EVC response to NSW parliamentary inquiry into Electric and hybrid vehicle batteries.

November 2023

With reference to:

https://www.parliament.nsw.gov.au/committees/inquiries/Pages/inquiry-details.aspx?pk=3005

That the Joint Standing Committee on Road Safety inquire into and report on:

(a) the risk and management of fires and other issues caused by batteries in electric and hybrid vehicles, including light electric vehicles

(b) the risk to workers in the automotive industry and emergency services personnel caused by batteries in electric and hybrid vehicles

(c) the adequacy of training and equipment for workers in the automotive industry and emergency services personnel regarding potential hazards of batteries in electric and hybrid vehicles

(d) any other related matters.

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Preamble:

The perception that Electric vehicles create a significant new risk from a fire safety standpoint has some history, and has been widely covered in the media.

The ACCC undertook an investigation recently into Lithium Ion battery safety, to which the EVC responded in some detail:

https://electricvehiclecouncil.com.au/submissions/evc-submission-to-accc-lithium-ion-battery-safety-consultation/

There are several perspectives to this issue worth exploring, which have a bearing on the nature of the risks, and the appropriate responses from government.

Summary of EVC recommendations:

NSW Government should act by way of the relevant state level building regulator, to make it clear that the treatment of EV charging installations and EV car parking locations as 'special hazards' is not required at this time.

The EVC suggests that NSW government should increase resourcing to NSW Fair Trading to address the rising incidence of unsafe lithium-ion battery containing products such as battery electric scooters, outside of the road-registered vehicle domain.

It may be appropriate for NSW government to investigate the case for recommendations relating to the safe storage and charging of electric scooters, especially in environments such as apartment complexes and offices.

NSW government should consider supporting EV FireSafe:

- **To undertake a robust and independent review of global literature on the subject of EV fire safety in the built environment**
- **To undertake work aimed at ensuring safe work practices for second responders such as tow-truck drivers, where there has been insufficient work done.**

Automotive industry - vehicle maintenance and repair:

Road registered vehicles with batteries at voltages high enough to be hazardous have been in the Australian market since the late 1990s, with the introduction of the Toyota hybrids. There are now in excess of 400,000 road registered vehicles with traction batteries on Australian roads, from many manufacturers.

From the point of view of risk to the people undertaking maintenance on these vehicles, it has long been understood that higher voltage batteries constitute a different type of risk. The relevant Australian standard in this domain is AS5732, which has recently been updated with input from a broad cross section of industry and government experts at a national level.

This standard is called up in the relevant commonwealth training programs and modules, such as AUTETH101. These courses have been offered in Australia for over ten years and are presently offered by about 185 Registered Training Organisations around the country.

In terms of the adequacy of this arrangement, we point to the fact that there is no record we're aware of *globally* where a fatality in the automotive maintenance space attributable to the battery in a hybrid or electric vehicle has occurred, and no incident we're aware of in Australia where an *injury* in the automotive maintenance space attributable to the battery in a hybrid or electric vehicle has occurred. We'd suggest that this is prima facie evidence that the existing regulatory arrangement is likely adequate – there are tens on millions of these vehicles on the road globally, in addition to the hundreds of thousands on the road in Australia.

We addressed this matter in our recent submission to the Electrical Safety Office in Queensland, which covered similar ground, including consideration of a requirement for all parties undertaking maintenance on Electric Vehicles to be licenced electrical workers:

https://electricvehiclecouncil.com.au/submissions/evc-response-to-final-report-on-queensland-electrical-safety-act-2002/

The Electrical Safety Office, following a long consultation process, arrived at a guidance position around this matter, essentially recognizing that the existing competency units and OEM training options are valid and adequate:

https://www.worksafe.qld.gov.au/safety-and-prevention/hazards/electricity/electric-vehicle-guidance

Emergency services personnel

There has been substantial international research in this domain. EV Fire Safe, a company funded by the Australian Department of Defence to research electric vehicle battery fires & emergency response, are among the world leaders in this space.

The short version is that vehicle OEMs provide data to the ANCAP rescue app, have been proactive in supporting training for first responders, and have supported and complied with requirements to label EVs for easy recognition by emergency services.

Vehicle fires are, by their nature, hazardous, regardless of the powertrain. The products of combustion of a vehicle are toxic. The same measures used by emergency services personnel to protect themselves from harm when addressing petrol and diesel vehicle fires are applicable when addressing electric vehicle fires.

