LEGISLATIVE COUNCIL ECONOMY AND INFRASTRUCTURE COMMITTEE

Inquiry into Electricity Supply for Electric Vehicles

Melbourne – Thursday 12 March 2026

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Necessary corrections to be notified to executive officer of committee

WITNESS

Emma Sutcliffe, Project Director, EV FireSafe.

The DEPUTY CHAIR: I declare open the Legislative Council Economy and Infrastructure Committee's public hearing for the Inquiry into Electricity Supply for Electric Vehicles. Please ensure that mobile phones have been switched to silent and that background noise is minimised. I would like to welcome any members of the public watching via the live broadcast, and we will start by introducing the committee members.

John BERGER: John Berger, Member for Southern Metro.

The DEPUTY CHAIR: Richard Welch, Member for North-East Metro.

Gaelle BROAD:Gaelle Broad, Member for Northern Victoria Region.

Emma SUTCLIFFE: I am pleased to meet you – Emma Sutcliffe from EV FireSafe.

The DEPUTY CHAIR: Thank you. Just as advice to witnesses, all evidence taken is protected by parliamentary privilege as provided by the *Constitution Act 1975* and further subject to the provisions of the Legislative Council standing orders. Therefore the information you provide during the hearing is protected by law. You are protected against any action for what you say during this hearing, but if you go elsewhere and repeat the same things, those comments may not be protected by this privilege. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament.

All evidence is being recorded. You will be provided with a proof version of the transcript following the hearing. Transcripts will ultimately be made public and posted on the committee's website.

Thank you for identifying yourself for the Hansard record. We now invite you to make some opening remarks. We understand you have got a presentation, and then we will go to questions and answers.

Emma SUTCLIFFE: Thank you to the committee for allowing me to speak here today. My name is Emma Sutcliffe. I am the CEO of EV FireSafe, and I am also an operational firefighter.

Visual presentation.

Emma SUTCLIFFE: EV FireSafe is an Australian female-led research and consulting company focused on improving global understanding of electric vehicle battery fire risks and emergency response. We were founded with support from the Australian Department of Defence in 2021 when were awarded seed funding to develop and refine the world's most comprehensive global database of electric vehicle battery fire incidents, and with that we aim to analyse real-world incidents to better understand the likelihood and causes of lithium ion battery fires in electric vehicles, particularly where that vehicle is connected to EV charging. Due to the impact that we have had, we have successfully secured additional rounds of funding from 2023 to 2026, enabling expansion of that database and our research capabilities.

Today we operate in a number of areas as subject matter experts, supporting the safer adoption of electrified transport. That includes global research and incident data collection. We also do a number of consulting projects, particularly with businesses in critical infrastructure spaces and also with the Department of Defence and other government agencies. This year we are developing training, primarily for the use of industry to help them understand and reduce their battery fire risk but also emergency agencies. We also have developed a high-voltage firefighting specialist team to respond to incidents and also de-hazard and remove dangerous large lithium ion batteries post incident; we also deliver technical presentations and research globally. We have two websites: our research website is evfiresafe.com, and our dedicated learning management system is evfiresafe.training.

I have prepared a presentation that kind of gives you the 'battery fire risk at charging' 101, if that is okay for me to continue. When we talk about battery fire risk, we are talking here about lithium ion batteries. Lithium ion batteries are used everywhere in our daily lives. This is just a small sample of where you can find them in Australian homes. The latest research indicates up to 33 lithium ion battery-powered devices or vehicles will be used in Australian homes as of this year. When we talk about the battery fire risk, we are talking about a

process called thermal runaway. I will not go into this in too much detail, but essentially imagine we have an electric drill and in that electric drill we have, let us say, 10 lithium ion batteries. We drop the drill, one of those batteries gets damaged and it short-circuits, and it starts to heat up. It has an uncontrollable heating process as it short-circuits. Inside each lithium ion battery cell is a tiny amount of liquid electrolyte, and as that heating process starts, that liquid electrolyte boils and becomes a gas. The pressure builds up, and it bursts out of that cell. That gas is highly toxic and highly flammable. As that ignites, as it inevitably does, that heat spreads to the next cell in that power tool battery pack, and that cell does the same thing: it short-circuits. Then heat spreads to the next cell, and we get a domino effect until that cell –

John BERGER: Can I just ask a quick question: what causes the ignition?

Emma SUTCLIFFE: A number of things. It does not need to be an external point of ignition. The working theory that we have is that just the friction of those gases escaping and depression can be enough to cause ignition. We have this this domino effect often until the pack is burnt out. But we have three main hazards to human health: we have the offgassing, which is highly toxic and has caused serious injuries and fatalities just from the inhalation of those gases; we have ignition of course; and we have what we call a vapour cloud explosion, where those gases build up and actually explode rather than simply ignite. The risk of battery fires is highest with what we would term 'fast-moving consumer goods', so things like power banks in particular are a real issue at the moment. One, as you might be aware, actually caught fire on a Virgin flight to Tasmania last year. But primarily it is e-bikes, e-scooters, e-skateboards, hoverboards, those kinds of things. They are made very quickly, they are sold in huge numbers and they have very little regulation that they have to meet.

