# Heat and work injury panel discussion

## **Introduction:** Professor Dino Pisaniello, University of Adelaide

For the last two and a half years, an Australian research team has been exploring the issue of injury associated with work in hot conditions. So this has been done at a population level, whether it be an analysis of workers' compensation data; or surveys of health and safety managers and representatives; or analysis of interviews with workers, this is the first time that the issue has been systematically investigated. That's a key point.

When you do this sort of work, you get a handle on which workers, which jobs, which industries, and what types of injuries, and the scope of the curve, or the slope of the curve, if you like, relating injury and temperature, as well as perceptions about what should be done. For example, more awareness and training, or better management and control. So knowing the risk factors, and what people think about management gives us an evidence base to progress this area. That's the second key point.

In theory, traumatic injury, as Peta's alluded to, can arise in hot conditions, and without the worker experiencing frank illness. So, subjectively, it doesn't look any different, but injuries can occur. And it might arise because of loss of concentration, or reduced psychomotor performance, or cognitive function, or altered behaviour. If the worker takes off their PPE, for example, it could be all sorts of implications, including chemical exposure, for example.

So what we believe is, the increased susceptibility of workers, whether it's physiological or psychological, interacts with existing hazards to increase the likelihood of injury. Those workplaces and tasks, with multiple hazards, more complicated tasks e.g., working with power tools or ladders, or mobile plant might be a particular risk. It also negatively impacts on decision-making processes, resulting in poor or incorrect decisions that can lead to injury to individuals or damage to equipment. This can occur indoors as well as outdoors. More research is needed to understand the mechanisms by which this occurs in actual workplace conditions.

Okay, so what did we find in our research? When you use an injury lens instead of an illness lens, you get a certain picture of the problem. Lots of different industries appear to have higher rates of injury in hot conditions. Even moderately hot conditions, and in indoor environments. Young workers seem to be at greater risk, and the most common types of injuries are to the limbs, including the hands.

How big is this effect? There's lots of variability, but injury claims data show an increase of between 10 and 800% in hot conditions, compared with mild conditions. The biggest increase we found was for electricity, gas, and water sectors.

What did we learn about what could be done? Well, the surveys of health and safety professionals point to a need for more awareness of the injury issue, and some specific additional heat stress training. However, that's a shared responsibility by all parties in the workplace. That's a key point. Hydration, appropriate information, and work practice are key aspects of that shared responsibility. Moderately hot conditions, rather than extreme temperatures, correlate with the biggest injury burden.

Heat wave severity might be just as important, or even more important than maximum temperature, as then fatigue might have a greater role. Heat waves can occur outside of the traditional summer months, for example, in November and March. That's a key point.

Finally, yes, we're predicting more and longer heat waves and climate change, but the problem of injury is with us now.

## **Facilitator:** Dr Peta Miller

## **Panel members:** Martyn Campbell, Chris Ginever and Sandra Dann

Peta: Thanks very much Dino, I think that sets the scene very well for us. So, Sandra and Chris. Clearly somebody's actually acutely suffering heat stroke. We hope they won't be working, but what are the safety outcomes that you might see, associated with just working in hot temperatures?

Sandra: Okay, I speak from "lived experience," I think is the term now. When I was growing up in New Zealand, my first job was picking raspberries. I think I was probably 11 or 12. I went with my older brother. He found the work. Was there any training provided about working in hot conditions? You mightn't think New Zealand is that hot, but in places, it can be. No, no training. The employer was like many employers, and wanted production. They wanted that bucket filled with raspberries as quickly as possible, and they wanted them as least squished as possible. That was the extent of the training.

I picked like mad, because I was trying to save some money to buy Christmas presents. I think I'd made it to lunch time. Was there any water onsite? We didn't drink water in those days. Was there any sunscreen? We didn't use sunscreen in those days. Did I wear a hat? No, didn't like wearing hats. By lunchtime, I was quite ill. I had sun stroke. I decided against operating machinery and riding my bike home, so I pushed it home. I think I spent the next two days flat-out on my bed recovering.

I guess the early stages, you would want to see ... what is the workplace climate like? Is it safe for people to speak up? Is there a heat policy, and who knows about it? Is the culture conducive to positively prevent people getting to the point where they start to feel ill and at potential risk of injury?

