3M Transcript for the following interview: Episode 82 Cooling Towers

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Welcome to the 3M Science of Safety podcast presented by 3M Australia and New Zealand Personal Safety Division. This is the 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 equipment or maybe you are a bit of a safety nerd who finds this stuff really interesting, then this is the podcast for you.

(R) Today, we're talking all about cooling towers with Tej Shetty. Welcome, Tej.

(S) Thanks, Mark.

(R) Now, can you please introduce yourself? Who are you? Where are you from and a little bit about what you do?

(S) Sure, Hello to all the listeners. My name is Tej, Tejaswi Shetty. I work at Greencap as a property risk consultant at their Sydney office, and I'm here today to talk about cooling towers. So, to give you a bit of a background about myself, I'm a microbiologist by profession and interestingly, my whole career has been about legionella. The very first job that I got out of university was at a well-reputed water

treatment company where I started making media for legionella enrichment. So, that's how my love and my passion for legionella has grown.

(R) So, trying to grow legionella in the lab essentially?

(S) Exactly, so I started making media for it and then eventually, in the same company, I went on to doing testing of legionella with all the water samples that came from various industries, be it cooling towers or thermostatic mixing valves, warm water systems, hot water systems and various other water samples. Moving on from there, I did a lot of reporting of legionella samples that came in at a NATA accredited laboratory, which is very important. I've also done a lot of food and water testing, management as a quality manager for a global healthcare company, and from there on, my journey went on to being a consultant working at Greencap, which is a national risk management company. We have various teams which also look at environment, property risk, WHS. And in my current role, I do a lot of risk management development for cooling towers, a lot of risk reviews for various water distribution systems; not just cooling towers but other areas.

(R) Well, this is the exact reason why I got you in, to actually talk about cooling towers, because of your extensive background in this area. But to bring it right back down to basics, for those that may not be familiar, but what is a cooling tower and where would you find them?

(S) A cooling water system is an artificial water system. It is a heat rejection device. What I mean by 'heat rejection device' is where the device is used to lower the temperature of the water by evaporative cooling. At this point in the system, the heat is dissipated outside the building and hence provides the cold air to move, into the internal parts of the building and aligned cooling of the building.

(R) So, we're talking air conditioning essentially.

(S) Correct,

(R) So, it's part of that getting rid of that heat to make it cool for people to be comfortable in summer and warm in winter.

(S) Yes, absolutely. And coming to the next part of the question is where would you find them; there are various places where you can find a cooling water system. To start with, they're found in oil refineries, petrochemical industries, thermal powered stations, nuclear powered stations and most importantly, in the HVAC systems for cooling buildings, which is a heating ventilation and air conditioning building.

(R) Which is probably what most people are going to think about when they think of office buildings or shopping centres or other facilities is that keeping cool in a hot time.

(S) Yes, and in saying so, again to simplify this, if you wanted to know how a cooling water system looked just Google put the Google maps on and bring in Sydney CBD and every second high rise building in Sydney will have a jewel on its crown, which is the cooling tower.

(R) I haven't heard a cooling tower referred to as that, but not surprising from yourself, knowing your passion for cooling towers. So, it's a pretty integral part of a HVAC system, so how is a cooling tower actually working?

(S) Cooling towers play an important role in refrigeration and air conditioning, because they can effectively cool the ambient temperature through evaporative cooling. Cooled in one or more cooling towers perhaps, and delivered as an interface, as I was talking before through an air handling system, allowing the water to cool the air. Then, the air handling system delivers the cold air towards or to the integral parts of the building, and the hot air away from the building interior.

(R) So, standing look at the side of a cooling tower, you can hear the water flowing within a cooling tower. Is that part of that evaporative effect you're talking about?

(S) Yes. If you were to be standing next to a cooling water system, that's what you would hear. You would hear the noise. There would be a lot of trickling sounds that you could hear. There are different kinds of cooling water systems, but most of them have the same foundation or logic, is that there's a trickling of the water that the evaporation system using the water as a source and bringing in cold air into the building.

(R) Are there different types of cooling towers? I'm talking about the water trickling, but I know I've seen some other ones where I don't hear any water like I do in the other ones.

(S) Yes, there are different kinds of cooling water systems. Some are counterflows and crossflow systems, but the way they're made is different, but they all serve the same purpose at the end of it.