On the other hand, our road-registered electric vehicles – so electric cars, anything that plugs in – have to meet very strict regulation. They are very high quality cells. We know this from our research not just in Australia but globally. We know that electric bikes and scooters were responsible for the deaths of at least 10 Australians, four of whom were children. I will play a quick video here.

Video shown.

Emma SUTCLIFFE: This is an electric scooter. You can see here the three hazards I mentioned. This is the offgassing – highly toxic. The father and his child here and even the dog are now exposed to very highly toxic gases. That is a vapour cloud explosion, and then we have the resulting fire. This is why our smaller devices that sit in our homes are far more deadly than things like road-registered electric vehicles. The reason I have taken you down that path, which I realise is out of scope for this inquiry, is that we have this enormous misconception not just here in Australia but globally that if those smaller batteries are catching fire – and we are seeing those at a rate of at least one a day around Australia – then electric cars use lithium ion batteries and therefore they must be as dangerous. But actually when we look at the data for electric cars in Australia, we have very few battery fires, and it takes an enormous amount of damage for an electric car to go into thermal runaway, to have a battery fire. As you can see from the data, the leading cause of battery fires in electric cars in Australia is high-speed collision. We then also have some arson attacks and some other fires where the car was the victim of another fire that started. We have three with unknown causes, all coincidentally connected to charging – there is no correlation there, it is just coincidental.

Of those – in fact I have got another slide on that; I will come back to that in a sec. But I want to make a really important point. As I said before, there is this misconception that you plug an EV in and you are going to get a fireball, but actually EV charging is inherently safe. It is a really important point that if you are plugging in an undamaged electric vehicle to a charging unit that is electrically compliant in Australia – that is the RCM tick – and it has been installed to standard, which is AS 3000, appendix P, which I am sure you have heard a lot about, by someone who is a qualified electrician who knows what they are doing, you cannot cause a battery fire to occur. That is because when those systems are all in place there are safety checks that take place when you plug an electric car in, and it is electrically impossible for that car to be overcharged in order to lead to a battery fire. But as I mentioned before, we do have three incidents connected to charging, and all three of these our team has actually investigated. In one of these we have actually torn the battery pack apart to fully investigate what happened.

Now, in the first two cases, both of these occurred in private homes, one in Sydney and one on the Gold Coast. The first was out in the street, so there was no structural damage. The second occurred in a private home, and the home was destroyed. However, it is still under investigation as to whether or not the car was the actual point

of origin. But in both those first two cases we believe that there was a battery fault during the manufacturing process. We know that because now those manufacturers have recalled those vehicles as a result. The most recent one actually occurred last Tuesday the 3rd. That is currently under investigation. I do have some images to show you of the site and the level of damage, but just as a point of interest, globally the data tells us that around 15 per cent of all EV battery fires occur connected to charging. That number is now sitting at 23 per cent for Australia, but as you can see, it is quite a small sample size.

This is an electric vehicle that was connected to a 50-kilowatt DC charger in Queensland. This occurred, as I say, last Tuesday 3 March, in the evening, at around 5 pm. The owner had had it plugged in for about an hour. He had just actually bought it from an auction site. He had just picked it up. He had driven 30 kilometres down the road to charge it up. It had been charging for an hour when it went into thermal runaway. What you can see here on the left is that off-gassing that I mentioned before, on a larger scale because we have a larger battery pack. We then can see the ignition. We did not have a vapour cloud explosion with this. Vapour cloud explosions are actually much rarer for electric vehicles. We are sitting at about 38 globally since 2010 that we have been able to verify. This is the incident on the left during the incident, taken by a bystander. This is towards the end of the incident, where a Queensland fire department have actually been cooling the battery pack down a bit, dispersing some of the flame and the gas cloud there. This was the following day. This is the damage to the charger itself and to the concrete floor underneath the vehicle itself. Now, as a firefighter looking at that, it is relatively similar damage to what we would see with a petrol or diesel vehicle as well. The main difference with this type of incident is because of that thermal runaway – that domino effect that I mentioned before – it takes a lot longer for firefighters to manage the incident. As a general rule of thumb, a firefighter could put out a petrol or diesel car fire in under half an hour; with an electric vehicle we are often looking at, say, 2 to 4 hours, depending on the size of the battery pack, the type of damage and other factors.

