

3M Transcript for the following interview: Ep 100 Maurice Gould – Protective Coveralls Part 1

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(R) Welcome to the 3M Science of Safety Podcast presented by 3M Australia & New Zealand Personal Safety Division. This is the podcast that is curious about the science and systems of all things Work, Health and Safety that keep workers safe and protect their health. I'm Mark Reggers, an Occupational Hygienist who likes to ask the questions. "Why?" "How?" And "Please explain." Whether you're a safety professional, Occupational Hygienist, someone with any level of WHS responsibility in the workplace, maybe you're a user of safety equipment, or maybe you're a bit of a safety nerd who finds this stuff really interesting – then this is the podcast for you.

Today, we're talking all about selecting protective coveralls with Maurice Gould. How are you Maurice?

(G) Hi, very well, thank you.

(R) Well, thanks for joining us. So, can you please introduce yourself? Who are you? What do you do and where are you from?

(G) Okay, right, Maurice Gould and I work for 3M as European technical specialist. My main area of specialty is protective coveralls, but I also look after protective eyewear and some of the head and face products. So, that includes helmets and face shields. My career began with 3M... well it really began with a company called Dailys, back in 2008. And my job there was a technical manager and we manufactured Coveralls for 3M. So, it wasn't too much of a surprise that after a couple of years, 3M bought the company. So, 3M acquired Dailys and in doing so acquired me as well. So, my role has expanded since joining 3M and here I am today in my role of European technical specialist.

(R) So, we're talking about protective coveralls and now we can't get away from talking about the hierarchy of control. So, where do protective coveralls sit in the hierarchy of control? And why?

(G) The key thing for anyone considering personal protective equipment (PPE), whether it's coveralls, safety eyewear, respirators or hearing protection, is to understand that even though PPE is probably the easiest solution to the problem, other solutions to avoiding the risk of being injured by a hazard should be considered first. So, for example, is there a way of eliminating the hazard from the workplace? Are there alternatives? Are there any engineering controls that could be put in place, such as maybe putting a physical barrier between the worker and the hazard, and only when other solutions have been ruled out or cannot completely eliminate the hazard, should PPE such as the coveralls be considered.

(R) Now, when we talk about these different types of PPE, these different routes of entry. So, why should workplaces be so focused on covering the skin route of entry when it comes to these different types of hazards?

(G) Well, our skin is literally the largest organ in the human body and it's also one of the most complicated. Not only does the skin hold everything in, it also plays a crucial role in providing an airtight, a watertight and a flexible barrier between the outside world and the inside of the human body. So, it's important that we do all we can to protect it from the many hazards that people find in the workplace. There can be a liquid hazards, such as chemicals which can cause burns or are carcinogenic. But there may also be particulate hazards, so dusts, which may be just as harmful. So, you know, protecting the skin is critical.

(R) To help set the scene for our listeners, are the specific industries or common applications where coveralls are commonly used or may be used to protect workers and all these different areas?

(G) Well coveralls are used in all sorts of industries and applications. Some coveralls maybe worn, you know, to simply keep the wearer's own clothes clean. But in most industrial applications, they are worn to protect the wearer from very specific hazards. In terms of industries is the chemical and petrochemical industries are obvious ones where protection is needed against very specific chemicals. But most industries have a need for some sort of protective clothing, whether it's for asbestos removal,

the food industry, crop spraying, construction, manufacturing, car paint spraying, pharmaceutical, biohazards, clean rooms. You know that these all have very specific needs and it's important to select the correct coverall that offers the best protection for that application.

(R) I previously worked around the asbestos removal industry as a licensed asbestos assessor and certainly it was a key control measure for those removalists, whether it was friable or non-friable, so critical to get that right. Now, you've mentioned a lot of different industries, a lot of potential hazards there. So, when it comes to selecting a protective coverall, what are some of the key criteria or factors that workplaces should be thinking about, rather than just looking in the catalogue or a website and picking at the one that's got the nicest colour?

(G) There are so many factors that need to be considered that it is something that in many industries is the job of a health and safety professional. Although we're the manufacturer of a large range of coveralls, we don't understand the specific applications and the work environments, as well as the actual health and safety professional or the worker in any particular situation. So, there are many questions or factors that need to be considered. These are things like the physical state of the contaminant.

(R) Do you mean like a liquid or dust? Is that what you mean by the physical state or gas or vapor as an example?

