the big bang. Boom… then Ka-boom. If there is a correct dust/oxygen ratio floating around in the shop, it might as well be natural gas. A pile of dust on the floor is way too rich, a haze from a few minutes of sanding is probably too lean. A continuous operation that produces fine dust or sweeping up the shop on Sunday can get the mixture "juuust right", and one of those not-so-obvious ignition sources does the trick (vacuum system perhaps?). There's a plug for dust control if I ever saw it.

AH, CHEMISTRY

Hopefully the next section will not be too painful because it's important. My intention is to explain why things burn so that you can decide what to do or not do as the case may be. Please excuse the elementary approach, but Bill Nye finds it more effective as do I. When something burns, whether solid, liquid or *gas*, it is the gaseous form of the product that burns – even wood. Flammable liquids burn when they give off *vapour*. Some flammable liquids (like gasoline at about minus 46°F.) give off *vapour* that burns at normal ambient temperatures. Others don't give off vapours until much higher temperatures (like diesel at about 104°F.). This is called the "flash point" if you are looking up information on the product. Flammable *gases* exist as a *gas* naturally so are ready to go pretty much all of the time. Solids, of course, require a whole whack of heat to give off *vapours* so are significantly safer. Hopefully by now you have noticed that I have emphasized the difference between a *vapour* and a *gas*. Don't forget to keep *flammable gases* and *vapours from flammable liquids* separate in your mind.

Probably the most prevalent of the villains in our world are the vapours from flammable liquids. Flammable liquids cause us much grief because, unusual in the chemical arena, they abide by a rule. The vapours that evolve from the liquid are always heavier than air. The thing that causes such a problem is that the vapours tend to stratify in low areas rather than dissipating, thus allowing enough stuff to build up to light up. (By the way, the "heavier-than-air-rule" doesn't always apply to flammable gases: having fun yet?). Anyway, the same rule that causes the problem also allows us to avoid catastrophe. Because we know that they will likely be hanging around the floor, we know that we should extinguish pilot lights in the area and eliminate all those other pesky ignition sources, like grinding, as well. If you have a wood stove in the shop – think a bit about how long it takes for that thing to really go out. Best of all – get rid of the flammable liquid if possible.

Where is this significant? First of all, store the gas for the mower and the BBQ propane (it's a flammable liquid – trust me) where there are no ignition sources – especially at floor level. Next, if you have a furnace or water heater in your shop area, avoid using any solvents with flash points lower than room temperature (that info is available in a Material Safety Data Sheet – MSDS for short). Keep this in mind when using finishes (especially lacquers) or adhesives that have "driers". The real sneaky one is contact cement. For you French Polishers, watch out for methanol (methyl hydrate) because it follows the heavier-than-air rule and you can't see the flame: pretty cool stuff. I reduced one problem in my shop by installing an overhead furnace when I built it so that the pilot light is up high. Of course heavier-than-air vapours can be stirred up by movement (Aarrrggghh!!! Make it stop!), so the best thing to do is what the manufacturer says: eliminate all ignition sources and provide good ventilation. I could emphasize all this with both humorous and tragic war stories but these are best served with beer(s) and a couple of other firefighters.

By the way, MSDS's are available from whoever sells the product.

OH NO! MORE CHEMISTRY

Sorry to stay in the chemistry end of things but there is another relatively minor area of concern as far as home shop owners that still should be discussed. We tend to use various chemicals in our lives and some of them don't like each other (or, really like each other, as the case may be). The possibilities are endless – as I have found over the years – but a common possibility in our shops could be oxidizers. These can be in the form of acidic corrosives (battery acid is a good one – lots of "O's" in H^2SO^4), any fertilizer with "nitrate" in the name or any strong bleaching agent (Javex doesn't count). Watch out for things with "-ite" and especially "-ate" at the end. If these things come in contact with bone dry, finely divided, highly flammable, organic (stuff that burns) material, they tend to cause a reaction that generates enough heat to start a fire. Not common but it happens, so keep the chems in their (proper) containers and on the shelf.

