



LONDON FIRE BRIGADE

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**Freedom of Information request reference number:** 7964.1

**Date of response:** 05 October 2023

**Request:**

- 1) *Please confirm the number of electric vehicle fires in London in the last 5 years (by year) and the relative number of electric vehicles on London roads. Also please can you show a breakdown of the cause/situation ie charging, parked or moving.*
- 2) *Please confirm the number of petrol vehicle fires in London in the last 5 years (by year) and the relative number of petrol vehicles on London roads.*
- 3) *Please confirm official fire safety guidance for installation of EV chargers within close proximity of a residential homes. In particular any specified distance from charging bay /charger to a residential property.*
- 4) *I understand that the method of extinguishing an EV fire differs from that of a petrol fire due to the nature of the lithium battery. Please can you confirm the protocol in place for dealing with an EV fire at an EV charging hub on a residential street.*

**Response:**

Please see my response to your queries in turn below:

- 1) *Please confirm the number of electric vehicle fires in London in the last 5 years (by year) and the relative number of electric vehicles on London roads. Also please can you show a breakdown of the cause/situation ie charging, parked or moving.*
- 2) *Please confirm the number of petrol vehicle fires in London in the last 5 years (by year) and the relative number of petrol vehicles on London roads.*

In response to your questions 1) and 2), the tables below show the total number of vehicle fire incidents attended by the LFB in the last five calendar years. The second table breaks down the information by vehicle power type (where recorded), the type of vehicle involved and the main cause of fire.

Please note, the LFB do not hold information on the 'relative number of electric vehicles or petrol vehicles on London roads' so are unable to supply this to you.

We do record the address of incidents attended but we do not record a breakdown of the "*situation*" of the vehicle "*ie charging, parked or moving*". I have provided some further information about location details underneath the tables which you may also find useful.

<b>TABLE 1: Total vehicle fires attended by the LFB between 01 January 2019 to 30 September 2023</b>						
<b>Vehicle Power Type</b>	<b>Year</b>					<b>Total Incidents</b>
	<b>2023</b>	<b>2022</b>	<b>2021</b>	<b>2020</b>	<b>2019</b>	
Compressed Natural Gas	0	0	1	<i>Not recorded</i>	<i>Not recorded</i>	1
Diesel/Biodiesel	288	401	66	<i>Not recorded</i>	<i>Not recorded</i>	755
Diesel/Electric Hybrid	26	19	5	<i>Not recorded</i>	<i>Not recorded</i>	50
Electric batteries	71	35	9	<i>Not recorded</i>	<i>Not recorded</i>	115
LPG/Propane	1	3	0	<i>Not recorded</i>	<i>Not recorded</i>	4
Petrol	516	758	131	<i>Not recorded</i>	<i>Not recorded</i>	1,405
Petrol/Electric Hybrid	35	71	7	<i>Not recorded</i>	<i>Not recorded</i>	113
Unknown	121	158	18	<i>Not recorded</i>	<i>Not recorded</i>	297
Not recorded on Incident Management System (IMS)	0	1	1,190	1,481	1,898	4,570
<b>Total</b>	<b>1,058</b>	<b>1,446</b>	<b>1,427</b>	<b>1,481</b>	<b>1,898</b>	<b>7,310</b>

<b>TABLE 2: Breakdown of vehicle fires attended by the LFB between 01 January 2019 to 30 September 2023</b>				
<b>Year</b>	<b>Vehicle Power Type</b>	<b>Property Type</b>	<b>Main Cause of Fire</b>	<b>Number of Incidents</b>
2023	Diesel/Biodiesel	Agricultural vehicle	Heat source and combustibles brought together deliberately	1
2023	Diesel/Biodiesel	Agricultural vehicle	Overheating, unknown cause	2
2023	Diesel/Biodiesel	Agricultural vehicle	Unable to determine	1
2023	Diesel/Biodiesel	Bus/coach	Combustible articles too close to heat source (or fire)	1
2023	Diesel/Biodiesel	Bus/coach	Faulty fuel supplies – Electricity	4
2023	Diesel/Biodiesel	Bus/coach	Faulty fuel supplies – Petrol product	4
2023	Diesel/Biodiesel	Bus/coach	Heat source and combustibles brought together deliberately	3
2023	Diesel/Biodiesel	Bus/coach	Overheating, unknown cause	10