Electric vehicle battery fires, particularly those connected to charging, are pretty rare currently, which is good news. However, we do have a number of new hazards for emergency responders, particularly our firefighters, and we must not underplay the danger that they are facing, not just from lithium ion batteries in electric vehicles but lithium ion batteries in other devices as well. When we talk about one of those risks, electrocution, which is particularly relevant to charging, of course, when we have an electric car on fire, for reasons I will not go too much into, when we put water onto that electric car that is on fire, we do not run the risk of electrocution. There is no risk of electrocution there. We are putting water onto DC systems. But as soon as we add charging into the mix, suddenly we have got AC power and we have an electrocution risk there. It is very low, but we do have an electrocution risk there. I think the bigger risk is that firefighters are not adequately prepared currently, and I am not just talking here in Australia; I am talking globally. We do this work globally and we see the same. It is still an emerging piece of training globally.

Additionally, we have a confusing regulatory landscape. We assisted the Australian Building Codes Board to build an advisory notice in 2023, and the Australian Building Codes Board position is buildings should be EV ready, meaning you have got charging, as I am sure you are aware. The Australian fire agencies council have a position saying electric vehicles and charging are a special hazard and we need to be more cautious of them, and organisations such as the Australian Institute of Building Surveyors have a similar position. It has led to a lot of panic for charging site owners. We hear this all the time. I was just in a meeting prior to this with some councils from Sydney, who get this question from apartment buildings very regularly. They do not know what the risk is, they do not know how to manage that risk, they do not know what to do, and they either put it in the too-hard basket and they just kind of try to ignore the risk and think firefighters will deal with it if it becomes a thing, or they buy a product. I want to just make the point that there is no product currently out there that can extinguish an electric vehicle when it is in thermal runaway. I am aware that the committee had some evidence from a fire extinguisher company recently, and I want to just make the very strong point that these products do not work, and they can actually increase risk.

If you can hit play for me again, this is an electric vehicle fire blanket in a testing program we attended in the United States last year. I was on a technical panel for this testing program. These fire blankets are in pretty much every automotive dealership across Australia, and the manufacturers say if an EV goes into thermal runaway, put the fire blanket over the top and it will deal with your fire. This team here, by the way, are probably the most experienced team when it comes to managing electric vehicle battery fires in the world, and even they had an unexpected explosion that led to seven of them being thrown off their feet. Now, when we talk about these blankets and fire extinguishers and things in places like dealerships or around charging sites

where staff are maybe expected to use them, there is an enormous risk to their safety in the use of these products and the purchase of these products.

Very quickly – I promise I am almost finished – we work to reduce risk around charging sites in two ways. We worked, as I mentioned, in 2023 with the building code board to develop a 15-point safety plan. Off the back of that plan we then developed what we call the EV safer charging system. This is essentially a low-cost online training course that we are starting to roll out to Australian councils, and it essentially gives people all the information they need to make sure that they are compliant, they meet regulation and standards but they are also meeting global best practices. So there is a free way and there is a low-cost way that anyone with a charging site can follow to improve fire safety around their EV charging sites. Thank you, and I am very happy to take questions.

The DEPUTY CHAIR: Thank you so much. That was fantastic. That was really, really educational.

Emma SUTCLIFFE: Thank you.

The DEPUTY CHAIR: I will start, if that is okay, Mr B? It was a very good presentation. Just a couple of generic questions to begin with – the incidence of fires where charging is not taking place in EVs is scarce to vanishing, or if the underside has been damaged?

Emma SUTCLIFFE: Typically where we most often see charging-connected battery fires is following natural disasters. If we take the example of Florida, for instance, which gets hit by hurricanes quite often, there are a high number of EVs in Florida, and people have them in their garage – they have plugged them into charging, they get evacuated due to a hurricane warning, the hurricane comes through, it fills the garage or the home with floodwater, and it is salty floodwater, which is worse for batteries. If you get water ingress into any lithium ion battery pack it will start to corrode, but salt water is more corrosive. Then as that water starts to recede and recovery starts, that is when we see fires occur because the cells are corroding and the water has drained out of the pack, but it is still connected to charging. That is still considered a charging-connected battery fire. The other ways are typically battery faults. Electric vehicles are still fairly new, and some of the manufacturers are not quite getting it right with the manufacturing process. We have had massive recalls with Hyundai, Jaguar and other brands where owners have plugged those cars in and they have caught fire due to that fault – that is then a charging-connected battery fire.

The DEPUTY CHAIR: But in the ordinary course of events, a normal EV parked in a parking lot that is not being charged and has not been overtly damaged –

Emma SUTCLIFFE: Yes, it is perfectly safe. It is inherently safe to charge.

The DEPUTY CHAIR: Some of the figures you have provided about the level of prevalence of these things were in absolute terms, but another metric would be the percentage – X percentage. That would perhaps be a fairer metric. Do you have global percentage figures?

Emma SUTCLIFFE: We do not. We cannot even – and I think your next question might be how does it compare with internal combustion engine vehicles as well?

The DEPUTY CHAIR: No, I was not even going to go there – I was not going to be predictable like that.

Emma SUTCLIFFE: Oh, okay. All right, I apologise.

The DEPUTY CHAIR: No, but actually, you are right, it is a good question.