Electric vehicle fires in Australia have been small in number, with a total of 6 while in normal operation. In all cases, the EVs suffered major damage to the high voltage lithium-ion battery pack, leading to thermal runaway (battery fire). See appendix A for details. In all cases, fire fighters have successfully responded using existing tools and techniques for vehicle fires.

As with any emerging technology, fire & emergency agencies need to develop an understanding of the risks & hazards, standard operating procedures, awareness & training documentation, as well as connect with subject matter experts, such as EV FireSafe.

The new risks & challenges of electric vehicles is well understood by EV FireSafe, which has been contracted by a number of Australian emergency agencies to develop SOPs & training packages.

Additionally, EV FireSafe is involved with state-based, multi-agency working groups to collaboratively develop knowledge from emergency response through to towing, storage, salvage or repair of a damaged EV. This work is emerging and at this stage unfunded.

Ongoing training & education will continue to be necessary, to the extent that vehicles come to market requiring different techniques, or present different risks. The EVC encourages the fire services to determine their training requirements and secure sufficient resources / funding to undertake said training.

Second responders

EV FireSafe's data also indicates EV battery fire risk to towing, transport and salvage sectors. This is primarily due to a lack of awareness of the risks, rather than there being a greater overall risk to the Automotive sector from EVs.

Again, EV FireSafe have led the discussion with those sectors, however this work is not funded & has no overall national approach. Please see Appendix B for more detail on this.

Built environment

Many parties have suggested that the existing minimum requirements in our buildings are inadequate with respect to managing the risk posed by EVs.

FRNSW has been among these parties, taking a public position that amounts to, "follow the electrical regulations", https://www.fire.nsw.gov.au/page.php?id=9391, while taking a private position when engaging with fire engineers on consent processes for construction that installations of EV charging stations constitute a special hazard. We've included a de-identified example of this type of private guidance in Appendix C.

This duality of approach creates significant challenges for developers seeking to design buildings to support the uptake of electric vehicles. Treating car parking areas as 'special hazards' if EV charging equipment is included can increase the cost of construction of the building as a whole by between 5 and 10%. This is more than enough to convince developers not to install EV charging equipment. It also does nothing to reduce risk, because the fire risk comes from the cars, not the charging – and the car parks will be full of EVs in future, regardless of whether or not charging equipment is installed.

FRNSW launched a research program (SARET), with initial calls for expression of interest in November 2021, in part to work through appropriate measures to manage the perceived elevated risk in buildings. An initial workshop was held in February 2022. The EVC articulated early in this process that it would be appropriate for the SARET program to undertake practical testing, to determine the adequacy of existing construction code requirements. Regrettably, the SARET program appears to have failed to effectively engage key industry participants or secure adequate resourcing, and (to the EVC's knowledge) has not scheduled any practical testing of EV fires in structures built to Australian standards and codes.

For reference, substantial practical international testing has been done along these lines, to understand the differences between EV fires and petrol/diesel fires in the presence of specific suppression arrangements. From this work, it appears that under standard conditions, the risk of a fire spreading from an EV is lower than the risk of a fire spreading from a petrol or diesel vehicle:

https://www.researchgate.net/publication/373037873_Water_Spray_Fire_Suppression_Tests_Comparing_Gasoline-Fuelled_and_Battery_Electric_Vehicles

Like FRNSW, various Australian fire services have taken positions indicating that the potential presence of EVs in buildings, or the installation of EV charging equipment, should mean that the area is treated as a 'special hazard'. No evidence is typically provided to justify these positions, and no detail is typically provided for fire engineers to use to determine what a suitably safe design would be. While the guidance documents and position statements from the fire services don't generally have the legal force of regulation - and are therefore not subject to any meaningful form of regulatory impact testing or oversight - they often have the effective force of regulation because the community of certifying engineers in this space finds it very difficult to ignore the fire services guidelines. Examples include:

https://www.qfes.qld.gov.au/sites/default/files/2022-04/Electric-vehicle-chargingstations_0.pdf

https://www.mfs.sa.gov.au/community/building-and-commercial-fire-safety/guidelines-andinformation/Fire-Safety-Position-Statement-EV-Charging-Stations-in-Buildings-1.0.pdf

Fire Rescue Victoria has taken a similar pathway to New South Wales, refraining from taking a public stance opposed to supporting EVs, but issuing private guidance by email to fire engineers setting out expectations of 'special hazard' treatment of car parks.