2023	Diesel/Biodiesel	Bus/coach	Vehicle crash or collision	1
2023	Diesel/Biodiesel	Car	Accumulation of flammable material	1
2023	Diesel/Biodiesel	Car	Combustible articles too close to heat source (or fire)	2
2023	Diesel/Biodiesel	Car	Fault in equipment or appliance	14
2023	Diesel/Biodiesel	Car	Faulty fuel supplies – Electricity	22
2023	Diesel/Biodiesel	Car	Faulty fuel supplies – Petrol product	10
2023	Diesel/Biodiesel	Car	Heat source and combustibles brought together deliberately	16
2023	Diesel/Biodiesel	Car	Natural occurrence	1
2023	Diesel/Biodiesel	Car	Other intentional burning, going out of control	1
2023	Diesel/Biodiesel	Car	Overheating, unknown cause	34
2023	Diesel/Biodiesel	Car	Unsafe use of heat source - due to unsafe disposal	1
2023	Diesel/Biodiesel	Car	Not recorded on Incident Management System (IMS)	1
2023	Diesel/Biodiesel	Lorry/HGV	Accumulation of flammable material	3
2023	Diesel/Biodiesel	Lorry/HGV	Combustible articles too close to heat source (or fire)	3
2023	Diesel/Biodiesel	Lorry/HGV	Cooking – other cooking	1
2023	Diesel/Biodiesel	Lorry/HGV	Fault in equipment or appliance	1
2023	Diesel/Biodiesel	Lorry/HGV	Faulty fuel supplies – Electricity	3
2023	Diesel/Biodiesel	Lorry/HGV	Natural occurrence	4
2023	Diesel/Biodiesel	Lorry/HGV	Overheating, unknown cause	20
2023	Diesel/Biodiesel	Lorry/HGV	Unsafe use of equipment or appliance (heat source)	1
2023	Diesel/Biodiesel	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	5
2023	Diesel/Biodiesel	Minibus	Fault in equipment or appliance	1
2023	Diesel/Biodiesel	Motor Home	Fault in equipment or appliance	1
2023	Diesel/Biodiesel	Motor Home	Heat source and combustibles brought together deliberately	2
2023	Diesel/Biodiesel	Motor Home	Unable to determine	1
2023	Diesel/Biodiesel	Multiple Vehicles	Accumulation of flammable material	1
2023	Diesel/Biodiesel	Multiple Vehicles	Faulty fuel supplies – Petrol product	2
2023	Diesel/Biodiesel	Multiple Vehicles	Heat source and combustibles brought together deliberately	3
2023	Diesel/Biodiesel	Multiple Vehicles	Overheating, unknown cause	1

2023	Diesel/Biodiesel	Other road vehicle	Combustible articles too close to heat source (or fire)	3
2023	Diesel/Biodiesel	Other road vehicle	Faulty fuel supplies – Electricity	4
2023	Diesel/Biodiesel	Other road vehicle	Heat source and combustibles brought together deliberately	1
2023	Diesel/Biodiesel	Other road vehicle	Overheating, unknown cause	7
2023	Diesel/Biodiesel	Other road vehicle	Unsafe use of equipment or appliance (heat source)	1
2023	Diesel/Biodiesel	Other road vehicle	Unsafe use of heat source - due to unsafe disposal	2
2023	Diesel/Biodiesel	Other road vehicle	Vehicle crash or collision	1
2023	Diesel/Biodiesel	Other road vehicle	Not recorded on Incident Management System (IMS)	1
2023	Diesel/Biodiesel	Trailer (not attached to tractor unit)	Combustible articles too close to heat source (or fire)	1
2023	Diesel/Biodiesel	Trailer (not attached to tractor unit)	Heat source and combustibles brought together deliberately	1
2023	Diesel/Biodiesel	Van	Accumulation of flammable material	2
2023	Diesel/Biodiesel	Van	Bonfire going out of control	1
2023	Diesel/Biodiesel	Van	Combustible articles too close to heat source (or fire)	2
2023	Diesel/Biodiesel	Van	Fault in equipment or appliance	8
2023	Diesel/Biodiesel	Van	Faulty fuel supplies – Electricity	10
2023	Diesel/Biodiesel	Van	Faulty fuel supplies – Gas	1
2023	Diesel/Biodiesel	Van	Faulty fuel supplies – Petrol product	8
2023	Diesel/Biodiesel	Van	Heat source and combustibles brought together deliberately	25
2023	Diesel/Biodiesel	Van	Other intentional burning, going out of control	1
2023	Diesel/Biodiesel	Van	Overheating, unknown cause	18
2023	Diesel/Biodiesel	Van	Unable to determine	1
2023	Diesel/Biodiesel	Van	Unsafe use of equipment or appliance (heat source)	3
2023	Diesel/Biodiesel	Van	Unsafe use of heat source - due to unsafe disposal	1
2023	Diesel/Biodiesel	Van	Vehicle crash or collision	2
2023	Diesel/Electric Hybrid	Bus/coach	Combustible articles too close to heat source (or fire)	1
2023	Diesel/Electric Hybrid	Bus/coach	Fault in equipment or appliance	2
2023	Diesel/Electric Hybrid	Bus/coach	Faulty leads to equipment or appliance	1