Emma SUTCLIFFE: We do not have it in percentage terms. We could certainly try to supply that to you. There is no global percentage – we could certainly do that for Australia, given we know the number of electric vehicles on the road.

The DEPUTY CHAIR: And given that it is only, what, 2 per cent car penetration, an absolute number is probably not the right way to measure.

Emma SUTCLIFFE: Not the right way to measure. At this point the presentation, as you can imagine, is more designed for emergency responders to give them some certainty that it is not an everyday occurrence. But

electric vehicles are also very new – the average age of an internal combustion engine vehicle in the US is 12 years old, compared to about four years old for an electric vehicle. A percentage would be better, but a percentage in 10 years or 20 years will look very different as well.

The DEPUTY CHAIR: There will be some correlation there. Do the batteries become more prone to fire as they get older?

Emma SUTCLIFFE: At this stage we do not believe so. As batteries get older, they degrade – for instance, when you first get an electric vehicle, you have got 100 per cent use of that battery, and over time you might have 90 per cent use of that battery. Batteries are more prone to violent prolonged thermal runaway the higher the state of charge. We are not seeing that correlation at the moment, but again it is still very early days. What we can see – sorry, I am smiling because we cannot actually see it – is what we call dendrite growth. They are tiny, tiny little spikes in the separator layer of the internal battery cells, and they are like little stalactites. Over time they can grow, particularly depending on the chemistry and form type of the battery cell. If cars are constantly fast charged, those dendrites can grow quicker and they can actually puncture through that separator.

The DEPUTY CHAIR: A bit like stress fractures in an aeroplane.

Emma SUTCLIFFE: Correct. Yes, exactly.

The DEPUTY CHAIR: Particularly as the price of EVs comes down and we get more imports and they are less of a luxury vehicle as opposed to an every-purpose vehicle, do you have any concerns that the battery quality will start to then morph into the fast-moving product standard? And do we have proper protections?

Emma SUTCLIFFE: I am not concerned at all. In fact battery technology is rapidly improving. We have very good standards, particularly around having to crash-test these batteries and the tests that they have to undergo, but those tests apply to road-registered electric vehicles and to battery storage systems. Where we do have some concerns that, thankfully, have not been proven with real-world incidents is electric vehicles rolling into spaces, such as electric ground service equipment in our airports or material handling equipment in warehouses and ports, where they do not necessarily have to meet the same standard. They do not have to be crash-tested, for instance. So you are really relying on the supplier to test and test and test the viability of that battery and the safety of that battery for those environments where it is not required to be road registered.

The DEPUTY CHAIR: The classic scenario that you would be asked about is EV fires in garages under apartments and that risk. I can completely accept that the risk of a fire is low, but I would suggest that the rate of ICE, internal combustion, cars catching passively alight in basements is even lower, probably.

Emma SUTCLIFFE: I do not have any data, but anecdotally I would say – I am not comfortable answering as a comparison with other –

The DEPUTY CHAIR: That is where you could take that on notice, even. But if we go to a system with high adoption and we have lots of chargers in garages, therefore they are in that active state where this could happen, I think it is important to know, 'Okay, what is the ratio of risk of a passive internal combustion car sitting there passively, doing nothing?' Because I do not think they catch on fire if they are not being used. They will usually overheat or they are on the road or they have been involved in the act of an accident or something like that – not passively.

Emma SUTCLIFFE: Yes and no. You have got sort of 3000 moving parts in an internal combustion vehicle compared to maybe 30 in an electric vehicle, so there is more that can go wrong in an internal combustion vehicle to cause a fire. Certainly as a firefighter I have seen cars that were just sitting there that have caught fire.

The DEPUTY CHAIR: I am leaping around a little bit: the preparedness of our firefighters and their services and the equipment they have, do you rate that as a fairly significant problem?

Emma SUTCLIFFE: It is not a problem; it is a challenge to be overcome. It is a challenge to be overcome, because these battery fires in electric cars happen so infrequently that every time one happens our company is sort of madly trying to pull all the pieces together to share that with the emergency response community, because we learn something every time something occurs. I think that – and again, it is out of scope for this

inquiry – there is a far greater risk, particularly to our firefighters, from e-bikes, e-scooters, because it is difficult to get an entire, particularly a volunteer firefighting, force across every single risk and hazard that we are going to face when we go out on a truck. The Australian Fire Agencies Council have released some national training, which is online. But again, having everybody do that is quite difficult, and firefighters often like to learn hands-on and face to face. So there is that challenge, yes.

The DEPUTY CHAIR: From the tone of that answer, the impression I am getting is, 'Look, it's important we address it,' but it is not 'Oh, God. It's an emergency. We're really exposed and at risk because we haven't done it yet.'