(R) Which is cooling, hence the name 'cooling tower' as well.

(S) Yep.

(R) So, a lot of your background is around legionella, so what's the association with legionella disease and cooling towers and these water systems? What's the connection there?

(S) Yeah, so, let's start with legionnaire's disease. Legionnaire's disease is the infection of the lungs in the human system, and this is caused by a bacteria called legionella. Legionella is a gram-negative bacteria, or a microorganism, just in simple words. What it does is it attacks your respiratory system when people inhale water droplets, fine drops or aerosols, which has legionella growing in them. And that's the connection between legionella bacteria and the legionnaire's disease. Just to give you a bit of a picture on how the word 'legionella' was coined, or the legionnaire's disease was coined was because of an outbreak that happened in 1976 at an American legion convention where a lot of people who visited this convention, at a hotel at Philadelphia, were infected by an outbreak of pneumonia caused by the bacteria, legionella. And thereon, there was an investigation and

they found that the microorganism that caused this outbreak or caused the legionnaire's disease was a bacteria and they called it legionella pneumophila.

(R) So, these aerosols, are they coming from the cooling tower? Is that how it's actually spreading, or it was a malfunctioning cooling tower, or it's just normal you're getting this mist or aerosols coming from a cooling tower?

(S) It's not a malfunctioning cooling tower as such. It's just not a very well-maintained cooling tower which can lead to the growth and proliferation of legionella bacteria within the cooling water system. So, there are certain risk factors that you have to keep in mind when the stakeholders who are in charge of the cooling water system are looking after it. When these factors are not considered and the system that you have in place fails, then that's where there is a chance that these bugs are going to grow, and the water that's spitting out of the cooling water system, the aerosols, will cause the legionnaire's disease.

(R) From my basic understanding of this, it's more when the water's not moving, so it may have dead ends or dead legs in a water system, and that's when you can have a higher risk of legionella bacteria growing. Am I understanding correct there? And obviously, when they grow, then that moves through the system and that is what is potentially getting dispersed?

(S) Yes. As I said, mainly there are five risk factors that can lead to the growth of legionella and to start with, stagnant water. That's the one that you're talking about, if there is a dead leg, and it's never been used or intermittently used, then there is a possibility that the water that's sitting there with a low turnover, when activated, can lead to the spread of the bug going from one area to the other. The aerosols that you're inhaling may have presence of legionella in them. There are two different kinds of diseases that you can get out of the infection of the legionella. One is pneumonia and the other one is Pontiac fever. So, if you were a healthy individual, the most that you can get, most times, is Pontiac fever, which has symptoms that can go between three and five days, and then eventually you

will be fine. But pneumonia is more detrimental, it can vary from being mild to severe in people depending on their immune system.

(R) I was going to say, so a more compromised population like aged care facilities or elderly people or schools.

(S) Yeah, I would say vulnerable people. And that can vary from newborn babies to people who are above 50 and again, people who are immune compromised have different kinds of immune compromised diseases or someone who's just recently gone through a chemotherapy perhaps. These are the kinds of populations who can be affected by legionella.

(R) So, you mentioned earlier in the introduction, it's not just cooling towers, but you've had experience with other warm water systems. So, is the risk of legionella the same with other water systems, or you predominantly only find it in cooling tower scenarios?

(S) No, absolutely not. A cooling tower is just one area where the risk is prevalent. The other areas where it's equally important to manage your water distribution systems would be a healthcare and aged care facility with warm or hot water system, perhaps more with the warm water systems So, it's not just the cooling water systems. It's healthcare, hospitals, aged care facilities, retirement homes …

(R) Car washes? Would that be a potential area as well I hadn't thought of?

(S) Yes, definitely. It's been thought of and in most scenarios, they even go through a risk assessment to make sure that there is no risk for people who work around or for the guests who are visiting the car wash stations. The car wash stations have been implicated in the past with the spread of legionella. The other places could be recreational centres; water parks, water features like the fountains.

(R) Right. I hadn't thought of fountains, yeah.

(S) Yeah, spas, pools, hotels … that's where it started, the American legion convention … catering services and sometimes even childcare facilities. Yes, these are the different areas or different sectors where legionella can be a hazard.