(G) Exactly that and also obviously, what that contaminant is, what the exposure type. So, for example, if it's a liquid contaminant, is the risk a light splash of that coming onto the worker? Is it a light spray, or is it a heavy spray? And the reason I'm using that kind of terminology of a light splash, a light spray or a heavy spray will become clearer later on, when we look at the types of protection in chemical protective coveralls. For each one, there's a different solution and whilst you may think it's easier to go for the coverall that offers the highest level of protection against the most chemicals or the heaviest of sprays, this actually carries other risks to the wearer in terms of overheating. So, questions about the working environment also need to be considered, such as the temperature, the humidity and the length of time that a worker may actually be wearing a coverall for. Other things like if there's a risk of static build-up. Then again, this needs to be considered. If the working environment is in a clean room, then coveralls

that shed little or no lint, they also need to be considered, So, there's a whole array of considerations that need to be thought about.

(R) The way I guess I'm thinking about it, I do a lot of respiratory protection advice for workplaces, and quite often they just want to go for the filter with the most type of, you know, an ABEK filter as an example, but they may only need it just for an A. So, they're going to be paying for something, it's going to be heavier, more uncomfortable. I know it's a bit of a similar analogy for a different type of PPE, but it's got to be specific to the situation, and not just about whether it's acceptable, because that suitability is such a key criteria there.

(G) It is. Yes. There are different types of protective coveralls. And as I said at the last answer, if you choose a coverall that may be the most protective, you could actually be adding to the risks that the worker faces in terms of overheating. And one of the situations I often mention in this sort of question is the Ebola crisis a few years ago in East Africa, where workers were wearing quite necessarily quite a heavy coverall, but they were only allowed to wear it for a couple of hours, because they would overheat. They would get too hot if they wore it for any longer than that. So, they would then, after an hour or two, take it off, have an hour or two's rest, before they started work again.

(R) Now, sometimes I'll get a phone call or an email and someone will say I'm asking for a Type 5 or a Type 6 coverall. What does that mean, and does that sort of lead back to that, you know, whether it's a spray or a splash? Can you explain that for us?

(G) Yes, certainly. I'm based in the UK. So, under the European PPE regulations, there are three categories of PPE. Category 1, simple, Category 3, complex and Category 2, basically for anything in between. So, when we look at chemical protective coveralls or body protection in terms of those three categories, Category 1 products are simple coveralls that are intended only for protection against non-hazardous liquids and risks. There are no Category 2 coveralls, but within Category 3, which includes coveralls intended to provide protection against the hazardous substances, there are six protection types. So this is where it gets a little bit confusing cause we're talking about three categories and within one of those categories, Category 3, there are six protection types and what's known as Type 6 coveralls are the most common, or particularly Type 5/6. Type 6 coveralls provide protection against small splashes and light mists.

(R) So, we're talking liquid as that, you know, the physical state of the contaminant.

(G) Yes, that's Type 6. Staying with the liquid protection, a Type 4 coverall provides protection against sprays and are used for, a higher volume or more hazardous liquid exposure and possibly over a longer duration than a Type 6 coverall. And then you've got Type 3 coveralls, which offer the highest level of protection against jet sprays of liquids. So, you know, in terms of applications that Type 3 coverall might be used for things like cleaning out tanks or chemical spillages. So, you've got Type 3, Type 4 and Type 6 coveralls that offer liquid protection.

(R) So, one of those questions would be, all right, I'm working with a liquid. What is the type of interaction I'm going to have? Whether that's light or heavy or constant? So, that's a key question to think for our listeners out there: What are you doing? And what's that interaction you may be having with a liquid, potentially?

(G) Correct. It's not just the contaminant, so not just what the actual liquid chemical is, but also, as you say, the interaction. How heavy the interaction might be between the worker and that contaminant.

(R) So, what about dust or particulates? That's Type 5 you mentioned before?

(G) Correct. Yes, a Type 5 coverall is for particulate protection, such as dusts as opposed to the liquids. So, most coveralls that offer liquid protection also offer dust protection. So, they may be referred to as a Type 3/5 which is one that offers heavy protection against jet sprays and the dust and particulate protection or a Type 4/5 and then the most common is a Type 5/6. So that's dust protection and light splashes or sprays.

(R) So, depending on what that material is, then it could be a mix of those different ratings. Depending on how it performs in those certain tests. Makes sense, when you think about it. What is the type of hazards and what's the level of an interaction of that hazard.

(G) Yes, yes.

(R) So, with these materials, I'm thinking of a coverall. It's going to cover a worker you know, pretty completely and or their hands and feet sticking out. When coveralls are tested, do they test the material only, or do they test the whole suit, as a combination?