In our line of work, we don't see the positive stories. We get calls from people every day, women and very vulnerable, predominantly migrant workers, who have reached a point where they're in crisis at their workplace. Many of them report that they feel punished, they feel targeted if they do speak up, if they're feeling affected, or they think themselves and the rest of the workplace are at risk. We need to get beyond that, in terms of how we address this issue, how we approach the issue in the first place.

Workers typically will say to us that all of the responsibility for getting to this point of illness and/or injury is placed back on them. "You didn't drink enough. You didn't do the right thing. You came to work tired." We need systems in place, we need awareness, we need training.

Chris: Yeah, I would agree with that, Sandra. Certainly in civil construction and marine construction, as well, there are good systems in place. People are educated about those things before they actually go out into the workplace. We keep an eye on the weather, and plans are made to address those issues. In terms of good practice, that's what's happening in civil construction. But certainly, the high risk area would be domestic construction areas, and the young workers, has been borne out by a couple of recent incidents with young workers first day on the job. It's a heat wave, and they end up going away from the workplace in an ambulance.

Peta: So Chris, you're in the construction sector. So what are some of the safety implications that might ... apart from, obviously heat stress and heat illness, but in terms of traumatic injury?

Chris: As Dino alluded to, people are working with high risk plant, and as the statistics are borne out, where 48% of all workplace fatalities are falls of less than four meters. Working at heights in construction, high risk.

Peta: It can be a lethal mix.

Chris: It would be.

Peta: Martyn, the regulators I know across Australia have historically been quite well aware, particularly in South Australia, Queensland, the Northern Territory, and Western Australia about heat illness. How focused are you on, have you been, and are you in the future on heat-related injuries caused from working in heat?

Martyn: That's correct. We have been very focused on it. It's still pretty high on the priority. The 12 months I've been at Safe Work SA, I'd say we've undergone a lot of change, and part of that is some capability development for our inspectorate. I think it's critical that the inspectorate maintain their competency, knowledge, and experience in the new and emerging issues, because work's very different to what it was five years ago, ten years ago. The environment in which we do that work is very different.

 Before I came here, I was working on mining construction companies around Australia, Papua New Guinea, Brunei, and Indonesia. Yeah, some hot places. And they're all very different. So, some are 3,000 meters up a mountain, and when it was beautiful, it was beautiful. But when it wasn't, it was in cloud, and it was wet, cold, and miserable. And then Simpson Desert, Northern WA South Australia. The challenge I had was, how do I, as a head of safety for that organisation, interpret research, interpret what the regulator is focusing on, and what's reasonable, and what's enough. How much is enough for you to do the right thing?

Peta: So, I'm hearing that the regulators are focused on it. How much do you think the inspectors are thinking about the risks like falls from height when you're fatigued and your concentrations lapsed?

Martyn: It's really relevant, because as an inspector, and so as a regulator, when you're going on sites, and you're looking at the consequence of an event ... that may well be fall from heights, and generally, the easiest option, or the conventional way of looking at the practical aspect of it ... was it barriered? Who's had training? What's the procedure say? Has that person been trained in the procedure? Is there a bit of paper that's going to protect that person?

 Inspectorates across Australia have never really looked at the behaviours or the design of the task. So is the procedure really ... does that really consider the hazards and risks in the design of that work? Have they really dug down? Because we've all had procedures where we've looked at it and thought, "That's a great 55 page document." But that's not going to save anybody from falling off an edge. Is the design of that procedure, or the way it's written, forcing a type of behaviour which encourages people to take short cuts? And by taking that short cut, you expose yourself to a risk, and then you're injured.

 I don't think what we've always looked at in the past is the other issues, such as the effects of heat stress and illness. How does that affect people's cognitive ability? Is there some other relevant information that's impacting on their decision making which caused them to do that?

 I think from an inspectorate point of view, we've got a bit of work to do to work with our work environment unit to make sure that we're across the latest research, that we understand it, that we're considering it in our site visits, and we're talking to employers and workers about it.

Peta: I guess it all links back to fatigue, as well, doesn't it? I know that the jurisdictions are working with the industry and unions, in fact, to develop fatigue codes. But Sandra

Sandra: Yeah, I just wanted to add ... we certainly hear of people who have sustained injury in very hot conditions at work, so people who work in kitchens using fryers, and so on, that they haven't necessarily been trained on. Often, young workers, and often over the busy Christmas period, where they've been hired short-term.