(R) Well, it's definitely more broader than I thought coming into this, with my limited knowledge around cooling towers and the risk of legionnaires. So, you've highlighted the fact, obviously, we've got a risk here. So, what's the legislative requirements around managing cooling towers and these warm water systems, and is it the same in all the states and territories in Australia to try and tackle this risk area?

(S) Yes, there are legislative requirements in managing cooling towers, as you rightly said. These requirements vary from state to state and hence relevant state health websites should be referenced in seeking up to date information on legionella control.

(R) We usually do reference; wherever you are based, make sure you are aware of whatever the specific legislative requirements are.

(S) Absolutely.

(R) That's probably going to be very similar, I'd imagine, but as always, do doublecheck what those specific things are, so thank you for highlighting that.

(S) But in general, if I had to say, all legislative requirements underpin all aspects of the management of cooling water systems in Australia, including installation, operation, maintenance, risk assessment and auditing.

(R) So, the full life cycle, essentially, of the plant, from the beginning to the managing, operating and checking that things are in place, and decommissioning as well would be an important as well.

(S) Yes, It is as well and, in most states, you have to put it in writing when you actually decommission your cooling water system and let the council know within a stipulated timeframe. And I was talking about those risk factors earlier. Just going

through them again, the five risk factors that we have and we need to consider when we manage the cooling water system. Stagnant water, where we're talking about managing the dead legs, identifying the dead legs and ensuring that the dead legs are not an issue, by either completely eliminating the dead leg or bringing about a system in place where you can regularly maintain them. Ensuring that if there is an intermittent system that you have in place to manage your cooling water systems, then there is a maintenance schedule in place to make sure that they are operational. Even during shutdown times, you have a maintenance protocol in place, so that when you actually get to use it, there's no water stagnating and perhaps breeding legionella. The second risk factor is the nutrient availability and growth.

(R) So, how much food is in the water to encourage growth. Is that what you mean by the nutrient availability?

(S) Yes, that's one aspect of it. Also, the surrounding. If the cooling water system was next to a construction area, a lot of debris going into the cooling water system, how are you going to manage the amount of nutrition that the water is receiving from that area? Or if there are trees around in the area, whose branches are right on top of the cooling water system and then you've got all kinds of organic debris falling into it, how are you going to manage that? So, those are the things that you have to keep in mind when you're managing the second risk factor, which is nutrient availability and growth. And also, the amount of sunlight that the cooling water system receives on an everyday basis.

(R) So, you want to have your cooling towers inside, because I've been in different buildings in my past where you've got cooling towers on top of the buildings. You can have cooling towers inside plant rooms. Is there an idea location when it comes to that sunlight aspect?

(S) Ideal location would be to keep away from sunlight which probably in most cases is not ideal, but you can work around it by having roofs on top of the cooling

water system or when you actually install the cooling water system, to keep it in an area where for most parts of the day, there is no sunlight reaching the system.

(R) It's in shade, yeah.

(S) Yeah, So, the third risk factor is the poor water quality. With the poor water quality, you have to look at the chemical parameters, the microbiology section of the water. And by this, I mean get your water tested on a regular basis and depending on what the local legislation requires you to do. So, in most states, it's required that you do your heterotrophic plate count, which is just a generic bacterial count, to be tested on a monthly basis, to see what the levels are. And if there is a level that is about the requirement that's required for that particular state, then you have to take actions to ensure that the system's clean and then there is no proliferation of this bacteria because having other kinds of bacteria within your system is also an important factor which leads to the growth of legionella within the cooling water system. Also, having said that, legionella testing is also very important. The parameter for testing chemicals depends on what kind of water treatment biocides that's been used and the requirement as per your state legislations. You've got to test for your pH. You've got to test the turbidity, the alkalinity, and ensuring that they are within the limits that it's required to have. The fourth risk factor is deficiencies in the cooling water system itself. If you've got a really old cooling water system air intake louvres, or there's a lot of algae growing on it, or there's a lot of biofilm or sludge or anything of that sort, then you've got to maintain them. Or if you can't maintain them, then you replace them. Whatever you have to do, but you've got to make sure that these deficiencies within the cooling water system are looked at and rectified. The drift eliminator is another thing that you've got to make sure that you test as per legislative requirements and the Australian Standards that you are following, to make sure that the cooling water systems are managed well and if need be, replace them. Go through the hierarchy of controls for risk assessment, the very first thing you do, try to do, is to eliminate. If you can eliminate, that's the best thing.