Emma SUTCLIFFE: Firefighters are exposed and at risk, particularly firefighters that do not have breathing apparatus on their trucks. I think probably the thing that has risen to the surface for us in our research most recently, in the last six to 12 months, is an increasing number of firefighters who have suffered ongoing injury from the inhalation of those early gases, who have not been able to go back to work – in one case almost a year later. Firefighters are used to smoke, and we are used to dealing with that. But teaching a firefighter that, 'That's not smoke. That's something completely different that contains what we call hydrogen fluoride. When hits your airways, it can actually start to eat away at your flesh'– when you start to talk to them about it in those terms, then they understand.

The DEPUTY CHAIR: Standard-issue respirators and other things, are they sufficient?

John BERGER: I think we are probably getting into an area that is outside the scope of the inquiry.

The DEPUTY CHAIR: No, I do not think it is.

John BERGER: I think it is.

The DEPUTY CHAIR: Because if you are going to have EVs charging everywhere –

John BERGER: Even the witness has said initially that it might be outside the scope of where we are heading. I think we are focusing on the battery and its performance and fires.

The DEPUTY CHAIR: I disagree, Mr Berger. A safety issue of charging EVs is the potential that they might catch fire and how you would deal with those fires.

John BERGER: I just think you are heading into an area that is probably outside the scope of the inquiry.

Gaelle BROAD: Any other matters? Number 7 is eligible for discussion.

The DEPUTY CHAIR: I will leave it there and pass over to you, Mr Berger.

John BERGER: Thank you. A lot of your research is from the grid into the battery. That is primarily the intended process. What about the reverse, when a vehicle is going to push it back into the grid?

Emma SUTCLIFFE: From a battery fire risk perspective, we do not know what bidirectional charging will mean at this stage. It is not common enough for us to really deep dive on that at this stage. For a damaged battery, any input or export of power has the potential – this is a working theory only; it has not been tested – to cause a cell to collapse, leading to thermal runaway. One of the questions we get asked a lot is if a lower state of charge battery – if a battery at 20 per cent state of charge goes into thermal runaway, it might just off gas, there might be a couple of flames, but we will manage that pretty quickly, because there is less energy to burn off. A battery at 100 per cent state of charge will go for longer, it will be violent, there will be jetlike flames. We will have all the bells and whistles with that one. One of the questions I get asked is: if a car has been in a collision by the side of the road, can we drain the battery pack by the side of the road to make it safer if it does go into thermal runaway? The answer is: no, there are no tools to be able to do that at this stage. There is also the risk that if we drain that battery pack, we could also cause thermal runaway to occur. I do not have any proof of that statement.

John BERGER: Do you think that is something that is probably going to need some further investigation given that one of the selling points of an EV is having a battery plant on wheels to push it back into the grid?

Emma SUTCLIFFE: It certainly will, yes. Unfortunately burning electric vehicles is very, very expensive and difficult to do due to environmental protection reasons here in Australia. We often are attending tests overseas, such as the one I showed you. At this stage I am not aware of any of our colleagues in the US, Europe or the UK that is looking at bidirectional charging.

John BERGER: I think the same for me: questions need to be answered in terms of solar batteries when they have been fully charged, and then they start to come back the other way when they are charging appliances or used for household appliances.

Emma SUTCLIFFE: Are you talking about EV batteries that are end of life or battery storage systems?

John BERGER: Battery storage systems.

Emma SUTCLIFFE: It is a different kind of use case. Battery storage systems are specifically designed to do that, whereas electric vehicles are just designed to export power to give the vehicle momentum. As I said, in terms of a fire risk, it would need to be an electric vehicle that has been in a collision. I would then have some concerns about dumping the power out of that with any mechanical means.

John BERGER: In terms of battery storage or transportation in large numbers, are they tested beforehand to see if there are any issues with them if they do embark upon, say, bringing them from Sydney to Melbourne by road, by rail or by any other transport?

Emma SUTCLIFFE: It is a bit of a regulatory gap in Australia. If you are carrying electric vehicles where the battery pack is inside the electric vehicle and you are carrying the electric vehicle on a diesel –

John BERGER: Car carrier.

Emma SUTCLIFFE: Yes. You are not required to placard it; it is a car on a carrier. As soon as you take that battery pack out or you have drums of, let us say, vapes that all have a cell in them each or you are carrying e-waste in the form of e-bike batteries and those kinds of things, you are then required to placard them as class 9 dangerous goods. What we are seeing in Australia is a number of incidents – I think I am correct in saying at least three and there could be four – where we have had exactly that. It is a diesel truck carrying either electric cars in one case, drums of e-waste, or in one case my understanding is there was an EV battery in the back of the truck, but they were not properly placarded, and those batteries catch fire either in the back of the truck, or in the case of the one carrying EVs, I believe it was a tyre fire that spread. We are starting to see that kind of thing occur across Australia too, and we have certainly seen it globally.

John BERGER: Just one more, Chair, if I could. The ground support equipment in an aviation context – what are your experiences there and its application broadly, because when I think of aviation and batteries and petrol engines and aircraft engines, I think of big explosions if something goes wrong. How do you get that all right?