 The thing we hear about most, I think, and it was touched on in Dino's research, was the psychosocial issues that arise in workplaces where people are hot, they're aggravated, they haven't, perhaps, slept enough.

Peta: Is there a temperature which people are allowed to stop work? Perhaps I might start with you, Martyn.

Martyn: From my perspective, no, there isn't. I think you've got to look at individuals, look at the environment you're working in, looking at the task that you're doing, and the way that you're doing that task. And then taking on board the individuals that are doing it, and their physiology.

 I think it's probably a bit dangerous to put a temperature limit on work, unless you are considering the other factors in part of that risk assessment. So, I think once you start having workers who are suffering the effects of heat stress, then that's too late. It really needs to be brought a lot further forward, and considered in the planning stage, and certainly the design of the work.

Peta: So I guess, also, what we know, it's not just a temperature, it's also about humidity, and some other factors that Chris and Sandra, you might like to tell us about?

Chris: Yeah, well, absolutely humidity is a big factor, as well, and airflow and general radiant heat from surfaces, steel, et cetera. You don't want to be on the roof in 40 degrees, that's for sure. Again, you have to take all the factors into account.

Peta: I guess you picked up on something quite important, there, is that radiant heat. The ambient temperature might be one level, maybe even the humidity, but it's those environmental factors that also need to be built into the risk assessment.

Chris: Correct. Yeah, so air movement, as well. Very important factor, because if there's no air movement, and you've got high radiant heat, as well as high temperatures, then you've got some serious problems.

Peta: So do any industries have a temperature that they have in their industrial relations agreements?

Chris: There are some temperatures linked to EBAs, so where they will stop work at around 36 degrees, and then move out of direct sunlight.

Peta: That's pretty hot.

Chris: It is hot, but as we said before, there are many factors. And then where is that temperature being measured? Because it'll be 36 degrees in Kent Town at the Bureau of Meteorology, but it'll be 32 on the coast of Noarlunga, so people in Noarlunga aren't stopping work.

Peta: Sandra, I guess this comes to your point about whether people feel allowed to stop, whether they can speak up.

Sandra: Yeah, we, over the years, have represented a number of workers who work in hot house conditions, environments.So, picking tomatoes is the usual occupation. They're working in very hot and very humid conditions, because that's what's needed for the tomatoes to ripen. A number of issues that have come up with our clients have been around incredibly awful ear infections, which seem to have been exacerbated by humidity, dust, and chemicals. Often the employer will say, "Yeah, but you've always had ear problems. You came to this job with those ear problems, so don't come to me trying to log a worker's comp claim. It's actually your fault. Maybe you're not suited to this work."

 The other interesting case we had with a tomato picker is a long while ago now, but part of their duties was to push these trolleys along with trays. They had to fill the trays up and stack the trolley. By the time it got to the end of the row, or the trolley was full, that was incredibly heavy. Because of the humidity in these tomato hot houses, the ground was basically mud. So, trying to push those heavy trolleys through mud often resulted in quite serious shoulder injuries.

Martyn: We've all got a duty to look after our own health and safety, as well as that of each other. In that situation when you've got vulnerable ... well, any worker ... but particularly vulnerable workers, that they have a legislative right to stop work, to raise these issues, to address it with their employer. I think there's probably a reasonable proportion of the working public who don't really understand that there is a law behind it that gives them that support.

 Another aspect of it is organisational culture. So, if you do have a culture that's beating workers down in that respect, then quite often they don't know they've got a legal right for that, too. They don't understand that they've got a voice they can raise. So, I suppose it's giving them the understanding of what the law says, and supports them, but also what the regulator can do, or the educator half of our business can do, as well as the industry groups, and other support groups that are available to them.

Peta: What are some of the work environment factors that might be going on while people are working in heat? We heard Sandra tell us about in the humidity, the ground conditions. What are some of the other factors that we should be thinking of when we're doing our risk assessment around the work and the work environment?

Martyn: I think, for me, it really starts with the design. As an employer, my expectation would be, that the more knowledge you have, and the more resources available within your organisation, the higher the standard that I would expect, and the more that you should be doing.