2023	Diesel/Electric Hybrid	Bus/coach	Heat source and combustibles brought together deliberately	2
2023	Diesel/Electric Hybrid	Bus/coach	Natural occurrence	1
2023	Diesel/Electric Hybrid	Bus/coach	Other intentional burning, going out of control	1
2023	Diesel/Electric Hybrid	Bus/coach	Overheating, unknown cause	8
2023	Diesel/Electric Hybrid	Car	Faulty fuel supplies – Electricity	4
2023	Diesel/Electric Hybrid	Car	Faulty fuel supplies – Petrol product	1
2023	Diesel/Electric Hybrid	Car	Heat source and combustibles brought together deliberately	1
2023	Diesel/Electric Hybrid	Car	Overheating, unknown cause	1
2023	Diesel/Electric Hybrid	Other road vehicle	Overheating, unknown cause	1
2023	Diesel/Electric Hybrid	Trailer (not attached to tractor unit)	Faulty fuel supplies – Electricity	1
2023	Diesel/Electric Hybrid	Van	Faulty fuel supplies – Electricity	1
2023	Electric batteries	Bicycle	Bonfire going out of control	1
2023	Electric batteries	Bicycle	Fault in equipment or appliance	7
2023	Electric batteries	Bicycle	Faulty fuel supplies – Electricity	10
2023	Electric batteries	Bicycle	Heat source and combustibles brought together deliberately	8
2023	Electric batteries	Bicycle	Other intentional burning, going out of control	1
2023	Electric batteries	Bicycle	Overheating, unknown cause	7
2023	Electric batteries	Bicycle	Unsafe use of equipment or appliance (heat source)	1
2023	Electric batteries	Bus/coach	Fault in equipment or appliance	1
2023	Electric batteries	Bus/coach	Faulty fuel supplies – Electricity	2
2023	Electric batteries	Bus/coach	Heat source and combustibles brought together deliberately	1
2023	Electric batteries	Bus/coach	Natural occurrence	1
2023	Electric batteries	Car	Faulty fuel supplies – Electricity	2
2023	Electric batteries	Car	Heat source and combustibles brought together deliberately	1
2023	Electric batteries	Car	Vehicle crash or collision	1
2023	Electric batteries	Motorcycle	Fault in equipment or appliance	1
2023	Electric batteries	Motorcycle	Faulty fuel supplies – Electricity	2
2023	Electric batteries	Motorcycle	Heat source and combustibles brought together deliberately	1

2023	Electric batteries	Other road vehicle	Combustible articles too close to heat source (or fire)	1
2023	Electric batteries	Other road vehicle	Fault in equipment or appliance	6
2023	Electric batteries	Other road vehicle	Faulty fuel supplies – Electricity	5
2023	Electric batteries	Other road vehicle	Faulty leads to equipment or appliance	1
2023	Electric batteries	Other road vehicle	Heat source and combustibles brought together deliberately	4
2023	Electric batteries	Other road vehicle	Overheating, unknown cause	2
2023	Electric batteries	Other road vehicle	Pending Fire Investigation Team findings	1
2023	Electric batteries	Other road vehicle	Unable to determine	1
2023	Electric batteries	Other road vehicle	Unsafe use of equipment or appliance (heat source)	1
2023	Electric batteries	Towing caravan (not on tow or on site)	Combustible articles too close to heat source (or fire)	1
2023	LPG/Propane	Towing caravan (not on tow or on site)	Unsafe use of heat source - due to unsafe disposal	1
2023	Petrol	Bus/coach	Fault in equipment or appliance	1
2023	Petrol	Bus/coach	Faulty fuel supplies – Petrol product	1
2023	Petrol	Car	Accumulation of flammable material	3
2023	Petrol	Car	Bomb/incendiary device	1
2023	Petrol	Car	Combustible articles too close to heat source (or fire)	9
2023	Petrol	Car	Fault in equipment or appliance	21
2023	Petrol	Car	Faulty fuel supplies – Electricity	64
2023	Petrol	Car	Faulty fuel supplies – Petrol product	41
2023	Petrol	Car	Faulty leads to equipment or appliance	9
2023	Petrol	Car	Heat source and combustibles brought together deliberately	74
2023	Petrol	Car	Homicide/attempted: setting fire to other person/s	1
2023	Petrol	Car	Natural occurrence	4
2023	Petrol	Car	Other intentional burning, going out of control	4
2023	Petrol	Car	Overheating, unknown cause	90
2023	Petrol	Car	Unable to determine	4
2023	Petrol	Car	Unsafe use of equipment or appliance (heat source)	4
2023	Petrol	Car	Unsafe use of heat source - due to unsafe disposal	2
2023	Petrol	Car	Vehicle crash or collision	21