Emma SUTCLIFFE: We see everything from really excellent to suppliers of electric ground service equipment who are legacy suppliers who have been doing it with other forms of fuel for many years and have just gone, 'Oh, I can just stick some batteries in and do it that way now' but they are failing to take into account the unique characteristics of thermal runaway. We have worked with both airports and then airport tenants, and likewise with ports and then port tenants, who have faced the same challenges with electric material handling equipment and container handling equipment. As I say, we talk to some suppliers that are like, 'Yeah, we've done this' and we are like, 'That's brilliant. Love it,' through to we have asked what the chemistry is on a forklift, for instance, and they are like, 'Oh, it's just lithium ion' and they cannot tell us if it is LFP or NMC. They cannot tell us anything about their battery, which is always really concerning when you are running it underneath a $10 million aircraft. As I pointed out before, we see that as a big gap in the understanding for some of these operators – airports, ports, shipping, those sorts of spaces.

John BERGER: How will we tighten up the compliance around or regulate more around that to ensure safety for the travelling public?

Emma SUTCLIFFE: It is a tricky one, and thankfully way above my pay grade, but I think we need to be looking at some of the standards that apply to road-registered vehicles and applying those to some of this specialist equipment, essentially.

John BERGER: I think it is something that probably needs to feature in the report, given the possibilities around an aviation industry that is going to embark upon batteries as a source of their ground support equipment.

Emma SUTCLIFFE: And have. A really great example though is Air BP rolled in an electric aircraft refuelling truck in Brisbane a couple of years ago now, and it is incredibly well protected. They worked with the airport firefighter department, and it is designed to mitigate the risk. It is designed that in the event of a battery fire occurring, it essentially has a bit of a sprinkler system around it that a firefighter can hook a hose up to, and it sprays it to protect it from the fuel that it is carrying and the aircraft. They hook the hose up and they walk away and they just let it spray until that battery has burnt through.

John BERGER: I suppose the biggest problem would be that typically on an aircraft there will be ground support equipment that is attached to it that is unattended for periods of time. People would not necessarily know that something potentially could happen –

Emma SUTCLIFFE: Something is happening. Yes, correct. Yes, there is.

John BERGER: There would have to be a number of protocols in terms of leaving that equipment attached to the aircraft whilst it is unattended.

Emma SUTCLIFFE: Yes, and fires in traditionally-fuelled ground service equipment do happen and do destroy aircraft, but I think when we talk about lithium ion batteries in that space as well, I believe in the research now we are seeing at least one fire inside an aircraft from a battery being carried by passengers at least once a week at this point, including the one I mentioned in Tasmania on the Virgin flight.

John BERGER: Thanks, Chair.

The DEPUTY CHAIR: Thank you, Mr Berger. Ms Broad.

Gaelle BROAD: Thank you very much, Emma, for your contribution today. I am just interested in firefighters, particularly because I represent northern Victoria – regional Victoria – and liaise with CFA brigades around the region. I just want to understand what the risk is to those volunteers right now. This committee inquiry is to make recommendations. What recommendations would you like to see to make it safer?

Emma SUTCLIFFE: That is a great question. The biggest risk is a lack of knowledge. EVs seem to be very political online on any social media, and there are lots and lots of people that make a lot of money from telling everyone that they are going to kill everybody, because they sell something like fire extinguishers or fire blankets and that kind of thing. So firefighters are subjected to the same kind of misinformation that everybody sees online. But firefighters are also seeing these smaller fires, so e-bikes, e-scooters, vapes, power banks, that kind of thing. They are seeing those in homes and again, they are equating those – that is a lithium ion battery, also, there are thousands of them in this EV over here, therefore that EV must be very, very dangerous.

We also hear from firefighters very regularly – and I am a CFA firefighter – 'It's an electric car. If it's in a collision, I'm going to be electrocuted if I touch it.' So it is a new challenge. It is a lack of awareness. We often talk about it in the same way as when LPG tanks in cars became popular. We did not know about that either. So it is just a steep learning curve. This is not a plea for funding, but we spend a lot of time working with OEMs. We pay for that out of our own pocket. We do not get paid for that. We do not have any funding for that. We recently did it last year with Tesla, where we toured Australia. We kind of did a hop around Australia and we took some cars and we did some sessions for free for emergency responders. But you only hit a small number in each place. I have a grand plan as a Victorian and as a CFA volunteer to tour the state eventually and take a bunch of cars around and just let the crews get their hands on them: let them have a look, crawl underneath, have a look where the battery packs are, and then run them through what to do when they are in a collision and what do you do when they are on fire?

Gaelle BROAD: Is there capacity – because I guess there are so many brigades across Victoria – to put this kind of training online for a start?

