Anyone else wear a respirator while sharpening?

Posted by Allgonquin - 09 May 2012 20:58

I noticed a discussion about magnets to lessen the cleanup and swarf which collects around the WEPS after a session. I also noticed some direct evidence in my handkerchief after doing a few knives in a row and blowing my nose!

For a quick touchup - no, but If I'm reprofiling from scratch I'll put on my respirator (3M 7503 type). Doesn't help the cleanup of the WEPS, but I'm sure it helps my lungs. In my shop over the years I've used disposable masks and other single cartridge type respirators, but I find this 3M to be very comfortable and effective. Highly recommend this as a preventative measure.

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Re: Anyone else wear a respirator while sharpening?

Posted by wickededge - 11 May 2012 22:39

I've got a couple weeks of travel lined up, but when I get back, I'll definitely do some testing and research.

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Re: Anyone else wear a respirator while sharpening?

Posted by AnthonyYan - 12 May 2012 08:55

Has anyone tried the suction-nozzle thing yet? I mean a set-up similar to a woodshop where sawdust is vacuumed up as soon as it is generated.

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Re: Anyone else wear a respirator while sharpening?

Posted by dgriff - 14 May 2012 15:57

AnthonyYan wrote:

Has anyone tried the suction-nozzle thing yet? I mean a set-up similar to a woodshop where sawdust is vacuumed up as soon as it is generated.Well, I tried taping the hose of my vacuum cleaner to the stones, but the tape kept getting cut on the knife blade, and the hose was swinging wildly around....

I suppose if one had the room that a 'fume hood' arrangment could be useful. Something similar to that used on benches where a lot of soldering is done or chemicals are used, but usually they are noisy.

We could also let our nose hairs grow out to perform their natural filtering duties more effectively. It's more likely that the handkerchief spotting came from the nasal passage mucus membranes and hairs (doing their job), not the lungs. If you're coughing it up, then that would be more reason to worry.

I'm wondering if some of the 'airborne dust' is also from the binder matrix as it erodes away.

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Re: Anyone else wear a respirator while sharpening?

Posted by CrimsonTideShooter - 17 May 2012 18:16

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Allgonquin wrote:

Hi Clay,

The filters on my 3M are purple (2091 type) and I use the respirator for other stuff like wood sanding and rough metal grinding, so at the moment the evidence is tainted and somewhat difficult to see.

However the evidence was graphic in my handkerchief after doing several knives around Christmas time one evening. I too thought that most of the metal dust would be too heavy to float and be breathed, but it appears not to be so. And it's not like I'm swiping the stones with wild abandon - I think my technique is normal, at least after viewing tons of WEPS videos!

Rgds,

I think of occams razor in times like this..

Is it more likely that the heavy metal dust particles floated into your nose,

or it is more likely that the metal dust on your fingers got into your nose by you touching your face? Humans touch their faces on average 2.5-4.5k times a day, and we are not conscious of it most of the time.

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Re: Anyone else wear a respirator while sharpening?

Posted by Allgonquin - 17 May 2012 21:13

Howdy Crimson,

I'm a mechanical engineer with a lot of knife making experience. Been around a lot of shops, ground a lot of metal in my day. While I probably touch my face just as much as anyone, the black in my handkerchief wasn't from that! Just reprofile a set of half a dozen kitchen knives in one setting and take them up to 1000 grit. Then look at the WEPS mounting board, look at the paper towels or cloth rags you use to wipe off the blades from time to time. Lots of metal dust there. Lots. And some percentage is going up your nose, if you aren't using a respirator.

Someone noted that the stuff was most likely coming from my nose, rather than my lungs - I don't disagree, it most certainly was metal dust (and yes, perhaps diamond dust as well, which I don't want inside me either) which had stuck to the mucous membranes in my nose, later to be blown out. But I could feel in my breathing after that session that some was in my lungs as well. The feeling went away after some hours, can't say as I know the mechanism for that process, biologically speaking.

Don't get me wrong, I'm not trying to preach or "convert" everyone to using a respirator, far from it. I was just asking if others had adopted the habit. The older I get, the more I pay attention to stuff like this, and hearing protection, and gloves when applicable, etc.

Rgds,

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Re: Anyone else wear a respirator while sharpening?

Posted by BassLakeDan - 17 May 2012 23:24

I think of occams razor in times like this..

Is it more likely that the heavy metal dust particles floated into your nose,

or it is more likely that...(etc..) and we are not conscious of it most of the time.

Crimson I appreciate your thoughts on this but you must listen to experts here, and not rely on "occams logic." Allgonquin, an engineer, has told you, and now you get to hear it from an industrial chemist that managed factories where tons of finely divided metals were used every year. We had to put assembly workers, in some cases, in positive pressure breathing suits, to handle all manner of "heavy" metals, iron, titanium, magnesium alloys that floated up from the work. Take my word for it you are confusing yourself with the term "heavy". Finely divided materials float in air! Actually the air around you at this very moment is filled with pounds and pounds of junk, it is just that your eyes are not capable of resolving it and telling your brain that it is, in fact, there! It is a case of 'out-of-sight-out-of-mind" . It is very much there, and very much a hazard.

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Re: Anyone else wear a respirator while sharpening?

