3M Transcript for the following interview: Ep-1-Respiratory Selection Part 1

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Welcome to the 3M Science of Safety podcast presented by 3M Australia and New Zealand Personal Safety Division. This is a podcast that is curious about the signs and systems of all things work, health and safety, that keep workers safe and protect their health. I am Mark Reggers, an occupational hygienist, who likes to ask the questions Why, How, and Please Explain. Whether you are a safety professional, occupational hygienist, or someone with any level of WHS responsibility in the workplace, maybe you are a user of safety products or maybe you are a bit of a safety nerd who finds this stuff really interesting, then this is a podcast for you.

(R) Today we're talking all about air purifying respiratory protection filters. Now these types of filters and masks, those disposable masks that you may have seen on TV on those renovation shows, maybe a half face masks with the cartridges/discs on the side there that you may have used off the job at home, or maybe a full faced mask with an integrated shield in the respirator with the same cartridges. We're talking about all those types of masks and filters. What do you need to know? The selection requirements? When do you need to change those filters? Now one thing I really quickly want to add right at the start here is that these type of filters and masks, air purifying respiratory protection filters, they are not suitable for IDLH environments, which are environments that are immediately dangerous to life and health and/or oxygen deficiency environments. So, environments where there is just not enough oxygen. These masks and filters are not providing more oxygen,

they are just filtering and cleaning out the air for you to breathe in that immediate environment.

I had a fantastic and interesting conversation with Terry Gorman from 3M about these respiratory filters and all those particular topics I mentioned, plus a whole bunch more. Now it was a bit of a long conversation cause there's a fair bit of detail to know on this particular area. So, we've decided to break the podcast out into two parts. Now this is part 1 of those two parts of that conversation. So, enjoy my chat with Terry.

(R) – Welcome Terry!
(G) – Thank you, Mark.

(R)– Terry is a certified occupational hygienist who has been involved in workplace safety for over 30 years. Not quite as long as I've been alive, but still a fairly long time. He's been working for 3M Australia New Zealand for the past 18 years. He's also a current member of the Australia New Zealand standards committee around respiratory protection (ASNZS 1715 – 1716) as well as the Iron Face Standards Committee (1337 and 1338). He currently represents Standards Australia on the international standards organization committee, around respiratory protection. There's a whole bunch going around there at the moment Terry.
(G) – Sure is. Lots of work and still going.
(R) – Still going. I remember chatting to you a few years ago telling me it's just around the corner, and here we are a few years on and you're still telling me the same thing.
(G) – Yeah, international complications. Let's leave it at that.

(R) – Let's leave it at that no worries. So respiratory filters! So, when we talk about respiratory filters do all respirators have filters?

(G) – Not exactly Mark. There's obviously a need to provide respiratory protection. One of the major ways is to use a filter to capture the contaminant from the air and allow clean air to go into your lungs and let you work safely.

(R) – Now obviously we're talking about respiratory filters, so PPE. I guess it's an important point to reinforce that PPE is the lowest on the hierarchy of controls. Absolutely you want to be as a workplace highlighting, focusing on those higher controls, but the reality is that most of the time it's going to be a combination of controls. And I know when I'm doing training and talking to people, if you are needing PPE or it's an interim control it's no less important than any one of the other controls as well. Because it genuinely is the last line of defence between an exposure and something happening. Is that sort of similar in your experience Terry when you're trying to communicate where PPE fits into the scheme of things?
(G) – Oh absolutely. The principal is, as you say, the use of other controls first. PPE is available immediately which is a big advantage, you can start protecting your people as soon as you need to. But the other controls are more controllable in terms of what you can put in cost wise, practicality, all of those things come into play. PPE, the last step on the hierarchy, but an important one and there certainly is a lot of places where it's the only logical or reasonable way to protect people.

(R) – Like I always like to say, PPE can be really, really effective, no doubt about it. But the effectiveness relies on the worker. The individual. You could have the best respirator, the best systems, the best training in place, but if they don't put it on their mouth, well we're talking respirators, it isn't going to do anything. So that effectiveness really relies on that worker to make that decision and choice to do the right thing.
(G) – Yeah, absolutely. And as we all know, anything to do with people always becomes a bit more complicated. You've got to get them trained, you've got to get them motivated to do the right things, on an ongoing basis every day.