Emma SUTCLIFFE: It would be awesome. I think we tried a little while ago. I actually wrote the standard operating procedures for CFA a few years ago now. But what would be great – we see brigades doing it organically – would be to give each of the brigade training officers a bit of a kit where they can go, 'Let's call someone who has an EV. Let's do a training night and have the local person bring their EV down. Here are the points to hit to get your general awareness up.' As I say, we see some of the brigades doing it. If they have got a dealership nearby, they might go visit the dealership, that kind of thing. But that kind of gives them that basic awareness, but I think delving deeper into, 'Well, how do you isolate that high-voltage battery? What do we do following a major collision? Is it safe to cut into this EV if it's got high-voltage cables running through it?'

Gaelle BROAD: I would like to know the answers to all these questions. We have seen blankets that are still exploding, and you mentioned too that it is not possible to put out some fires.

Emma SUTCLIFFE: We have stopped using the word 'extinguish'. We say we control and contain a battery fire. It is a point I did not go into in the presentation, but if we have an electric vehicle that has had a battery fire – I drive a Tesla Model 3, for my sins, and I have 4416 battery cells in my car. If I have a collision and half my battery pack burns out, I have still got over 2000 cells. My car goes on the back of a tow truck to, let us say, Manheim in Altona, and it sits there for a while. That battery pack can go into thermal runaway again at any time, and our current record is two years post incident. So an EV was involved in a collision, it sat in a yard for two years and then caught fire again.

Gaelle BROAD: This is not filling me with confidence, I am sorry. I have so many questions. Are we, with the increased uptake of EVs – I notice you said EVs are safer charging, not safe charging – accepting a level of risk? Is it a higher risk than what we are seeing with ICE vehicles?

Emma SUTCLIFFE: It is a new risk. We use the word 'safer' because we cannot say to someone, 'We can completely remove the risk.' We are going to make it as safe as possible. And by that we operate on a methodology of prevent, prepare, respond, recover. So we are going to prevent it in the first place as much as we possibly can. We are going to prepare in case it does happen. Then if it does happen, we are going to be able to respond as quickly as possible and manage that incident very well with as minimum a risk to life and property as possible. And then we are going to be able to recover and get that site back to business as usual as quickly as possible. So that is the reasoning for that.

Gaelle BROAD: So a brigade, a CFA brigade of volunteers going out on site to put out a – say there has been a crash, an EV car has caught alight. Is it safe for them to respond?

Emma SUTCLIFFE: Yes. It is as safe for them to respond as it would be safe for them to respond to any incident. As you know, it does not matter what the call-out is, you never know what you are going to be arriving to. Volunteers, and CFA volunteers in particular, have a bit of knowledge now. They have perhaps witnessed a lithium ion battery fire. They will have certainly seen some videos online and that kind of thing. But I am very, very confident in the ability of our CFA volunteers and of all my colleagues to manage an electric vehicle battery fire efficiently and effectively.

Gaelle BROAD: Are you saying a recommendation from this inquiry would be to make that training more readily available?

Emma SUTCLIFFE: More readily available, and I think that it needs to – there is online training for all CFA volunteers, but I think, as I say, hands-on training. But we also need to deep dive into things such as – not to be too gruesome here – how we recover bodies from burnt electric vehicles. Because our belief is that if an electric vehicle can go into another ignition while we are moving it or working around that vehicle, then recovery should now be done wearing breathing apparatus. So there is a whole host of other satellite, new challenges that we need to be considering. None of them are insurmountable. EVs are inherently safe. The numbers of battery fires are very low at the moment. We have got this great opportunity to learn as much as we can.

Gaelle BROAD: But our uptake is also very low at the moment.

Emma SUTCLIFFE: Yes, correct.

Gaelle BROAD: I guess this is my concern, because there is a lot of popularity, there is a lot of, 'Oh, let's drive an EV.' Certainly fuel prices escalating is going to be making a lot of people question their choice. But I guess safety is important. I guess you are talking about the information that is put out there, and I saw that there was a ship, the *Morning Midas*, last year with 3000 vehicles apparently on board that could not be put out. It was suppressed and was left. What are the risks, and particularly with EV vehicles such as fire trucks, I know FRV has now got an electric fire truck. Is it an increased risk putting that out into a fireground, for example? What are your thoughts on that?

Emma SUTCLIFFE: No, not at all. That is an urban truck.

Gaelle BROAD: Well, it may well be. I mean, we are seeing the push for electric vehicles and buses.

Emma SUTCLIFFE: Electric tankers. Yes, absolutely.

Gaelle BROAD: So what would be the risk to a regional area?

Emma SUTCLIFFE: From an electric fire truck – these vehicles are designed to be as safe as possible. I think the biggest risk that we have with that type of thing is that there is a fault during the manufacturing process and it has not been recognised and we have a fire in an electric truck. To give you an example, an electric bus in New Zealand last year was involved in a head-on collision with a petrol car. The petrol car caught fire and that spread to the bus. It destroyed the bus, but none of the battery packs went into thermal runaway. So very frequently when we have these kinds of external fires spreading to these cars, we often do not see battery involvement. However, I will make the point, though, that those batteries are now compromised and are at a higher risk of thermal runaway because of that thermal damage, and potentially if they were impacted in the collision.