2023	Petrol	Lorry/HGV	Faulty fuel supplies – Electricity	1
2023	Petrol	Lorry/HGV	Heat source and combustibles brought together deliberately	1
2023	Petrol	Lorry/HGV	Overheating, unknown cause	1
2023	Petrol	Motorcycle	Accumulation of flammable material	1
2023	Petrol	Motorcycle	Combustible articles too close to heat source (or fire)	1
2023	Petrol	Motorcycle	Fault in equipment or appliance	1
2023	Petrol	Motorcycle	Faulty fuel supplies – Electricity	4
2023	Petrol	Motorcycle	Faulty fuel supplies – Petrol product	14
2023	Petrol	Motorcycle	Heat source and combustibles brought together deliberately	70
2023	Petrol	Motorcycle	Other intentional burning, going out of control	5
2023	Petrol	Motorcycle	Overheating, unknown cause	10
2023	Petrol	Motorcycle	Playing with fire (or heat source)	3
2023	Petrol	Motorcycle	Unable to determine	1
2023	Petrol	Motorcycle	Unsafe use of equipment or appliance (heat source)	2
2023	Petrol	Motorcycle	Unsafe use of heat source - due to unsafe disposal	2
2023	Petrol	Multiple Vehicles	Accumulation of flammable material	1
2023	Petrol	Multiple Vehicles	Fault in equipment or appliance	2
2023	Petrol	Multiple Vehicles	Faulty fuel supplies – Electricity	2
2023	Petrol	Multiple Vehicles	Faulty fuel supplies – Petrol product	1
2023	Petrol	Multiple Vehicles	Faulty leads to equipment or appliance	1
2023	Petrol	Multiple Vehicles	Heat source and combustibles brought together deliberately	12
2023	Petrol	Multiple Vehicles	Overheating, unknown cause	3
2023	Petrol	Other road vehicle	Faulty fuel supplies – Petrol product	1
2023	Petrol	Other road vehicle	Heat source and combustibles brought together deliberately	1
2023	Petrol	Other road vehicle	Overheating, unknown cause	1
2023	Petrol	Van	Accumulation of flammable material	1
2023	Petrol	Van	Cooking – chip pan/deep fat fryer	1
2023	Petrol	Van	Faulty fuel supplies – Electricity	5
2023	Petrol	Van	Faulty fuel supplies – Gas	1

2023	Petrol	Van	Faulty fuel supplies – Petrol product	1
2023	Petrol	Van	Faulty leads to equipment or appliance	1
2023	Petrol	Van	Heat source and combustibles brought together deliberately	5
2023	Petrol	Van	Natural occurrence	1
2023	Petrol	Van	Overheating, unknown cause	1
2023	Petrol	Van	Unsafe use of equipment or appliance (heat source)	1
2023	Petrol	Van	Vehicle crash or collision	2
2023	Petrol/Electric Hybrid	Bus/coach	Overheating, unknown cause	1
2023	Petrol/Electric Hybrid	Car	Combustible articles too close to heat source (or fire)	2
2023	Petrol/Electric Hybrid	Car	Fault in equipment or appliance	2
2023	Petrol/Electric Hybrid	Car	Faulty fuel supplies – Electricity	7
2023	Petrol/Electric Hybrid	Car	Faulty fuel supplies – Petrol product	2
2023	Petrol/Electric Hybrid	Car	Faulty leads to equipment or appliance	1
2023	Petrol/Electric Hybrid	Car	Heat source and combustibles brought together deliberately	4
2023	Petrol/Electric Hybrid	Car	Other intentional burning, going out of control	1
2023	Petrol/Electric Hybrid	Car	Overheating, unknown cause	4
2023	Petrol/Electric Hybrid	Car	Unable to determine	1
2023	Petrol/Electric Hybrid	Car	Vehicle crash or collision	1
2023	Petrol/Electric Hybrid	Lorry/HGV	Accumulation of flammable material	1
2023	Petrol/Electric Hybrid	Lorry/HGV	Faulty fuel supplies – Electricity	1
2023	Petrol/Electric Hybrid	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	1
2023	Petrol/Electric Hybrid	Motorcycle	Faulty fuel supplies – Petrol product	1
2023	Petrol/Electric Hybrid	Motorcycle	Heat source and combustibles brought together deliberately	3
2023	Petrol/Electric Hybrid	Multiple Vehicles	Heat source and combustibles brought together deliberately	1
2023	Petrol/Electric Hybrid	Van	Combustible articles too close to heat source (or fire)	1
2023	Unknown	Bicycle	Combustible articles too close to heat source (or fire)	2
2023	Unknown	Bicycle	Faulty fuel supplies – Electricity	1



2023	Unknown	Bicycle	Heat source and combustibles brought together deliberately	3
2023	Unknown	Bicycle	Overheating, unknown cause	1
2023	Unknown	Bus/coach	Heat source and combustibles brought together deliberately	2
2023	Unknown	Bus/coach	Overheating, unknown cause	2
2023	Unknown	Car	Bomb/incendiary device	1
2023	Unknown	Car	Combustible articles too close to heat source (or fire)	1
2023	Unknown	Car	Faulty fuel supplies – Electricity	2
2023	Unknown	Car	Faulty fuel supplies – Petrol product	1
2023	Unknown	Car	Faulty leads to equipment or appliance	4
2023	Unknown	Car	Heat source and combustibles brought together deliberately	17
2023	Unknown	Car	Other intentional burning, going out of control	2
2023	Unknown	Car	Overheating, unknown cause	16
2023	Unknown	Car	Unable to determine	3
2023	Unknown	Car	Unsafe use of equipment or appliance (heat source)	1
2023	Unknown	Car	Vehicle crash or collision	1
2023	Unknown	Caravan on tow	Heat source and combustibles brought together deliberately	2
2023	Unknown	Caravan on tow	Natural occurrence	1
2023	Unknown	Lorry/HGV	Accumulation of flammable material	1
2023	Unknown	Lorry/HGV	Combustible articles too close to heat source (or fire)	1
2023	Unknown	Lorry/HGV	Overheating, unknown cause	5
2023	Unknown	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	4
2023	Unknown	Minibus	Faulty fuel supplies – Electricity	1
2023	Unknown	Motor Home	Heat source and combustibles brought together deliberately	1
2023	Unknown	Motorcycle	Faulty fuel supplies – Petrol product	1
2023	Unknown	Motorcycle	Heat source and combustibles brought together deliberately	8
2023	Unknown	Motorcycle	Other intentional burning, going out of control	2
2023	Unknown	Motorcycle	Overheating, unknown cause	3