AS PROMISED, "OILY RAGS" EXPLAINED

Ever since I can remember, I have been told that "oily rags" are a fire hazard and I think that's pretty standard. It would seem that we generally understand that there is a "spontaneous combustion" situation involved here. So, what is spontaneous combustion? Generally it's a situation where heat builds up very slowly (or sometimes astonishingly fast) from a chemical reaction creating enough heat to ignite the material in question. The chemical reaction that takes place is oxidation – just like the sulphuric acid on wood shavings. The difference is that it is usually biological in nature. Wet hay is a classic: the hay gets wet, starts to rot (oxidize), and the heat generated starts a self-accelerating cycle leading to ignition. The oil in "oily rags" is not petroleum based oil, but a vegetable oil such as linseed or tung or similar. In their raw state (arranged in such a way as to be easily heated – like on a crumpled rag) these contain bacteria that will work on the organics in the oil creating a slow oxidation process just like the hay. If the oil is boiled, the bacteria is killed and doesn't present near the problem, although not eliminating it all together. Watco is notorious for this problem because it contains a certain amount of raw linseed oil. Not to slag only Watco, there are lots of others out there with the same problem.

This is a curious problem around the shop. I have been to a fire in a cabinet shop on Sunday night that took all weekend for the rags in their van from the last job on Friday to take off. I have been to a house fire where the husband did his yearly "watco-ing" of the cedar paneling, dumped the rags out on the porch, cleaned up, grabbed a beer, sat down to watch the game and "whoosh" – roaring blaze on the porch. I have tried to produce a controlled fire in this way and have not been able to do it. There is obviously a very specific combination of ambient heat, humidity and the way the combustibles are arranged that allows this to happen. While you are working with the stuff, don't place the rags on the bench all bunched up. Open them up and hang them on something so they can't heat up. That way, when the phone rings and you forget them, they don't get to do their thing. Once you are done, there is only one way to eliminate this problem when using an oil finish: dispose of the rags in a sealed metal container reserved for that waste only. Ideally, outside the shop is best. There are special containers made for just that purpose, but a paint can (with lid) works well, too. Putting them in a container filled with water works but that can be pretty messy. If you can burn them in the fireplace – great. If you have to put them in the garbage, wait until you put it at the curb before adding the rags.

GETTING IT OUT ONCE IT'S STARTED

OK. Let's defy all logic and say that a fire gets going in the shop. My first advice is to alert everyone in the house/shop and then either call the fire department or get someone else to do it right away. Don't forget your address. Then go after it with an extinguisher and/or hose. I know you are going to think it's best to attack the fire right away, but if you try and fail, calling the fire department somehow gets forgotten: yes, it's happened. If things get out of hand, make sure you close the door as you bale out. If you think I'm full of it, pass on the phone call, attack the fire and win, call the fire department anyway. Fires tend to extend themselves unknowingly and, anyway, the insurance company likes to see a fire report.

Fires in wood, cloth etc. (class A) can be put out with water or regular dry chemical. Flammable liquids (class B) require "dry chem" or CO^2. Energized electrical (class C) required CO^2. My recommendation is a minimum 5 lb. ABC type dry chem extinguisher. The ABC type of dry chem is the most effective of all; just turn any power off if electricity is involved at all (always do that anyway). I would not recommend CO^2 at all, even if you have one now. Expensive to buy and maintain and very ineffective. Have a water hose connected and within reach of the shop. If you have a pressurized water extinguisher, that's handy; just keep the pressure up. Definitely do not try to fight a flammable liquid fire with water as you will only spread the misery around.

Mount any extinguishers right by the door for easy access (and quick get away if things go south). Every year or so, take a rubber mallet, turn the extinguisher upside down and thump it until you can feel the dry chem "slosh" back and forth. If a dry chem is discharged even a little bit, it must be recharged as the powder screws up the seal and it will leak down.

If you buy a dry chem extinguisher, get one with a metal head: you can't refill the ones with a plastic head. And here's a good one – without anyone watching, read and understand the instructions before the fire.

Cheapest of all: get a 1 to 5 gal. pail or similar with a closing top that you can reach your hand into, go to Save-On and fill it with bulk baking soda. That's all regular dry chem is, and it works the same. Good plan for the kitchen but on a smaller scale – unless the cook is prone to burning dinner a lot. The stuff in the extinguishers is treated with silicone to flow nicely and not clump up. The ABC powder is different stuff completely and there is no cheap alternative.

FINALLY – THE END

My objective is simply to give food for thought and perhaps some little known background. Most of the stuff here is all about common sense, available information, general shop cleanliness and some proactive thinking. I have no problem sharing this information as it does not jeopardize my job security one tiny bit. Over the years I have learned that I have a good job, in large part, because "some people just need lookin' after". By definition, a woodturner doesn't fit into that category, so you should all be a little safer and my day job will still be there tomorrow.