(G) The testing is really thorough and, yes, it is both; the fabric and once the testing of the fabric has been completed, we will then make up full suits and they then go through a whole array of further tests. So, it is the complete product that's tested.

(R) So, if you were developing a new product, what would be the first thing you would do? You would make the suits the whole? Or you'd start with the fabric to begin with?

(G) We start with the fabric. So, you know, let's say if we're developing a new product, the first thing we do is test the fabric. There's a number of mandatory tests that include both testing the physical properties - mainly around the strength of the fabric – as well as the level of chemical protection that the fabric offers. The physical tests are all to approved European standards, many of which are also ISO (that's international standards). These tests include seeing how the fabric resists abrasion. So, for example, being damaged by being rubbed against other materials. So, you know, in a workplace, if you've got somebody moving around rubbing against work surfaces, abrasion resistance is quite critical. We also have to test to see how easily the fabric may crack. So, for example, you don't want to be wearing a coverall made from a fabric that easily splits or cracks, because any break in the fabric will then allow any chemical contaminants - any chemical liquids - through. We also test the physical strength of the fabric. So, we're looking to see how easily it can be torn or punctured by sharp tools, for example. So, when we've tested the physical properties of the fabric, we then start looking at how effective it is in protecting against splashes of chemicals. Obviously, it's impossible to test every chemical, so in the European standards, there are four chemicals that are selected for testing. Those are sulfuric acid at 30% concentration, sodium hydroxide, 10%, o-xylene and butan-1-ol. These are tested in what we call a 'gutter test', where you look at how much of a chemical is repelled off a fabric - which hopefully it's going to be all of it - and how much penetrates the fabric and ideally, you want none of the chemical to actually penetrate through the fabric. If we're testing a fabric that's going to be used in a Type 4, so that was the spray or a Type 3 jet spray coverall, then we also have to test for chemical permeation. So, that's a much longer test than the gutter test, which is penetration and repellency. But a permeation test looks to see how long it may take for the challenge chemical to permeate through the

fabric on a molecular level. So, it's a much more complex test. And only when the fabric has been fully tested and we can see that it should do what we want it to do, do we then make up the full suit samples for further testing.

(R) So, you get these materials, make a full suit. Then how is the full suit testing done?

(G) Again, the type of full suit test that's carried out depends on the intended purpose of the finished product. So, for a Type 6 coverall a wearer – and this is an actual live person - literally puts on the coverall they put it on over a special absorbent undergarment and they then stand in a spray booth, which is like a shower, and they're then showered with a light mist of dyed water. It's normally a blue dyed water. After a minute, he steps out of the booth and the coverall is very carefully taken off. It's kind of peeled off, almost, by the laboratory examiner and he then looks for any blue stains on this under suit that the wearer was wearing. If there are any stains on that undergarment, these are measured and provided they are less than three times the size of a calibration stain, then they are considered to have passed. So, interestingly, you are actually allowed to have a little bit of penetration go through the cover all and it can still count as a pass. Ideally, we want there to be none. The Type 4 test is very similar to the Type 6. The main difference being that the volume of liquid that's showered onto the wearer is much higher than in the Type 6 test. The Type 3 test is quite a bit different, but the principle is the same. So, instead of a shower of this blue dyed water, the examiner actually fires a powerful jet at the wearer, at various points on the suit that he has considered to be the weak points. So, this is usually the seams or the crossover points or the zipper. So that's the liquid tests. We look at the Type 5 tests, that's done for dust particles or particulates. And it's also done in a special booth, but this time using a sodium chloride solution and that's dispersed inside this special booth, whilst a wearer does various exercises, such as walking on a treadmill or doing squats and at various points in the test, readings were taken from inside the suit to measure how many particles have then penetrated through. To get a pass for a Type 5 test, 10 suits are tested, and there are certain criteria that have to be met in terms of the amount of particle penetration. So, we've looked at the liquid tests. We've looked at the dust particulate test and then the other thing that we do on a full suit is the seam strength tests. And this is to see again how robust the finished coverall is. So, we've looked at the strength of the fabric, but we're now looking at how strong the coverall has actually been constructed, How well it's been sewn up, and will it stand up to the rigours of being worn in an industrial environment?

(R) That makes sense with seams, but being potentially the weak point of the coverall, you know, this really fantastic material, but if it's sewn together quite poorly or weakly, it's going to tear and allow those contaminants to get in. So, it does make sense that the seam strength is also part of those tests as well.

(G) Yes.