The industry peak body for fire services (AFAC) has gone in this direction as well, with the publication at the end of 2022 of a position statement of their own:

https://esa.act.gov.au/sites/default/files/2023-01/afac_evs-in-built-environment_2022-1222_v1-0.pdf

In addition to the fire services and their peak body, we've seen efforts by the Australian Institute of Building Surveyors to develop a policy position that approval or authorisation for installation of dedicated electric vehicle charging points in existing buildings should be inclusive of an assessment against technical criteria by a building surveyor:

https://aibs.com.au/Public/Public/News/2022/Member-Alert-Charging%20Electric%20Vehicles%20in%20Buildings%20-%20Draft%20Policy.aspx

This is not currently required in existing buildings, because the installation of Electric Vehicle charging points is electrical work, which is already a highly regulated activity, undertaken by licenced professionals under a robust regulatory regime. Were this position to change in the manner favored by the AIBS, it would generate significant new income for AIBS members, and raise the cost and complexity of EV charging equipment installations for consumers. As with the fire services positions, no evidence is presented to justify the additional costs which would be imposed upon consumers, or analysis undertaken to show that the proposed measures will deliver a real-world safety benefit.

For the avoidance of doubt, FRNSW and others are seeking an outcome where additional requirements are imposed in the built environment, at substantial cost to consumers, without evidence as to the need for these measures, or any form of regulatory impact testing. These positions are being pursued despite the presence of robust global evidence that road-registered EVs do not present a higher risk in our built environment than our existing petrol and diesel fleet of road-registered vehicles.

There have been some efforts made by government to set the record straight on this matter. The Australian Building Codes Board published a guidance note, laying out practical and low cost recommendations where new buildings are including EV charging:

https://www.abcb.gov.au/resource/advisory-note/abcb-advisory-note-ev-charging

This was welcomed by the industry. Regrettably, while the ABCB guidance does not call for special hazard treatment, it also does not make it clear that special hazard treatment of car parks is not warranted. The result of this is that at least one fire service (ACTF&R) is taking a stance that amounts to 'buildings (new *and* existing) will comply with the ABCB guidance note *and* the car park will *also* be treated as a special hazard in new builds'.

NSW Government should act on this matter by way of the relevant state level building regulator, to make it clear that the treatment of EV charging installations and EV car parking locations as 'special hazards' is not required at this time.

The EVC supports the development of robust requirements in this domain. Critically, these requirements must be informed by evidence, and be subject to appropriate regulatory impact testing. The status quo is that the requirements are being decided without evidence, appropriate process, or transparency, by parties without an interest in the cost implications of the requirements.

The EVC suggests that given FRNSW has had two years to produce useful results from the SARET program and has not yet scheduled the type of work likely to yield these results, it might be more appropriate for CSIRO or EV FireSafe to do some work in this domain, which NSW government could

contribute to financially. A robust and independent review of global literature and test reports on the subject would be a good start.

Regulation of vehicles – the difference between cars and scooters.

The EVC observes that while electrified micro-mobility presents an excellent pathway to reducing overall transport emissions and lowering the overall cost of transport, and that the technical standards associated with these types of products may be adequate, the regulatory environment around these products in Australia is presently inadequate.

The importation and sale of equipment of this type is very lightly regulated in practice, which predictably results in the importation and sale of cheap, non-compliant product. Better regulation, and regulatory enforcement activity around the importation and sale of this type of product is needed. By comparison, road-registered vehicles, such as cars, motorbikes, and trucks, are massively regulated, with strong enforcement regimes.

This is borne out in the output of the ACCC process, which identified that just 1% of the lithium ion battery fires FRNSW responded to over a twelve month period involved a vehicle. 99% of lithium Ion battery fires responded to by FRNSW are for other consumer products. See section 5.1.4:

https://www.accc.gov.au/system/files/Lithium-ion%20Batteries%20report_3.pdf

Global Automotive OEMs are aware of the hazards associated with batteries, and already design their products to minimise the associated risks, in the context of a consumer product type where high speed mechanical damage needs to be minimally likely to result in a fire. For example:

https://www.dekra.com/en/high-safety-level-of-series-produced-electric-carsconfirmed-in-dekra-crash-tests/

Further, where a global vehicle manufacturer identifies a problem that has the potential to result in a fire, the standard real-world response is a massive recall and rectification process. By way of example, Hyundai identified an issue in their Kona product, which had the potential to start a fire. Globally, 77,000 vehicles were recalled and rectified, including about 800 in Australia. No actual fire incidents occurred in Australia as a result of this issue. The potential hazard, having been identified by Hyundai, was corrected by Hyundai before the fault resulted in a fire in this country.