(R) – So if I'm a workplace and it's dusty or maybe I'm using paints or solvents and I want to get information about respiratory protection. Where would be, where's a good resource, a good place that places could look up or have a read of?
(G) – There's a number of places. If you are seriously into respiratory protection, you should be looking at the Australian standard 1715, that gives a whole lot of information about the issues you need to consider. There's resources online, there's some of the government regulators, the state regulatory bodies, the Safe Works and the Test Safes and those sorts of things. There's plenty of general information all across the web if you go looking. Manufacturers are a good source, they know their products. They know what they can and can't do. What they're designed to do, what are the operating parameters and even the limitations.

(R) – So I'm a workplace and I'm a building company and I'm looking at my workplace, what do I need to know, what type of filter or respirator should I select?
(G) – The first issue is what are you needing protection from? So, what are the contaminants that are in your workplace? That then drives towards a solution. So, you've got identification of the contaminant, and then you've got to worry, or make an assessment of the level of that exposure. Is it low down, low level not so bad or is it maximum level, very significant health hazard area? So, it depends on that specific knowledge in your applications in your workplace as to which way to jump.

(R) – So I know I've got dust, or particulates. So, as you say in more layman's terms, how much? Do I have a little, do I have a lot that I'm trying to protect against? That's on the particulates side. Gas and vapour, what kind of knowledge would a workplace be thinking of in that space?
(G) – It's the same game. You need to identify what the exposures to the gas or vapours in your workplace attached to the tasks that are being done. Then again, you'd look at the scale of that exposure, is it insignificant, is it moderate, is it very high level? And that again drives you towards a solution in terms of the protection that you need.

(R) – So we've got dust, few mist fibres that sort of fall in that particulate category. Then we've got our gas and vapor. So, if we know we are trying to protect our workers from particulates, we'd look at a particulate filter. I've seen those white ones on The Block and those kinds of TV shows. Is it as simple as that? Go for the white one?

(G) – Well, some of them are white, you're right. It's a case of once you've established what your exposures are and to what materials, and if they are particulates you can go with a disposable type mask, as you talk about the white ones you seem commonly, they will give you a level of protection. They are not going to be able to deal with the excessive high exposures, but in the right context and the right exposure level, they can certainly give you a protection that can be affective.

(R)– So another thing on respirators – P1, P2 and P3 – what's the difference between them?

(G) – Right so that gets us back to the sort of standard, the Australia New Zealand combined standard for respiratory protection and that sets up the guidelines if you like in terms of what we use. For particle filters there are 3 grades. P1, as you said, that's for mechanically generated particles. So, materials created by a mechanical action – grinding, sanding, cutting, sawing, drilling, all those sort of mechanical actions will create a relatively large particle and a P1 filter will be able to deal with that. P2 is the next level up – that is a level that is designed to deal with the mechanically generated as we just talked about, plus they can deal with thermally generated particles. So, the classic example there is welding fume, where a high energy type input, like a welding arc or molten metal bath or some plasma cutting something like that is breaking apart the sub straight, creating a whole lot more smaller particulates and we need a higher preforming particle filter to capture those and the P2 is the one rated for that type of operation, or those types of operations.

(R) – I've seen those disposable ones that we've mentioned, and P1 to P2, just looking at it by eye they look pretty much exactly the same. What's actually different about them, because to touch them, to look at them, they're pretty darn similar.
(G) – Yeah, there's not a whole lot of difference as you say, visually. The difference is in the filtering efficiency. So, all these masks are tested against a standard testing aerosol. And we require the P2 to have a higher efficiency than the P1. That means you've got slightly more filtration material in the product, not enough to look different or you know be obviously different as you say, but they do have that different performance because of that slightly thicker filter let's say in broad terms, gives us a better filtration performance and captures those smaller particles that we get from thermal generation.

(R) – Well aware that a P1 changes over to a P2, will there be much difference to the wearer going from a P1 because of that depth or the size of the filter?
(G) – There is a small penalty to pay – if you increase the filtration efficiency that broadly involves increasing the depth of the filter. That increases the breathing resistance, so there's a slight increase in the resistance to your breathing when you go to a P2 from a P1. It's not cheese and chalk, it's not a massive increase, but there would be a small measurable increase.