 That said, I appreciate that sometimes it's difficult to interpret best practice, but I would expect certainly tier one, two builders and large companies and multinationals, that they should be engaging people with the right skills to help them interpret that.

 It's not a level playing field for everyone, from my perspective. I certainly expect more from the larger organisations. When you get organisations like that, that do voluntarily comply, allows us as a regulator to help and focus our resources on the people that really need support, which is the smaller organisations and vulnerable groups.

 I think, when it comes to managing those risks, it's understanding the design of the task and the work. That would then help to support, to write the procedure. I'm a firm believer that procedures don't save people's lives, but it's important that you have a process documented, which understands how that work is done in the environment with the people that you have. Then you can apply the adequate controls to those tasks, and again, it's not a one size fits all. It's something that organisations should look at for every place, and every time that they do that. Because depending on the environment, the same task might require different controls.

Peta: What might some of those environment challenges be, and what might some of the controls be?

Chris: It depends on your work environment. If you're the marine environment, you've got to consider the swell, as well as the ambient temperatures and radiant heat. What's the task at hand? And is there a storm front on the way?

 If you're working in the foundry, you've got a more fixed environment, and perhaps there are methods of isolating workers from their heat sources, and creating artificial air flow, as well. Whereas, if you're on a barge doing some drudging, then it's unlikely that you'd be able to create artificial air flow.

 So, yes, it's horses of courses, and we have to apply what's reasonably practicable.

Martyn: You're right, there, Chris, because even things like fairly innocuous tasks in an environment that's not too hot or humid, but you add things like welding hoods to the equation, then suddenly what can be a fairly medium-heat, low-risk, low-humidity task suddenly becomes a higher-risk task, because of the equipment you're wearing.

Chris: Exactly.

 So, some of the power air respirators that you're required to wear when you're removing asbestos, for instance, yeah. You've got to have a negative air pressure units inside the asbestos removal room. And all the PPE, you'd be pretty hard to manage the airflow, in some respects, so...

Peta: So what's some practical controls that would be operating then?

Chris: Well, that's the million dollar question. Some of the PPE's very advanced, it has its own air flow, but I personally wouldn't like to be doing that job on a 40 degree day.

Peta: So is that things like job rotation, though, that would then-

Chris: Yes. That's-

Peta: go and see you’re monitoring your worker's-

Chris: Yeah, absolutely, you're going to have to employ those other control measures, like job rotation, et cetera.

Martyn: Even things like heat vests and cool packs applied to the body, and external ventilation.

 There was an employer a few years ago on a mine site, had a number of slushy machines, which were stocked 24/7, so that people could have iced slushies at the drop of a hat. That helped to bring down core temperature, and help keep them cool. Not advocating that you go out and buy a selection of slushies for the workplace, but it was a control that they viewed was worthwhile investing in, and it had a benefit.

Peta: We've spoken a little about some of the environmental factors, and some issues to do with the tasks that are ... but what about the individual? And their own risk factors? Perhaps I could briefly ask you, Sandra, to talk about ... are there gender, are there age issues? What are some of the individual, personal factors?

 And then, if I could turn to you, Chris and Martyn, to talk about what that means in terms of practical controls in workplaces.

Sandra: Yeah. Just picking up on the job rotation issue, fantastic idea.

 When you talk to anyone in the community sector who is relying on government funding, perhaps they're an NDIS supplier, the flat answer will be, “We can't afford that." Yes, it would be great to have back up workers, particularly where, maybe care workers, traveling around, often in their own vehicles. The air conditioning may or may not work on a hot day. Those community workers whose job it is to go and monitor people whose health is at particular risk during a heat wave, how much though do we pay to their working conditions on a day like that? Enormous responsibility, if you combine a heat wave with a power outage, and people in their homes are relying on equipment to keep them alive, basically.

 Job rotation can be used in some industries, but in the community sector, there just isn't the funding for that sort of ... what an employer would see as a luxury. So we see workers going to people's homes without even any ... the poorest of risk assessments around whose home are they going to, what's going on in that home, what risk are you at in that home?

 Things around domestic violence, so walking into a house where there may be a violent partner. Now, that doesn't have to do with heat, I get that, but we rely on these workers to work through a heat wave, to provide services to very vulnerable people in our communities, and thank goodness they do.