The result of this much more stringent regulatory environment is that while the battery in a road-registered electric vehicle like a car is much bigger than the battery in something like an electric scooter, it is far less likely to catch fire. Again, the data bears this out – EV fire safe has sought to identify the number of EV battery fires globally, and has discovered 246 instances between 2010 and 2022, across a global battery electric vehicle fleet of more than 20 million units. Fires in electric cars are rare - far less common than fires in petrol or diesel cars.

https://www.evfiresafe.com/_files/ugd/8b9ad1_6fa2d5ae7ffd46e69b91d84d4de2f6c8.pdf

The EVC suggests that NSW government should increase resourcing to NSW Fair Trading to address the rising incidence of unsafe products outside of the road-registered vehicle domain.

Further, it may be appropriate for NSW government to investigate the case for recommendations relating to the safe storage and charging of electric scooters, especially in environments such as apartment complexes and offices.

The base case – what about the petrol and diesel vehicles that the EVs are replacing?

Per appendix A, there have been six instances that we're aware of in Australia where a road registered BEV or PHEV has gone into thermal runaway while in normal operation.

In all six instances a significant external cause was present – for example arson, structure fire or high speed impact. An additional case at Sydney Airport, involved the dis-assembly of the vehicle with parts left exposed to the elements for months. In no cases in Australia to date has there been any link between EV charging and a fire.

In all cases, traditional fire-fighting techniques were successfully applied to manage the incident.

The 7 known EV fires in the country over a three year period (6 in normal operation, one as a result of deliberate dis-assembly by an unqualified person) coincided with a starting number of EVs on the road when the first one happened of roughly 30,000, and the number on road today being about 150,000. This implies something on the order of ~2-4 electric vehicle fires per 100,000 per year.

By comparison to petrol/diesel vehicles, FRNSW attended ~2,461 vehicle fires in the 2020/21 (page 36: https://www.fire.nsw.gov.au/gallery/files/pdf/annual_reports/annual_report_2021_22.pdf).

Based on the ~5.89m registered vehicles in NSW in the time frame (https://www.abs.gov.au/statistics/industry/tourism-and-transport/motor-vehicle-census-australia/latest-release), this implies a vehicle fire rate of ~41 vehicles per 100,000 per year.

This is broadly aligned with similar research out of Europe, where it's been concluded that EVs burn at about one twentieth of the frequency of petrol/diesel vehicles:

https://www.msb.se/sv/aktuellt/nyheter/2023/maj/brander-i-eltransportmedel-under-2022/?ref=warpnews.org

The upside of EVs, by comparison to petrol and diesel vehicles, is well understood in terms of emissions outcomes – practically speaking, we cannot achieve net zero without electrifying road transport. Failure to achieve net zero will have strategic consequences for our country.

From a narrower human safety aspect, though, we can consider the health impact on our citizens of petrol and diesel exhaust in our cities. Melbourne University has undertaken robust work in this space, concluding that vehicle emissions are responsible for 11,000 early deaths in Australia each year:

https://www.unimelb.edu.au/newsroom/news/2023/february/vehicle-emissions-may-cause-over-11,000-deaths-a-year,-research-shows

Based on the vehicle fleet size of 20 million vehicles, this means that for every ~1800 vehicles transitioned to electric, we could reasonably expect the annual early-fatality count to fall by 1.

To the extent that opponents of vehicle electrification successfully delay the transition, through measures like obstructing the ability to charge EVs in our built environment without evidence of actual risk, we can expect to continue to see the current fatality rates associated with air pollution.

Work by the insurance industry in this space

Prompted by some insurers in Australia taking positions opposing the installation of EV charging equipment in buildings, the EVC reached out to the Insurance Council of Australia. The EVC understands that the ICA is working towards a publication on this topic.

The status quo in Australia today is that some building insurers have taken a view that EVs pose a new and significant risk, and guide building owners to follow the sorts of special hazard guidance outlined above. This type of guidance massively drives up the cost and inconvenience associated with EV charging equipment installations, often to the point that they do not happen.

By contrast, there are some insurers who follow the evidence, and treat EVs in buildings, and the charging equipment that serves them, as not having any higher risk than the petrol and diesel vehicles they're replacing.