(R) So, with some of the material tests you mentioned before and you mentioned some of them. Are a lot of these tests just like a pass/fail-type test? All these different levels... because I could imagine depending on the material it's not going to be as straight black and white when these things may be past their limit, so to speak.

(G) Yeah, absolutely right. For all of the physical and the chemical and the seam strength tests, there is a minimum pass level, but there are usually six levels or classes, so it's easier to compare one coverall to another. So, for example, in the abrasion resistance test, a sample of fabric is tested in a laboratory on a machine called a 'Martindale Abrasion Machine'. The way the test is done, the sample is rubbed against an abrasive paper and the examiner will determine how many rubs it takes before a hole appears in the fabric, and the size of this whole is really, really small. It's less than 0.5 millimetres. So, to get a pass, the minimum is 10 rubs for a class one. So, if the whole appears in the fabric in less than 10 rubs, it's a fail, and that fabric is not going to be suitable for a chemical protective coverall. If it passes at 10 rubs, that's a Class 1 and you then carry on doing the test at various intervals up to 2000 rubs, which is the pass level for a Class 6. So, you've got lots of stages between Class 1 and Class 6. And it's very similar for the other physical strength tests, such as tensile strength, trapezoidal tear, flex cracking or puncture resistance. They all have six class levels. For the chemical gutter tests, there are three classes for chemical penetration, with the highest being a Class 3, if less than 1% of the challenge chemical penetrates through the fabric and for repellency, Class 3 is if it's more than 95% of the challenge chemical is repelled off the fabric. If we want to claim that a coverall offers biohazard protection under the European regulation, there are four different tests. And again, each of those tests has different class levels. It can be quite complicated but having class levels does make it easier to do comparisons, particularly if you're looking for a certain type of protection, it might be that one property, whether it's a physical property, the physical strength or the chemical protection, might be more important than another.

(R) I think in the past, when I've looked at protective coveralls and you think "that's just a simple piece of material" or "that's just a coverall". I know I personally didn't appreciate, you know, the criteria and the testing goes through these types of products to perform on the job and protect workers as required. There really is a lot here. Now, I do have a few more questions I do want to ask you. So, I'm going to get you back for a part two, if that's okay. But to wrap up what we've been speaking about today, what would be that key point you'd want to leave with our listeners?

(G) I think that the key point would be to make a careful assessment of the risks that you're trying to protect against, first of all to see if those risks could be eliminated. But if they can't then select the most suitable body protection coverall, taking all of the factors into account. It is a bit of a balancing act, trying to make sure that the worker is suitably protected without being overprotected. So, as I said earlier, don't, for example, use a Type 3 coverall for protection against jet sprays, if the risk is only against light splashes. In that example a Type 6 coverall would adequately protect the worker, but the coverall would be lighter, more breathable, and more comfortable.

(R) I think you mentioned earlier about that heat stress and thermal impact. That breathability is such a key criteria, with all these types of products. If it's not breathable, it's going to get quite hot. So, a lot of things there to consider. So, for those that are interested, for the time being, to get a bit more information about what we have discussed, where would be a good place they should head online?

(G) Go to the 3M website, www.3m.com.au, and from there, if you select Personal Protective Equipment and then Protective Apparel, you can see the full range of 3M coveralls.

(R) And you have covered a lot and I'm sure there's probably a few more technical questions, but if our listeners did want to get in contact directly with yourself, what would be the best way to do that?

(G) Probably best by email, given the time difference. So, my email address is mgould@mmm.com.

(R) Excellent. And could they find you on LinkedIn as well? I know a lot of our guests are also on LinkedIn. Is that an option for you as well?

(G) Yes, certainly. Yes. Maurice Gould.

(R) Excellent. Well, thank you so much for your time today. Really appreciated you sharing your wealth of knowledge there.

(G) Okay. My pleasure.

(R) Well, thanks for listening, everyone. You can get in contact with a show by sending an email to ScienceofSafetyANZ@mmm.com if you have any questions, topic suggestions or would like some assistance in your workplace around appropriate selection of protective coveralls or maybe other types of PPE, 3M are certainly here to help. You can also visit our website <https://3m.com.au/sospodcast> for further resources on protective coveralls, as well as a transcript of the chat we've just had today. Plus, it has all the other previous episodes we have release up until this point in time. Be sure to subscribe, rate, review and share through Apple Podcast, Spotify, Google Podcast or wherever you get this podcast from.

And as Theodore Roosevelt said, "Believe you can, and you're halfway there." Thanks for listening and have a safe day.