 So, is there a gendered aspect to this? I think there is. You would expect me to say that. So, around things like a heat wave, and perhaps inability to get quality sleep, let's talk about women who are pregnant. There are periods through pregnancies where many women say, "Ugh, I can only sleep a couple of hours." Perhaps a parent is a sole parent with the care of a number of children, who also aren't sleeping well. So, if you can get a few hours' sleep, good for you. During that few hours when you expect to sleep, you may have the care of a baby who needs to be fed during the night, or another member of the household, perhaps, who has a disability, who needs to be turned, rotated during the night.

 Those people are not going to be flash when they go to work the next day. We know that heat waves in Adelaide will often last for what, eight days? By the end of that period, people are probably not fit for work, not fit to be driving around in their cars.

Peta: Are there some other individual factors that we need to be thinking about, in terms of risk of injury?

Chris: Everybody's got different tolerance to heat, and this applies to elite athletes, as well. Some people can go out and play football in the early part of the season and not suffer, but others are suddenly being carted off the field, and needing ice vests and hospitalisation. So, yes, everybody's got different levels. Of course, as we know from public health warnings, the very young and the very old are the big risk factors.

Peta: I guess this comes to a bit of a tricky question, Martyn, about reasonable adjustments and the extent to which an employer needs to know their workforce and the issues, and build risks in for people's variability. Perhaps they've got a ... they're unwell, or, as we're hearing, they're fatigued. So it's a pretty tall order for employers. How are they going to manage that?

Martyn: Look, it is. And there isn't a silver bullet answer. But what I said before about larger organisations, more mature organisations, those with a mature safety culture, the larger multinationals and tier one, two building companies. The expectation is that their standards should be higher, because they have the resources and the people available to breathe life into that.

 Mom and dad businesses, there's not an expectation out that they'll have that level of maturity. And I understand that. As a regulator, I'm sympathetic to their position, and we will do everything that we can, in our power, to help them. But that said, depending on the severity of the breach, the injury, and the other factors will determine whether or not we prosecute them.

 Look, the prosecution aspect is just one compliance outcome. There are a range of others that we'll consider before we get to that. As a regulator, I don't want to be in court prosecuting everybody for every breach. It's completely impractical to do that. That should be the most serious cases.

 But certainly from a regulator's perspective, there's not a will for me to come down with a heavy stick on everybody for every single breach. It'll be proportionate, and certainly, everyone will be considered on their own merit.

Peta: But if the risk is known, you expect it to be controlled.

Martyn: Yes. Most certainly. In many respects, the fact that our temperature, our environment, our climate is getting hotter is no shock to anybody, unless they've been living in a hole for the last 10 years. I think the shock is how quickly it's changing, and that we need to keep up with that.

Peta: So Chris, you're representing the construction sector here, so the sector that routinely works in hot environments. You've alluded to working on roofs in places where there's lots of radiant heat going on. So what are some of the practices that you're seeing out there that are good practices that we should be paying attention to?

Chris: Yes, so, certainly there's a lot of education, in terms of the requirement to keep hydrated, have processes in place for rest breaks, shade, obviously, is a big one, as well, because you can work longer if you're in the shade. So portable shade equipment supplied during the weather. Job rotation, crib rooms that are air conditioned to rotate through. Those are the best practice sort of principles that are applied.

 Certainly, there's more simpler control measures that are used by some sectors, like the housing sector. I start early and finish early. We just simply knock off by 1:00pm.

Peta: So what about fatigue and what you, Martyn, reminded us that health and safety is everybody's responsibility, and workers have a duty to look after their own health and safety. What is it that we can do in those periods when the temperatures are rising to actually look after ourselves, particularly around fatigue and those issues?

Martyn: I think one of the important things, for me, in relation to fatigue is, it's not just lack of sleep that brings that on. There are a lot of other factors in there, as well, so diet, and stress, and anxiety, and those other things can affect it.

 The other thing I would say is, we're quite fortunate, Adelaide, as to have a really advanced research and academic footprint here in the sleep research centre. Dr Savon Banks, I spoke to a few years ago, and took her and some of her colleagues to PNG to do some research for us there in relation to fatigue. Completely different ... same sort of risk, but in a completely different environment. Different food, different work patterns, different altitude, different temperatures, different culture, different people. The issue there wasn't necessarily the fatigue onsite, at work, it was back in the village on their week field break, and they were actually turning up to work fatigued.