(R) We speak about it all the time; the hierarchy of control. We don't want to be jumping to the bottom, whatever that may be, administration and PPE. A lot of applications are spoken about, but you've got to ask the question and show why it isn't possible or have that recorded rather than, "Oh, we just went straight to the bottom." So, important stuff there. Any other risk areas?

(S) The last one is the location and access to cooling towers. The location is very important to make sure that the cooling water systems are in an area where it's not easily accessible to people, and it's also restricted. You don't want general public walking into the area ...

(R) Wandering around and, "Hey, what's this wonderful water feature I've never seen before."

(S) Yes, and also to have your PPE in place when you actually walk into the area, to ensure that you have your mask in place. If it's a plant room, have your earplugs in place, your gloves if you're dealing with the water system itself. The water treatment chemicals are out there, ensure, that you're nowhere near if you don't need to be. The other point within that risk factor, the location, if the cooling water system is around a childcare centre or it's closer to a restaurant with a kitchen exhaust around it, that's a good environment for all the suspended solids from that area to fall into the cooling water system. Or perhaps you have a lot of other office buildings in the area which means the population's really dense and the amount of people who may be affected in case of an outbreak of legionella can be massive. So, as much as possible, to make sure that you are considering all these risk factors, at the very beginning, when you're installing your cooling tower.

(R) Planning your building and construction, whatever it may be.

(S) Yeah, and if not, then try and mitigate the risk keeping in mind these factors.

(R) So, if you're a building owner, facility manager, or you may be that responsible party or person looking after cooling towers, what are some of the best practice systems? So, you've mentioned the risk areas, but what are some of the controls to

address some of those factors that may be people who are listening go, "Oh, I hadn't thought about it," that may be helpful for them?

(S) Definitely, if you are a building owner, a facility manager or any responsible person or duly qualified person who is responsible to make sure that the cooling water system does not have an impact on the local public, some of the considerations are to actually ensure that you understand where you plan to set your cooling water system in the very first place. So, the planning location and the sitting of the cooling water system is itself very important and if you can get that right in the very first place.

(R) It's a good starting point.

(S) Yeah, it's a good starting point, absolutely. The design features of the cooling water system also plays an important role in ensuring that you're mitigating the risk. The installation and starter features; before you even commission the cooling water system, you have everything in place, all your maintenance records, your cleaning, your flushes, the water treating biocides that's going into it. You've managed all of those aspects. Maintenance features, as I was talking about; all the different tests, service reports, which have all your chemistry test profiles, the microbiology test, the cleaning of the water system itself. All that's important.

(R) Is the test monthly? I think you referred before about it being monthly. Is cleaning monthly as well, or is that a longer time period?

(S) It is not monthly, but it again depends on the legislation in each state. And most places we've seen, it's anywhere between three to six months that you have your cleaning schedule in place. But again, as I said, it varies from state.

(R) Based on how many, where it is, what are the risk factors you've spoken about that are factored in that individual building, facility manager, risk assessment process.

(S) Yeah, and the final one is decommissioning. That's another important factor, that the building owner needs to know that when you are decommissioning your cooling water system, the council is notified. It's important that you take the time to inform the council, as they require, through the formal process.

(R) You mentioned chemicals before. What types of chemicals are being used as part of this cleaning and maintenance cycle of things?

(S) Yeah, with the cooling water systems, it's usually a combination of biocides, not just one because one set of biocides is never enough, and it probably won't be very effective. The best way to go about treating these cooling water systems is to have a combination of chemicals or biocides.

(R) You mentioned before earlier about nutrients. Does the pipes over time corroding ... I mean, does that come into the assessment and the risk of the pipe's conditions?

(S) Yes, definitely, for example, if you have rubber pipes installed, over a period of time, they can wear out, and most times, this is the best place for the legionella to grow if the pipeline hasn't been used for a very long time. When you flush it out the next time, there it is. It's just growing and moving to every other part of the water distribution system. That's why maintenance for the cooling water system is important, to have your cleaning done, your services done on time, your testings done to ensure that all these chemicals are within the levels that you require it to be, to ensure that the pipeline is fine.

(R) So, taking everything you've said, you think about the cooling tower on the top of the building or maybe in a plant room, but it really is about managing and maintaining the water flowing throughout the whole entire building or through that system, and keeping the environment to do what it needs to do to control that legionella bacteria. Would that be an accurate summary of what you've described there?