2023	Unknown	Motorcycle	Playing with fire (or heat source)	1
2023	Unknown	Multiple Vehicles	Heat source and combustibles brought together deliberately	3
2023	Unknown	Multiple Vehicles	Overheating, unknown cause	2
2023	Unknown	Other road vehicle	Heat source and combustibles brought together deliberately	1
2023	Unknown	Other road vehicle	Overheating, unknown cause	3
2023	Unknown	Towing caravan (not on tow or on site)	Faulty fuel supplies – Petrol product	1
2023	Unknown	Towing caravan (not on tow or on site)	Heat source and combustibles brought together deliberately	1
2023	Unknown	Towing caravan (not on tow or on site)	Overheating, unknown cause	1
2023	Unknown	Towing caravan (not on tow or on site)	Unable to determine	1
2023	Unknown	Towing caravan (not on tow or on site)	Unsafe use of equipment or appliance (heat source)	2
2023	Unknown	Towing caravan (not on tow or on site)	Unsafe use of heat source - due to knocking over	1
2023	Unknown	Towing caravan (not on tow or on site)	Unsafe use of heat source - due to unsafe disposal	1
2023	Unknown	Trailer (not attached to tractor unit)	Faulty fuel supplies – Electricity	1
2023	Unknown	Trailer (not attached to tractor unit)	Unsafe use of heat source - due to unsafe disposal	1
2023	Unknown	Van	Accumulation of flammable material	1
2023	Unknown	Van	Fault in equipment or appliance	2
2023	Unknown	Van	Faulty leads to equipment or appliance	1
2023	Unknown	Van	Heat source and combustibles brought together deliberately	3
2023	Unknown	Van	Overheating, unknown cause	3
2023	Unknown	Van	Pending Fire Investigation Team findings	1
2023 Total				<b>1,058</b>
2022	Diesel/Biodiesel	Agricultural vehicle	Faulty fuel supplies – Petrol product	1
2022	Diesel/Biodiesel	Bus/coach	Accumulation of flammable material	1

2022	Diesel/Biodiesel	Bus/coach	Combustible articles too close to heat source (or fire)	3
2022	Diesel/Biodiesel	Bus/coach	Fault in equipment or appliance	2
2022	Diesel/Biodiesel	Bus/coach	Faulty fuel supplies – Electricity	2
2022	Diesel/Biodiesel	Bus/coach	Faulty fuel supplies – Petrol product	1
2022	Diesel/Biodiesel	Bus/coach	Heat source and combustibles brought together deliberately	4
2022	Diesel/Biodiesel	Bus/coach	Overheating, unknown cause	23
2022	Diesel/Biodiesel	Bus/coach	Unsafe use of equipment or appliance (heat source)	1
2022	Diesel/Biodiesel	Bus/coach	Unsafe use of heat source - due to knocking over	1
2022	Diesel/Biodiesel	Bus/coach	Not recorded on Incident Management System (IMS)	1
2022	Diesel/Biodiesel	Car	Accumulation of flammable material	1
2022	Diesel/Biodiesel	Car	Bomb/incendiary device	1
2022	Diesel/Biodiesel	Car	Bonfire going out of control	1
2022	Diesel/Biodiesel	Car	Combustible articles too close to heat source (or fire)	5
2022	Diesel/Biodiesel	Car	Fault in equipment or appliance	10
2022	Diesel/Biodiesel	Car	Faulty fuel supplies – Electricity	33
2022	Diesel/Biodiesel	Car	Faulty fuel supplies – Petrol product	12
2022	Diesel/Biodiesel	Car	Faulty leads to equipment or appliance	5
2022	Diesel/Biodiesel	Car	Heat source and combustibles brought together deliberately	34
2022	Diesel/Biodiesel	Car	Natural occurrence	1
2022	Diesel/Biodiesel	Car	Other intentional burning, going out of control	1
2022	Diesel/Biodiesel	Car	Overheating, unknown cause	44
2022	Diesel/Biodiesel	Car	Unable to determine	3
2022	Diesel/Biodiesel	Car	Unsafe use of equipment or appliance (heat source)	1
2022	Diesel/Biodiesel	Car	Unsafe use of heat source - due to knocking over	1
2022	Diesel/Biodiesel	Car	Unsafe use of heat source - due to unsafe disposal	2
2022	Diesel/Biodiesel	Car	Vehicle crash or collision	6
2022	Diesel/Biodiesel	Lorry/HGV	Accumulation of flammable material	4
2022	Diesel/Biodiesel	Lorry/HGV	Combustible articles too close to heat source (or fire)	6
2022	Diesel/Biodiesel	Lorry/HGV	Fault in equipment or appliance	5