 I think, in relation to that, it's not necessarily looking at fatigue in isolation, it's going back to that planning stage and design, and considering the other factors that are relevant on it, and actually looking at it holistically.

Peta: Have either of you got some practical suggestions about fatigue management when the temperature's rising?

Sandra: We talk about compassion fatigue in the caring sector. It's a different type of fatigue, but we know that good workers, often very low paid workers, slog their hearts out because someone has to do this work, and they find it rewarding. But there's nothing like a crisis period like a heat wave, or like a bush fire that will bring all of that discomfort, discord, resentment to the surface. We talk about that, as managing worker burn-out is really important, as well, because I hate the word "resilience," but if workers feel strong, and feel that their contribution is valued, they're going to be less likely to fall over at a time when we're all challenged by environmental considerations.

Peta: I think that's a really interesting point that comes to a conversation we were having before about the interrelationship of all of the hazards. In fact, that working in heat is not something to consider in isolation. Perhaps, Chris, with your practical insights, have you got any comments on that, about heat just being one of the hazards that needs to be considered?

Chris: I think you've hit the nail on the head. There's many attendant issues in the workplace, we need to be cognizant of all of those factors, and have to, obviously incorporate them into a holistic approach to risk assessment for the task at hand. Obviously, a great one is to look out for your work mates. So, if somebody's not looking like they're faring too well, understand what the signs are, and then apply appropriate first aid.

Peta: I think that's a really great point.

 Look, I want to go to one of the elephants in the room, here, which is, what about for those workers who can't stop work? Perhaps they're emergency services, they're ambos, they’re firefighters ... Martyn. What happens there?

Martyn: Yeah, so, from my perspective, and certainly I've been on sites and projects ... another good example is people like shock firers, drill and blast engineers in the mines working 300 meters at the bottom of a pit. When I was at Prominent Hill, it would get to 58 degrees at the bottom of that pit. It's about the controls that you apply, because there are quite a few jobs that, really, you can't not do. That doesn't mean you can't control them in some other way. So, job rotation ... the use of air conditioned buildings, portable buildings that you would put on site. The PPE, access to water, electrolytes, the training, that sort of thing.

 Another big one for me is, you can have all of those controls onsite, but if you've got an organisation that's got a bad culture, that's going to smash down the individual that puts their hand up and says, "I'm really tired." Then that's a waste of time and money, because if somebody's frightened to put their hand up and say, "I need to stop work," then all of the other stuff becomes a bit of a moot point. So culture, for me, is another big one.

Peta: So that goes to people feeling that they actually have the power to stop.

 Look, we've just started to touch on one of really important ones, about PPE. You mentioned when we started, Chris, the conversation around masks, and those sorts of things. But I understand, in many sites, it's now a requirement that people wear "long longs," as you put it. So what do you do when the PPE itself is actually creating some of the issue?

Chris: I suppose, again, you have to look at the design of the clothing. There are many new items of light clothing that's long-sleeved, long pants, and ventilation of the armpits, and the like. So it's fit for purpose. Again, it's about, as with any piece of plan or kit, you have to do a risk assessment.

Sandra: One of the complaints we get from a lot of women working in construction, or other male dominated industries is, when the employer provides the clothing that is required to be worn, it's men's clothing, so it doesn't fit. They're often issued with a shirt that's way too big, and is increasing the likelihood of injury, but they have to wear it, because that's what's issued.

 I think things are improving around clothing that is tailored for women's bodies, but also around safety boots, and so on. Wearing equipment that is going to increase your risk of injury is not a great idea, but there's no room for individualism.

Peta:We're very lucky today, because in the audience we've got some extra experts. So, I'm going to throw to them. Ross, I was wondering if you'd like to make some comments around what we've heard today. Are there some points around designing and managing work in heat that you think we haven't actually picked up so far?

Ross: I think we've touched on most of the points. One that comes to mind, in particular, is the pre-planning of work. This comes from a number of different directions. With the Bureau of Meteorology information we can now get, we can pre-plan months ahead. You know when there's going to be ... pretty good knowledge of the types of temperatures. So we need to educate our work planners to start to design work, particularly outages, and the like, to occur in a better climate, wherever we can control that. And the concept of sometimes doing a job at night, rather than doing it in the middle of the day. I think the planning aspect of things, we're not doing as well as we could be doing. So that's one of the areas that comes to mind.