The guidance from the EVC to building owners is essentially: "If your insurer has an issue with your plans to deploy EV charging equipment in your building, call your broker, and find an insurer that aligns their risk assessments with the evidence".

Appendix A: Incidences of EV fires in Australia:

BEV & PHEV LiB Fires in Australia

All EVs were in normal operation at the time HV battery fire (thermal runaway) occurred:

All caused by damage to the battery pack from
- Arson x 1
- External fire (structure burnt down) x 3
- Collision x 1
- Road debris x 1

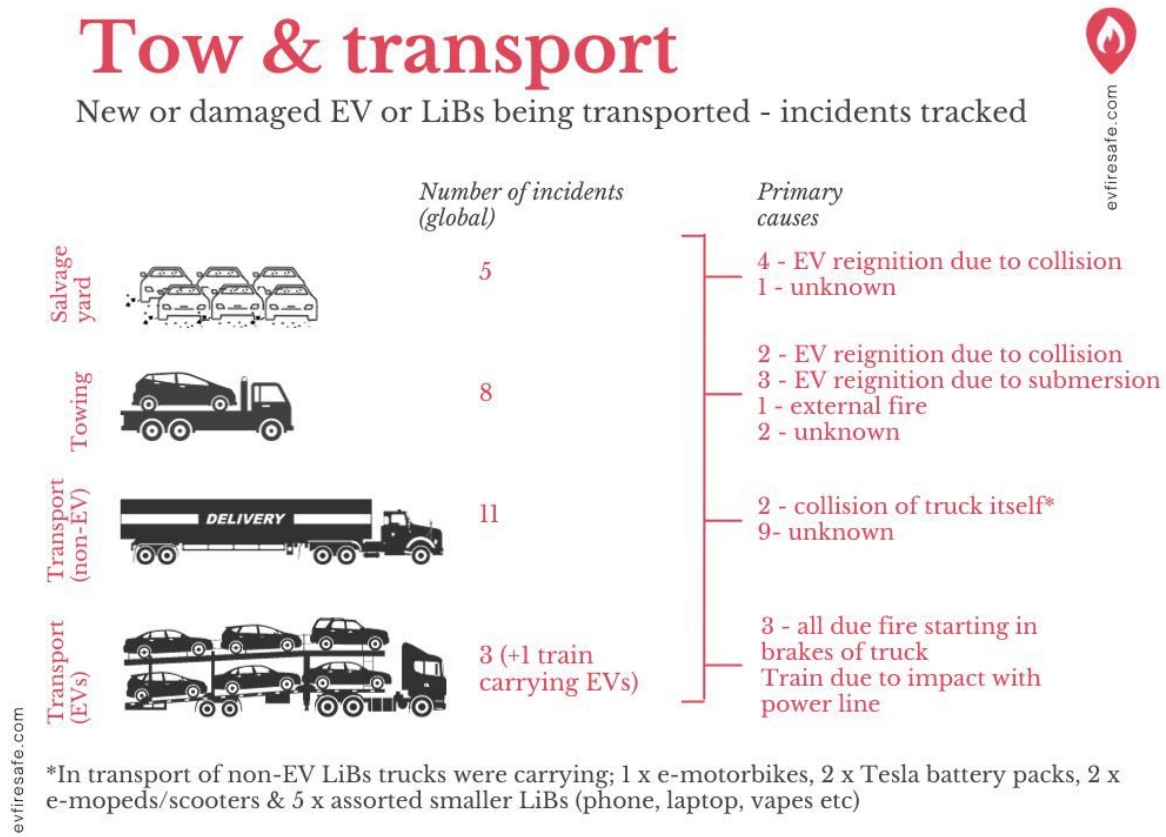
None of the EVs:
- Were on charge at the time
- Were spontaneous or unexplained
- Caused a vapour cloud explosion

In these incidents:
- Most required 10,000+ litres of water
- 2 x were brought under control in <30 minutes
- There were no injuries requiring hospitalisation
- 1 x fatality, cause currently under investigation

evfiresafe.com

evfiresafe.com

Appendix B: Global incident rate of electric vehicle battery fires during tow, transport, including incidents involving non-EV batteries being transported.