Gaelle BROAD: It is kind of like a bike helmet that gets dropped.

Emma SUTCLIFFE: Correct.

Gaelle BROAD: Same concept. I am just interested in battery recycling. There were previous witnesses that talked about banning batteries from being exported or banning batteries from going to landfill and processing batteries in Australia. One of them made the comment that some major brands that boast about their sustainability credentials are opting to ship batteries offshore to countries such as India because of their lower environmental and labour standards, allowing for cheaper processing. I guess there has been a push for, with the uptake, an increase of recycling occurring onshore, but I am aware of lithium ion batteries catching alight in the back of garbage trucks on their way to landfill. What are the risks in trying to do that element of it? You talk about a car sitting there for two years and suddenly catching alight. What are the risks of looking at doing that?

Emma SUTCLIFFE: Thank you. It is a great question, and I do want to touch on it, given it is in the terms of reference. We are all for the reuse of end-of-life EV batteries in another form. However, currently we can essentially plug a device, a diagnostic tool, into an electric vehicle and get what is called a state-of-health check on that battery, and that state of health tells us: has the battery degraded over time and through use and through DC charging? It says, 'Yes, the battery's looking pretty good and that's no problem.' But what it does not give us is a state of safety. Going back to your comment around bike helmets, if we think of an EV battery as, say, a footballer's head, and over time you get a knock and a knock and a knock and a knock, then suddenly you get that one knock that is going to cause the real issues. We cannot currently measure that with EV batteries, so we cannot plug a diagnostic tool in and go, 'Actually there are some cells in here that are at risk of collapsing' or 'They've got dendrite growth' or that kind of thing. Reusing EV batteries for another purpose, such as battery storage? Great, love that idea. We want to see as much recycling as possible. However, at the moment EV FireSafe could not say to you, 'Yes, that battery is perfectly safe; it's not going to catch fire.' Nobody in the world can say that. The only way we can actually check that is to open that battery pack and individually check every single cell, which I believe some companies are potentially starting to do.

Gaelle BROAD: Thank you, Chair.

The DEPUTY CHAIR: On that last point, tracking the provenance of the battery is the tricky bit there.

Emma SUTCLIFFE: That is the tricky bit. The Europeans have introduced a battery passport that will start to do that, which we are watching from afar, but even then it is tricky. You just do not know which knock –

The DEPUTY CHAIR: Well, the owner is not going to necessarily confess, 'I actually did run over a speed hump badly,' or whatever.

Emma SUTCLIFFE: Yes, that is it, because of their insurance. We have seen where people have run into lamp poles and they have torn the battery pack in two and there is no fire at all, and then we have seen a little knock – a guy came off the road and kind of turtled himself on a concrete culvert on the side of a driveway and that led to a battery fire, but it was at low speed. There is just no line in the sand where we can go, 'No, we're not comfortable.'

The DEPUTY CHAIR: It is a very interesting one for the insurers there.

Emma SUTCLIFFE: We work a lot with insurers, yes.

The DEPUTY CHAIR: Last question: for the committee's edification, could you explain the difference between lithium ion and the other form of battery, the LMC battery – why one is less likely to have a fire?

Emma SUTCLIFFE: Lithium ion battery is the umbrella term, and then under that you have a whole bunch of chemistry. LCO – there is a whole bunch of it. The two main ones are LFP, lithium iron phosphate, and NMC I can never remember – nickel, magnesium, cobalt. They are the most commonly used, particularly in electric vehicles. There is again this overriding conception that LFP are fireproof. That is actually just down to good marketing by companies like BYD. They can catch fire. There is no such thing as a fireproof lithium ion battery. When I mentioned before the liquid electrolyte in each of the cells, currently it is liquid, and when the battery overheats and it boils off and becomes the gas, that is the flammable bit. When you start to hear about solid or semi-solid state, that is making the electrolyte solid so that cannot happen. In theory a solid-state battery will be fireproof. If you try really, really hard – let us face it, you never know what people are going to do with their batteries – you can get them to catch fire, but it will be at a far less great rate.

The DEPUTY CHAIR: Do they have a substantial or material cost or performance difference as a result?

Emma SUTCLIFFE: It does boil down to energy density and how big you want your battery to be, and that is a whole rabbit hole there. Certainly there is a cost difference when you want to recycle NMC versus LFP. Again, I cannot recall which one is worth money and which one is not. I will come back to you on that. But certainly there is a cost difference in what you can capture – I believe it is NMC, because you can capture more metals from that that then have more value essentially.

The DEPUTY CHAIR: Wonderful. Unfortunately we have run out of time. Thank you so very much.

Witness withdrew.