2022	Diesel/Biodiesel	Lorry/HGV	Faulty fuel supplies – Electricity	4
2022	Diesel/Biodiesel	Lorry/HGV	Faulty fuel supplies – Petrol product	1
2022	Diesel/Biodiesel	Lorry/HGV	Natural occurrence	1
2022	Diesel/Biodiesel	Lorry/HGV	Other intentional burning, going out of control	1
2022	Diesel/Biodiesel	Lorry/HGV	Overheating, unknown cause	29
2022	Diesel/Biodiesel	Lorry/HGV	Unsafe use of heat source - due to knocking over	1
2022	Diesel/Biodiesel	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	4
2022	Diesel/Biodiesel	Motor Home	Faulty fuel supplies – Electricity	1
2022	Diesel/Biodiesel	Motor Home	Overheating, unknown cause	1
2022	Diesel/Biodiesel	Multiple Vehicles	Bonfire going out of control	1
2022	Diesel/Biodiesel	Multiple Vehicles	Fault in equipment or appliance	1
2022	Diesel/Biodiesel	Multiple Vehicles	Faulty fuel supplies – Electricity	3
2022	Diesel/Biodiesel	Multiple Vehicles	Faulty fuel supplies – Petrol product	1
2022	Diesel/Biodiesel	Multiple Vehicles	Heat source and combustibles brought together deliberately	3
2022	Diesel/Biodiesel	Multiple Vehicles	Overheating, unknown cause	2
2022	Diesel/Biodiesel	Other road vehicle	Combustible articles too close to heat source (or fire)	3
2022	Diesel/Biodiesel	Other road vehicle	Fault in equipment or appliance	2
2022	Diesel/Biodiesel	Other road vehicle	Faulty fuel supplies – Electricity	3
2022	Diesel/Biodiesel	Other road vehicle	Faulty fuel supplies – Petrol product	1
2022	Diesel/Biodiesel	Other road vehicle	Natural occurrence	1
2022	Diesel/Biodiesel	Other road vehicle	Overheating, unknown cause	5
2022	Diesel/Biodiesel	Other road vehicle	Unsafe use of heat source - due to unsafe disposal	2
2022	Diesel/Biodiesel	Van	Accumulation of flammable material	4
2022	Diesel/Biodiesel	Van	Combustible articles too close to heat source (or fire)	10
2022	Diesel/Biodiesel	Van	Cooking – other cooking	1
2022	Diesel/Biodiesel	Van	Fault in equipment or appliance	2
2022	Diesel/Biodiesel	Van	Faulty fuel supplies – Electricity	16
2022	Diesel/Biodiesel	Van	Faulty fuel supplies – Petrol product	9
2022	Diesel/Biodiesel	Van	Faulty leads to equipment or appliance	3
2022	Diesel/Biodiesel	Van	Heat source and combustibles brought together deliberately	32

2022	Diesel/Biodiesel	Van	Natural occurrence	2
2022	Diesel/Biodiesel	Van	Overheating, unknown cause	22
2022	Diesel/Biodiesel	Van	Playing with fire (or heat source)	1
2022	Diesel/Biodiesel	Van	Unsafe use of heat source - due to knocking over	1
2022	Diesel/Biodiesel	Van	Unsafe use of heat source - due to unsafe disposal	7
2022	Diesel/Biodiesel	Van	Vehicle crash or collision	4
2022	Diesel/Electric Hybrid	Bus/coach	Fault in equipment or appliance	1
2022	Diesel/Electric Hybrid	Bus/coach	Faulty fuel supplies – Electricity	1
2022	Diesel/Electric Hybrid	Bus/coach	Faulty fuel supplies – Petrol product	2
2022	Diesel/Electric Hybrid	Bus/coach	Faulty leads to equipment or appliance	1
2022	Diesel/Electric Hybrid	Bus/coach	Overheating, unknown cause	9
2022	Diesel/Electric Hybrid	Car	Faulty fuel supplies – Electricity	1
2022	Diesel/Electric Hybrid	Car	Heat source and combustibles brought together deliberately	1
2022	Diesel/Electric Hybrid	Other road vehicle	Overheating, unknown cause	1
2022	Diesel/Electric Hybrid	Van	Heat source and combustibles brought together deliberately	1
2022	Diesel/Electric Hybrid	Van	Overheating, unknown cause	1
2022	Electric batteries	Bicycle	Fault in equipment or appliance	1
2022	Electric batteries	Bicycle	Faulty fuel supplies – Electricity	4
2022	Electric batteries	Bicycle	Heat source and combustibles brought together deliberately	1
2022	Electric batteries	Bicycle	Overheating, unknown cause	2
2022	Electric batteries	Bicycle	Unsafe use of equipment or appliance (heat source)	1
2022	Electric batteries	Bicycle	Unsafe use of heat source - due to unsafe disposal	1
2022	Electric batteries	Bus/coach	Overheating, unknown cause	1
2022	Electric batteries	Car	Fault in equipment or appliance	1
2022	Electric batteries	Car	Faulty fuel supplies – Electricity	1
2022	Electric batteries	Car	Overheating, unknown cause	1
2022	Electric batteries	Car	Unsafe use of equipment or appliance (heat source)	1
2022	Electric batteries	Lorry/HGV	Overheating, unknown cause	1
2022	Electric batteries	Multiple Vehicles	Heat source and combustibles brought together deliberately	1
2022	Electric batteries	Other road vehicle	Fault in equipment or appliance	2