(S) Yes, to look after your cooling water system. The planning of the cooling water system installation itself is very important. The design features are important. The installation and starter features, maintenance features and decommissioning, keeping in mind the five risk factors that we spoke about earlier, to be aware of these risk factors, hazards, and then to be able to mitigate the risk.

(R) So, what are some of these very specific state and territory requirements some of our listeners should be aware of, depending on where they're based?

(S) There are legislative requirements and compliance requirements for each state and territory in Australia. But they vary from state to state. For example, in New South Wales, it's a requirement under the legislation that we have a certificate of risk management plan completed every five years, or more frequently if required, and an annual certificate of audit completion by an independent New South Wales Health Certified auditor is also required. In Victoria, it's a requirement to have a certificate of risk management plan and independent audit submitted every year, and that's the same case in South Australia. It requires a certificate of RMP, and the independent audit submitted to the health department every year. With Queensland, it's a little different. So, the Queensland water treatment responsibilities are based on Victorian Code of Practice for Water Treatment Service Providers. However, the frequency of the review of RMPs are not legislated and are based on best practice and perhaps the KPI targets between the owners and the water treatment service providers. It's different in different states but I think the ground rules are still the same. They all have to do their RMPs at different timeframes, but those RMPs still have to follow those risk hazard analysis, as I was talking about before, and in case of an outbreak, ensure you notify the council or the local health department. And adding onto the legislative requirements that I was talking about earlier, the Australian New Zealand Standard 3666 series is what's used as a guideline in some states, but also as a legislative standard in other states, in installation, operation and managing of cooling water systems in Australia.

(R) So, there certainly is a lot of information here and we've only been able to touch on a couple of the key areas in just a short time that we've had, but if you had to have a key takeaway point for our listeners, what would that be?

(S) Yes, I do have a few key takeaway points for the listeners today. As I was talking about before, in the hierarchy of controls, the very first thing you try and do is to eliminate the whole hazard. And the best way to do this is by looking at alternate heat rejection technologies. That would be the first option, in my opinion. But for any reason you can't do that, it is important to remember that hazards relating to legionella are not just restricted to cooling water systems and can occur in general, in any water distribution system, which has the potential to retain water temperatures between 20 and 60 degrees Celsius. Some of the water distribution systems at risk would be the warm water systems with thermostatic mixing valves prevalent in hospitals, aged care facilities and retirement villages. Other areas of concern may include car wash stations, childcare centres and aquatic centres. For relevant parties involved in management specifically in cooling water systems should consider the five risk factors that we spoke about earlier and an understanding of the risk of legionnaire's disease should underpin all aspects of the management of the cooling water system.

(R) So, there's quite a few key takeaway points and we've only just touched on a couple of those key areas, but for those that do want to get a bit more detailed information online, where would be a couple of good locations they should head?

(S) Most states in Australia have cooling water systems legislated and, in my opinion, the best place to acquire up to date information would be by visiting the relevant state health website and to refer to the Australian New Zealand Standard that I was talking about which is the 3666 series. Also, Greencap's regular white paper and risk review publications on our website and social media are another great way to keep oneself informed on issues relating to legionella, educating your team and keeping up to date with industry standards.

(R) And if our listeners do want to get into contact with you or Greencap, what would be the best way to do that?

(S) The best way to get in touch with us is by visiting our website, which is www.greencap.com.au or just reach us on our social media, which is LinkedIn or Twitter, or just search us online.

For more information and resources on cooling towers go to www.greencap.com.au/coolingtowers.

(R) Well, thank you so much for your time today. Really appreciate you coming in.

(S) Thank you. Likewise.

(R) Well, thanks for listening everyone. You can get in contact with the show by sending an email to scienceofsafetyanz@mmm.com if you've got any questions or topic suggestions or guests you think would be great to get into the studio. 3M are certainly here to help in your workplace when it comes to PPE. You can also visit our website, 3m.com.au/sospodcast for further resources on cooling towers and a transcript of the chat that we've just had today. Be sure to subscribe, rate, review and share through Apple Podcasts, Spotify, Google Podcasts or wherever you get this podcast from. And as Harry Wong said, "The person who does the work is the only one who learns." Thanks for listening and have a safe day.