(R) – So P3. We're going from P1 to P2 and going up. So natural assumption P3 is a higher level of protection or efficiency. Will that be a safe assumption, or if there is a safe assumption to assume?
(G) – Sure, P3 is the highest rating of particle filter, sometimes called a HEPA filter. These are for obviously, will capture all particulates at a very high rate of efficiency. So that's the one we use when we're going to need high levels of protection against high concentrations of particulates.

(R) – As well as high ones, I know I've read about highly either toxic, when you think about I guess contaminates where it won't take much to actually cause a significant amount of harm, that would be a P3 situation as well?
(G) – Sure. Materials that are very toxic, and as you say, very small amounts can cause a health affect, we obviously want to make sure we're capturing those with our particle filters, so would use the highest level or particle filters, and a high level of overall protection from the respirator that's being used.

(R) – So these filters – P1, P2, P3 – all being particulates, how do they actually work? Because we're talking about really small stuff, we're talking about really big stuff – is certain filters better for different sizes? Or not as good for different sizes of particulates?
(G) – Umm, yeah sure. So, hygienists basically say the larger size particle that's going to get into your respiratory system is about 100 micron. That's .1 of a millimetre. So, we're talking pretty small. They're the ones, the big ones get caught in your nose, the smaller ones, the micron and sub-micron size will go all the way down through your lungs and right down deep into the alveoli where the oxygen interchange takes place. So, we need to be able to capture those particles across that whole range to keep them out of our lungs. The particle filters are designed to do that. They are designed on a fibre, so you have a bed of fibres. These fibres have an attraction for the particulates. There are forces that work to make those particles stick on if you like, and get captured. So, as they go through the filter bed, they will hit a fibre or be pulled onto a fibre and held, therefore the air is getting cleaned and therefore we're getting clean air coming through to our lungs.
(R) – I know it sounds a bit silly, but when I try to explain filters and you know to try to visualize it, cause you go "it's just a bed of fibres". I go "imagine a plate of spaghetti. And the deeper the plate of spaghetti, the more it's got to work its way through". I know it probably sounds a bit silly, but I find it helps visualize it for people trying to think about you know you're breathing that air through, and that particulate has got to work its way through the spaghetti to work its way through to

the other end of the. Any other sort of visual things to help explain this when you're thinking about how these filters are actually working?
(G) – Yeah, that's sort of, you're right, its broadly like that. The concept is defence in depth. So, we're not talking a tea strainer, we're not talking about particles getting caught because the hole to get through is too small like we do with a tea strainer. We use that concept; the filter would block up very quickly and would not last long. We're talking about defence in depth where the bed of fibres, maybe the particle going through misses the first fibre, missing the fifth fibre, misses the 10th fibre through but it'll get caught by the 20th or the 50th fibre that is passes. Overall though, that filter is working at the level at which it is supposed to – P1, P2, P3 – and giving us the protection we expect.

(R) – So something I've read – P1 80% efficient. Now I remember when I first read that. I saw that and through "gee, that's not very good. That's only 80% efficient letting 20% of stuff in". Can you explain that? Because that doesn't sound very good when you first read it.
(G) – Yes, it's not a logical thing, or its logical when you understand it. But yes, off the bat it seems a bit strange. Now, we already said P1's are targeted for use against mechanically generated particulates. When the filters are tested, they are tested against a particle size of about .1 micron in size. The physics of particle capture, and that's a whole chunk of science in itself that I think we're just move past. The physics show us that the most difficult particle size to capture is about .1 micron size. The bigger particles are easier to capture, and everyone gets that – bigger particle, easier to capture – that's logical. But conversely, the smaller size particles are easier to capture. That is not logical. So smaller than .1 micron are easier to capture than the .1 micron size. That doesn't fit in with our normal common-sense approach, but what's happening is those very small particles are being bashed around by the air molecules. They're so small they're having an interaction with molecules. They're being pushed sideways into the fibres and the effectiveness of the capture goes up. At the end of the day, we're using P1 rated

filters for mechanically generated particles. They are micron and 10's of microns in size. Those size particles are very well captured by a P1 rated, and way higher than the 80% required against the test aerosol. So, in practice as long as we use a P1 for mechanically generated, we will get the performance that we expect.