2022	Electric batteries	Other road vehicle	Faulty fuel supplies – Electricity	6
2022	Electric batteries	Other road vehicle	Faulty fuel supplies – Petrol product	1
2022	Electric batteries	Other road vehicle	Heat source and combustibles brought together deliberately	2
2022	Electric batteries	Other road vehicle	Overheating, unknown cause	5
2022	Electric batteries	Towing caravan (not on tow or on site)	Heat source and combustibles brought together deliberately	1
2022	Electric batteries	Van	Accumulation of flammable material	1
2022	LPG/Propane	Car	Overheating, unknown cause	1
2022	LPG/Propane	Lorry/HGV	Overheating, unknown cause	1
2022	LPG/Propane	Other road vehicle	Combustible articles too close to heat source (or fire)	1
2022	Petrol	Agricultural vehicle	Faulty leads to equipment or appliance	1
2022	Petrol	Bicycle	Heat source and combustibles brought together deliberately	1
2022	Petrol	Car	Accumulation of flammable material	8
2022	Petrol	Car	Bomb/incendiary device	2
2022	Petrol	Car	Bonfire going out of control	1
2022	Petrol	Car	Combustible articles too close to heat source (or fire)	11
2022	Petrol	Car	Fault in equipment or appliance	32
2022	Petrol	Car	Faulty fuel supplies – Electricity	96
2022	Petrol	Car	Faulty fuel supplies – Gas	1
2022	Petrol	Car	Faulty fuel supplies – Petrol product	45
2022	Petrol	Car	Faulty leads to equipment or appliance	13
2022	Petrol	Car	Heat source and combustibles brought together deliberately	106
2022	Petrol	Car	Natural occurrence	5
2022	Petrol	Car	Other intentional burning, going out of control	2
2022	Petrol	Car	Overheating, unknown cause	127
2022	Petrol	Car	Pending Fire Investigation Team findings	2
2022	Petrol	Car	Playing with fire (or heat source)	1
2022	Petrol	Car	Unable to determine	3
2022	Petrol	Car	Unsafe use of equipment or appliance (heat source)	2
2022	Petrol	Car	Unsafe use of heat source - due to knocking over	1

2022	Petrol	Car	Unsafe use of heat source - due to sleep or unconsciousness	1
2022	Petrol	Car	Unsafe use of heat source - due to unsafe disposal	4
2022	Petrol	Car	Vehicle crash or collision	23
2022	Petrol	Lorry/HGV	Combustible articles too close to heat source (or fire)	1
2022	Petrol	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	1
2022	Petrol	Motor Home	Faulty fuel supplies – Petrol product	1
2022	Petrol	Motor Home	Natural occurrence	1
2022	Petrol	Motorcycle	Accumulation of flammable material	1
2022	Petrol	Motorcycle	Combustible articles too close to heat source (or fire)	4
2022	Petrol	Motorcycle	Fault in equipment or appliance	1
2022	Petrol	Motorcycle	Faulty fuel supplies – Electricity	6
2022	Petrol	Motorcycle	Faulty fuel supplies – Petrol product	21
2022	Petrol	Motorcycle	Heat source and combustibles brought together deliberately	129
2022	Petrol	Motorcycle	Other intentional burning, going out of control	11
2022	Petrol	Motorcycle	Overheating, unknown cause	19
2022	Petrol	Motorcycle	Playing with fire (or heat source)	2
2022	Petrol	Motorcycle	Unable to determine	7
2022	Petrol	Motorcycle	Vehicle crash or collision	4
2022	Petrol	Motorcycle	Not recorded on Incident Management System (IMS)	4
2022	Petrol	Multiple Vehicles	Accumulation of flammable material	1
2022	Petrol	Multiple Vehicles	Combustible articles too close to heat source (or fire)	3
2022	Petrol	Multiple Vehicles	Faulty fuel supplies – Electricity	4
2022	Petrol	Multiple Vehicles	Faulty fuel supplies – Petrol product	2
2022	Petrol	Multiple Vehicles	Heat source and combustibles brought together deliberately	15
2022	Petrol	Multiple Vehicles	Overheating, unknown cause	4
2022	Petrol	Multiple Vehicles	Unsafe use of equipment or appliance (heat source)	1
2022	Petrol	Multiple Vehicles	Unsafe use of heat source - due to unsafe disposal	2
2022	Petrol	Multiple Vehicles	Vehicle crash or collision	2