The other thing Martyn picked up on, and I think is probably very, very, important, is the cultural aspect. For the individual to be able to say, "Look, I'm feeling the heat. I really need to take a couple of minutes, just to have a drink, just to rest," and to understand that the impacts from that, that couple minute break, is going to actually have benefits down the line in productivity.

The only other one, I think, is a classic example of a well plan job. A number of years ago in Central Queensland, a company was doing some work in a very hot environment in a smelter. They pre-planned the work, they built a specifically-designed platform with air cooling vents, and ergonomically designed. It cost them a considerable amount of money, but when they did the business case, it turned out that it saved them double what they paid. So, you can pre-plan better than what we're doing.

Peta: I think they are some really interesting insights. I think you've touched on a point that we hadn't mentioned, it's that there's the human, but there's also a financial cost of actually getting it wrong, and some productivity benefits in getting it right.

 Did either of you want to comment on that?

Martyn: Yeah, I wouldn't mind sharing an example. Before I started this job three and a half years ago, I was asked to go and fix up some issues that, at a gold mine in Papua New Guinea, they killed two people readily close together, and they were closed down for nine weeks. That was $2.4 million per day lost production in overheads. The cost of getting safety wrong is enormous in lost productivity, the human element, the delays in the jobs, as well as the contractual delays, and the consequences of that.

 I'm a firm believer that if you get the safety right, the quality and the production will follow. Investing up front in some engineering controls might look expensive, but in the grand scheme of things overall, it'll be a drop in the ocean.

 I've said to people a number of times, and repeated the adage that, "If you think safety's expensive, try having an accident."

Sandra: One of the issues that we heard about this morning was the use of technology to better provide potential for pre-planning. But in a number of workplaces that I'm aware of, because I've represented clients from there, there is an absolute black ban on using mobile phones during working hours. If people are relying on technology to get a business case to go to their employer and say, "Look. This is what my app is telling me about the hot conditions that we're working in," there are some employers I know who will immediately put them on performance management for accessing their mobile phones during working hours. We've got a bit of dissonance between policies.

Peta: So, I also know in the audience we've got Dr. Richie Gun. That wasn't planned, but it's a great segue. I was wondering if you can provide any insight in ... we've heard about some of the problems with not being able to use a phone, but are there any apps or technologies you think that are coming into play, here, that we should be looking at?

Dr. Richie Gun: We can't advocate physiological monitoring for everybody, but I think we've asked the question about where people are ... when you're in a real emergency situation, maybe, or maybe essential maintenance has got to be conducted.

 I think in those circumstances, if you can't solve it by ideal solutions like job rotation, then I think you do have to consider physiological monitoring. It's relatively easy these days, you don't necessarily have to have radio pills, by the way, because nowadays we get a pretty good fix on people's body core temperature by measuring their temperature in their eardrum, like what happens when you go to see a GP. That gives you ... not absolutely accurate, but it's a pretty good fix on your core temperature. What we've done is actually measured in both eardrums, and go by what is the maximum reading that you can get.

Peta: So your message for us, there, is that in some limited circumstances, biological monitoring in high-risk work may have some benefits.

Dr. Richie Gun: I think it should be considered, in some of these cases, yes. Where people can't ... particularly where they can't self-pace. If I could just add that. I think there doesn't need to be more emphasis. First of all, before you're looking at environmental parameters, the capacity for self-pacing. This is really perhaps the most important thing that needs to be looked at.

 I learned this a few years ago. I was doing a study on some people exposed to a lot of solar radiation, working all day out in intense sunlight, the average dry bulb temperature during the day was about 39 degrees. We didn't get any casualties, because people were able to ... and their body core temperature was under control, because what happens is, when it gets hotter, your productivity drops. And that's a good thing!

 But I also looked at a group of shearers, and it's different for them, because when it gets hot for them, they override the natural tendency to slow down, because that's what will affect their pay. We actually monitored their output by ... because they keep a record of their tally of how many sheep they shear, because that determines how much they're going to get paid. We found when the temperature went up 39, 40, the number of sheep they would shear per hour would still stay the same. And so, what happened in their case, unlike the other outdoor workers I mentioned, their body temperature started to go up.