(R) – So what are the efficiency levels on the P2 and P3?
(G) – Right, the P2 is a higher efficiency as we said. It's at a minimum of 94% efficient against that same teste aerosol. That's to allow for the smaller particles that we talked about, the thermally generated ones. P3 filters are 99.95% or better against the test aerosol.

(R) – I've seen filters for half face masks that have P2/P3. So, what's happening there?
(G) – To achieve the full measure of protection that a P# filter gives you, you've got to look at the overall performance of the product. So, the face masks itself has got a performance separate from the filters. Once the filters are on the mask, that overall respirator, it is given a protection factor by the Australian Standard, and that's what we use to assess what's suitable in the workplace. If we are using a P3 on a half mask, we get the same level of protection as you would if you were using a P2 filter on a half mask.

(R) – So that filter can essentially go on a half face and full face, and you would base that protection factor off what it's going on?
(G) – Correct. It's the overall performance that's of concern. The filters do their thing, the mask has to do its thing as well and seal on the face and provide the overall level of protection for that whole product.

(R) – So if I'm wearing a respirator and I'm working hard, well I'm appearing to, no I am working hard, when do I change a particular filter? Does it – once a day, once a week, once a month – what do I need to know?

(G) – So the particle is capturing particles as designed. It's loading up with those particles and over time it will start clogging up the air, it gets harder and harder for the air to get through that filter. Now depending on how much dust and how many particulates you're working with, that time will vary, but at some point, that breathing resistance to get the air through that filter becomes too high and no longer comfortable for the wearer, that's the time to change it. That could be in one hour, five hours, five days, depends on that loading on that filter as to when it is time to change.

(R) – So essentially there's lots of variables in every situation and every work place will vary slightly depending on all those different factors. What about limitations? They sound pretty amazing, they can capture all these things and the smaller they get, the better they capture it. When would I not use a particulate filter?
(G) – Well you would not use a particulate filter if you don't need it. So, it's all a case of horses for courses, if you like. If the particulate level exposure is of concern, then you need that particulate filter, to give you the right type of particulate protection. Particulate filters though do not work against vapours and gases. So, you've got to take that into account. If you have a mixture, you would need to use both types of filters. A particle filter plus an appropriate gas filter.

(R) – So, Terry are there other standards or ratings of other particulate filters that people may come across in Australia that are not Australian standards approved, or through that rating system?
(G) – Ahh yes absolutely. The Australian New Zealand standard has their own regime and own application in the jurisdictions in the states and even other countries are using the Australian New Zealand Standard. But the other big jurisdictions who have their own respirator standards, is the European standard and the USA's standard for respirator protection. They have slightly different testing regimes, slightly different classification schemes, and you'll see different ratings for those. The European's have a quite similar system where you'll see them talking

about P1, P2 and P3 much the same as we have. The American's have a different nomenclature. You will see things like N95, P95, R100's that sort of thing, and that's the rating under their standard. The most common one you'll probably bump into is the N95, that's the standard P2 equivalent if you want to put it into Australian New Zealand terms. So that could be appropriate for use in similar applications, that is mechanically generated and thermally generated particulates. (R) – That's the end of part 1 of our chat with Terry Gorman. Really hope you've enjoyed what you've been listening to so far and we'll have that second part in our next episode of the podcast. Thanks for listening to part 1 so far. If you have any questions, comments, suggestions for any future topics or guests you think would be great to get in the studio, please shoot us an email at scienceofsafetyanz@mmm.com You can also contact us via that email if you need any further information on anything we've been talking about today. Or would like any other information related to PPE selection, hazard identification, use and maintenance of safety equipment in the workplace. Be sure to subscribe to the podcast through iTunes or wherever you get this podcast from so you don't miss any future podcast. If you enjoyed the podcast, or found it informative, we'd really appreciate it if you could take a few minutes to give us a review at it really helps other people find the podcast as well. And as Louis Beniwal says "Age is something that doesn't matter, unless you are a cheese". Thanks for listening and have a safe day.