Posted by AnthonyYan - 18 May 2012 02:25

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Hi Allgonquin, BassLakeDan,

Thanks for your input.

I guess there's another way to think about it:

In desert areas, there is a ton of airborne dust, which is basically very fine sand. Sand is relatively heavy, but still gets airborne. Apparently, sand can have a specific gravity from about 2.6 to 7.0 (give or take depending on purity and porosity). Steel definitely is denser, with a specific gravity around 7.8.

www.reade.com/Particle_Briefings/spec_gra.html

You might think,"Oh, well, steel is several times denser than sand, so it won't be airborne." However, one should return to scaling laws from undergraduate physics. Since steel is 3x times denser than silica, it can get airborne so long as the particles are 3x smaller. Below, I briefly describe the physics for this.

For a particle, the two main forces we're interested in are the force due to air resistance (ie: small air currents), and the particles weight. When the force due to air resistance is at least as big as the weight of the particle, then it can easily take-off and get airborne. Very roughly speaking, the air-resistance of a small particle is proportional to it's cross sectional area. But it's weight is proportional to it's volume. Let's assume the particle is roughtly spherical.

Let c1 and c2 be constants (discussed below).

Let r be the radius of the spherical particle.

Force on the particle due to the small air currents in a typical room:

F_air = c1*r^2

Force of gravity due to the weight of the particle.

F_grav= c2*r^3

I'm cheating a little, because the force due to air, F_air, will depend upon the velocity of the air. (ie: the "constant" c1 will depend on air velocity.) But suppose we fix the velocity of the air to be something small, but typical of air-currents in a typical room (say with air conditioning or something; maybe several inches per second (I'm guessing based on watching steam or smoke in the kitchen)).

For gravity, we'll adsorb various constants like the density of metal into the constant c2. This also includes things like the constant factor for the volume of a sphere, namely (4/3)*pi.

Now we can ask, what happens when the radius, r, gets very small? As r shrinkgs, the cube, r^3, goes to zero faster than the square, r^2. So at some point, r will be small enough so that F_air > F_grav. At that point, we have liftoff for our tiny metal particles.

Particle can fly when F_air >= F_grav which is the same as saying F_air/F_grav >= 1.0

F_air/F_grav = (c1/c2)*(r^2/r^3) = (c1/c2)/r = c3/r

where the constant c3 = (c1/c2).

So whatever the constant c3 is, if we make r small enough, then c3/r will be huge, in other words bigger than 1.0. For a fixed constant c3, we can always make r small enough so that:

c3/r >= 1.0 which means F_air >= F_grav.

Here is the key point and conclusion:

We have just shown that for a very simple model (spherical particles), you can always get airborne, so long as the particle is small enough.

In physics we give this type of r^2 versus r^3 analysis a name. We call it "surface-area versus volume" or "surface-area to volume ratio", and it occurs all the time. What the math shows, is that as we shrink the particle size, it's air resistance shrinks, but its weight shrinks even faster! So at some point, air-resistance beats particle-weight, and the particle can go airborne.

In practice, how small does r need to be for steel particles to float around a room with currents from air-conditioning? I don't know, because I have not finished the calculation which would involve getting actual numbers for the constants c1 and c2.

But just consider that r is very very small.... With our super-fine grits these days, our grit-sizes are already micron or sub-micron sized. It is not hard to imagine that the swarf we generate could be about as big, or smaller than the grit size. So we're talking about micron and sub-micron sized metal particles. Given that powdered glass (ie: very fine sand dust) can easily blow around in the wind, it's not hard to imagine that steel could do the same, so long as it was more finely ground.

Our metal particles are smaller than a human red blood cell (6-8 microns)!

en.wikipedia.org/wiki/Red_blood_cell_distribution_width

Our analysis above shows that the critical particle size is inversely proportional to density (the density got adsorbed into the constant factor c2 as a linear factor). So, steel with a specific gravity if about 7.8, and sand with a specific gravity if around 2.6, gives us a density ratio of 7.8/2.6 = 3.0. So if sand-dust blows around with a particle size of r_sand, then we know that if the particle size for steel is just 3 times smaller, it can also blow around. If you believe sand-dust (or dirt-dust) can blow around in the air, then steel-dust can too, so long as the steel dust is about 3x finer.

If airborne particles of sand can have a radius of r_sand, then particles of steel of radius r_steel can blow around where

r_steel

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Re: Anyone else wear a respirator while sharpening?

Posted by CrimsonTideShooter - 18 May 2012 15:10

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Feel like I should clear up my post above since I think it was misinterpreted a bit.

It was meant to be a bit of humor, not some kind of serious post. Tone is hard to measure across written word, I guess that's why smileys were invented.

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Re: Anyone else wear a respirator while sharpening?

Posted by AnthonyYan - 18 May 2012 15:17

Hi CrimsonTideShooter,

LOL!

Well, you're in a forum full of people who enjoy being helpful.

And I'm a science junkie who likes explaining stuff... So don't mind me.

"When in doubt on the internet, it is better to over-smiley than to under-smiley."

Sincerely

--Lagrangian

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Re: Anyone else wear a respirator while sharpening?

Posted by mark76 - 19 May 2012 00:55

It's great, Lagrangian, to have someone who can throw in some exact analyses in addition to the experiences and wisdom here! I enjoy many of your posts.

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