*In transport of non-EV LiBs trucks were carrying; 1 x e-motorbikes, 2 x Tesla battery packs, 2 x e-mopeds/scooters & 5 x assorted smaller LiBs (phone, laptop, vapes etc)

Appendix C: Example of FRNSW correspondence with Fire Engineers:

FRNSW Comment: It's noted that EV charging stations are in the basement levels and based on recent internal and external discussions held by FRNSW with other stakeholders on the issues associated with fires involving lithium batteries, FRNSW have compiled the following recommendations which outline FRNSW's requirements to address the unique and specialised hazards associated with these types of batteries. Literature evidence and documented recent events indicate Lithium-Ion batteries fires release Hydrofluoric acid in a flammable and toxic mix with hydrogen, CO, HCN, HCL, benzene and others. Firefighters would therefore be exposed to such dangers as respiratory hazards, explosions, and electrocution. A fire event involving the EV's would be protracted, complex, challenging and extremely dangerous. Consequently, the following should be incorporated into the assessment:

1. It is to be clearly outlined how effective the proposed AS 2118.1-2017 sprinkler system will be in providing suppression to a fire involving the EV's. In particular, it is to be clearly outlined how the unique challenges of a lithium-ion battery fire will be combated, as well as comparatively assessing the effectiveness of the AS 2118.1-2017 sprinkler system to that of a tested system (where applicable).

2. Acknowledging that lithium-ion battery fires may require substantial suppression efforts which includes a heavy reliance on sprinklers to control a fire until final extinguishment can be achieved through direct fire brigade intervention, FRNSW recommends the assessment consider an improved level of redundancy of the sprinkler system. Such factors include, but not limited to;

Utilising first principles to determine if an increase in the proposed onsite water supply duration is necessary.

Determine if additional sprinkler booster inlets are required over and above the required (4) sprinkler booster inlets as required by AS2118.1-2017 to combat a worst-case fire.

Providing infill capability to allow FRNSW pumping appliances to supplement water to the water storage tanks to extend the duration of water supply to the sprinkler system if required.

Sprinkler pumps being of high quality and selected from 'listed pumps and drivers.

The fuel supply to the pumps configured to allow FRNSW operational personnel to safely fill the fuel tanks whilst the sprinkler pumps are running.

No single point of failure existing between the water supply and the sprinkler control assemblies for the sprinkler system.

3. Off gas detection and alarm system, which would assist in providing the following principal measures and mechanisms to prevent further risk or harm:

Switching off power to the charging stations, thus preventing further input of energy into the EV lithium-ion battery to prevent introduction of additional causes of thermal runaway.

Activation of a ventilation system designed to exhaust explosive gases prior to reaching the Low Explosive Limits (LEL) or the explosive range of the off-gases and other gaseous products produced from the development of the fire. FRNSW anticipates that the off gases and other by-products released would depend on the battery chemistry of the type of lithium-ion batteries used. This would prevent:

1. Further escalation of the fire incident by mitigating the risk of explosion; and

2. Mitigating the risk to firefighters who may be present or within proximity to the location of the fire origin. Without quantification of the risk of explosions from these lithium-ion battery systems, it would be impossible to determine the severity or the extent of potential consequences with the explosion involving the lithium-ion battery off gases.

4. Regarding DtS Provision E2.3, the assessment should determine if additional smoke hazard management measures are necessary due to the respiratory hazards and explosive risks associated with and the characteristics of a lithium-ion battery fires. FRNSW operational personnel wearing Self Contained Breathing Apparatus (SCBA);

having to travel extended distances within hazardous atmospheres and environments.

having to fight fires for extended periods due to the characteristics of lithium-ion battery fires.

5. Atmospheric monitoring system, which would notify attending firefighters of a potential explosion risk. This should be connected to alarm and warning strobes to provide the required level of notification. The appropriate signage should also be provided.

6. The provision of firewater containment, preventing any risk of further damage and/or risk to electrocution to both occupants and attending firefighters. With the possibility of energy potentially remaining to be stored in some of the EV's that are connected to the charging stations, FRNSW recommend consideration of these risks as it could cause both life safety and environmental impact harm or damage.

7. All signage is to be specifically listed as Essential Fire Safety Measures in the building's Fire Safety Schedule.

8. Management-in-use processes and procedures to accompany the requirements listed above. Representative(s) on site should be aware of the requirements listed above such that they are able to assist attending firefighters during an incident, i.e., handover. The contact details of these representatives are to be made visible in signage and/or block plans provided at the FIP.

Measures outlined above relating to fire brigade intervention would assist fire brigade operational planning and preparations for a way to extinguish the fire and eliminate the risk, which is FRNSW's role and obligation under the *Fire and Rescue NSW Act 1989*. These recommendations have been provided to facilitate this requirement.