 So I think the first thing you've got to look at, what is the capacity for self-pacing?

Peta: I think that's a really interesting insight, and I guess it goes to your point, Martyn, about culture and trust.

Martyn: Yeah. Yes it-

Peta: Sorry.

Martyn: No, go on, Sandra.

Sandra: I'd like to make a comment. Australia has put a lot of effort into filling job shortages that Australians would ... that Australians, apparently, don't want to do. That is around, perhaps, at harvest time in agricultural areas. We're looking more and more at drafting our workforce from overseas countries, so bringing in, perhaps, seasonal workers, or 457 workers. I don't know, I honestly don't know what proof those employers have to provide about their work health safety practices and policies. So I would suggest that one way of making people a little bit more accountable would be to produce their well-researched, well-written, well-implemented heat policy, if that work is going to be carried out in high-risk areas.

Peta: I know that in the audience we are very pleased to have John Nairn from the Bureau of Meteorology. Your organisation provides invaluable information to Australia, and this we've heard about the importance from Ross about pre-planning. So what can the BOM offer us, in terms of information, help us plan ahead for, not just heat waves, but as we've heard, just high night time temperatures that may increase our fatigue?

John Nairn: Yeah, well, certainly our observational data set is pretty good. And we'll improve over time, particularly as the internet and things starts to take off. We'll become a very, very, large, big data organization as we start to aggregate all those data sources. Think about virtually any place that wants to put something on the internet, in terms of monitoring, we'll have it. That's the intention.

 In terms of the outside environment, we’ll be assimilating that into our super computer, and numerical modelling will be ensemble-based, so you'll have probabilistic forecasts in terms of certainty of forecasts, as well as very high resolution data to look at.

 So there's prospects of actually a lot more data coming out, and when we get that flood of data, it really should probably be objectively taken up best by machine-to-machine responses. In terms of actually getting the real productivity from it.

 In terms of what we're doing right now, we do have capabilities in giving seasonal outlooks, and, indeed, extremes. Outlooks will be provided on a 12 month looking-forward basis, probably in about three years’ time for agriculture. So, who else wants it, is the question. Who else wants to partner up with us to find out how they can use it, is really the real question. The Bureau has taken on a customer-centric approach to its strategic plan only in the last two years, so we're looking to how we can partner up effectively to get people using our data better for impact and value. We have a zero lives lost philosophy, so we're looking for that outcome, wherever we can partner up.

Martyn:We're having incredible cut-through with emergency services, and high levels of government, in terms of the pick-up of our data. We're not having the same impact across business. And we are endeavouring to make those inroads.

Peta: So I'd just like to ask our panels to give us some take home messages. Perhaps I might start with you, Chris, first. What are some succinct messages for us to take back to our workplaces, to think about working in heat?

Chris: I think the key messages are that you take notice of your own capability to withstand heat, keep aware of upcoming weather patterns, hydration, and watch out for your work mate.

Peta: You, Sandra?

Sandra: I think supporting people to speak up in their workplace, and not be victimised for that is really important. So having engagement of all parties in a workplace to design a good heat policy, based on invaluable research. We need the evidence to know what we need to be doing and not doing. I think that's really important.

Martyn: For me, it's about creating the right culture. I'm not sure that Scott knows, but I did a walk and talk at the ASC yard a few months ago, and I did it... yeah, yeah. And that was a really good example of an organisation that has that culture. Because when you go around and talk to people, they were quite happy to stop. It was a pleasure to go into that sort of environment.

 To get there, if you're not certain how to get there, come and ask us. I'm trying to engage industry, and I'm trying to work with our partner agencies to be more open and receptive. Safe Work's got some very talented specialists, a couple of which are here, and I'm looking at them now, who are more than willing to provide some guidance and advice. I appreciate that none of us know everything, but we'll know somebody who can help. It's just a case of reaching out.

Peta: I'd like to thank our panellists and to take the insights that we've heard today, and as we head into the hot time of the year, to start applying them. Pre-planning, as Ross has reminded us to do, to actually anticipate the risk to our risk assessments, and bring in real risk controls.