2022	Petrol	Other road vehicle	Fault in equipment or appliance	1
2022	Petrol	Other road vehicle	Heat source and combustibles brought together deliberately	1
2022	Petrol	Towing caravan (not on tow or on site)	Bonfire going out of control	1
2022	Petrol	Van	Faulty fuel supplies – Electricity	2
2022	Petrol	Van	Faulty fuel supplies – Petrol product	2
2022	Petrol	Van	Faulty leads to equipment or appliance	1
2022	Petrol	Van	Heat source and combustibles brought together deliberately	4
2022	Petrol	Van	Overheating, unknown cause	7
2022	Petrol	Van	Unable to determine	3
2022	Petrol	Van	Unsafe use of heat source - due to unsafe disposal	1
2022	Petrol/Electric Hybrid	Car	Combustible articles too close to heat source (or fire)	2
2022	Petrol/Electric Hybrid	Car	Fault in equipment or appliance	7
2022	Petrol/Electric Hybrid	Car	Faulty fuel supplies – Electricity	15
2022	Petrol/Electric Hybrid	Car	Faulty fuel supplies – Petrol product	4
2022	Petrol/Electric Hybrid	Car	Faulty leads to equipment or appliance	2
2022	Petrol/Electric Hybrid	Car	Heat source and combustibles brought together deliberately	6
2022	Petrol/Electric Hybrid	Car	Overheating, unknown cause	21
2022	Petrol/Electric Hybrid	Car	Unsafe use of heat source - due to unsafe disposal	1
2022	Petrol/Electric Hybrid	Car	Vehicle crash or collision	2
2022	Petrol/Electric Hybrid	Lorry/HGV	Accumulation of flammable material	1
2022	Petrol/Electric Hybrid	Motorcycle	Combustible articles too close to heat source (or fire)	2
2022	Petrol/Electric Hybrid	Motorcycle	Faulty fuel supplies – Petrol product	1
2022	Petrol/Electric Hybrid	Motorcycle	Heat source and combustibles brought together deliberately	3
2022	Petrol/Electric Hybrid	Motorcycle	Overheating, unknown cause	1
2022	Petrol/Electric Hybrid	Multiple Vehicles	Overheating, unknown cause	2
2022	Petrol/Electric Hybrid	Other road vehicle	Unsafe use of equipment or appliance (heat source)	1
2022	Unknown	Agricultural vehicle	Accumulation of flammable material	1



2022	Unknown	Bicycle	Combustible articles too close to heat source (or fire)	1
2022	Unknown	Bicycle	Heat source and combustibles brought together deliberately	4
2022	Unknown	Bicycle	Other intentional burning, going out of control	1
2022	Unknown	Bicycle	Overheating, unknown cause	1
2022	Unknown	Bicycle	Playing with fire (or heat source)	1
2022	Unknown	Bicycle	Unsafe use of heat source - due to unsafe disposal	1
2022	Unknown	Bus/coach	Overheating, unknown cause	2
2022	Unknown	Car	Bomb/incendiary device	1
2022	Unknown	Car	Combustible articles too close to heat source (or fire)	5
2022	Unknown	Car	Fault in equipment or appliance	2
2022	Unknown	Car	Faulty fuel supplies – Electricity	5
2022	Unknown	Car	Faulty fuel supplies – Petrol product	2
2022	Unknown	Car	Faulty leads to equipment or appliance	1
2022	Unknown	Car	Heat source and combustibles brought together deliberately	32
2022	Unknown	Car	Overheating, unknown cause	24
2022	Unknown	Car	Unable to determine	1
2022	Unknown	Car	Unsafe use of equipment or appliance (heat source)	1
2022	Unknown	Car	Unsafe use of heat source - due to unsafe disposal	1
2022	Unknown	Car	Vehicle crash or collision	3
2022	Unknown	Car	Not recorded on Incident Management System (IMS)	1
2022	Unknown	Caravan on tow	Faulty fuel supplies – Electricity	1
2022	Unknown	Lorry/HGV	Combustible articles too close to heat source (or fire)	1
2022	Unknown	Lorry/HGV	Overheating, unknown cause	3
2022	Unknown	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	3
2022	Unknown	Motor Home	Faulty fuel supplies – Electricity	1
2022	Unknown	Motor Home	Overheating, unknown cause	1
2022	Unknown	Motorcycle	Accumulation of flammable material	1
2022	Unknown	Motorcycle	Combustible articles too close to heat source (or fire)	1

2022	Unknown	Motorcycle	Heat source and combustibles brought together deliberately	7
2022	Unknown	Motorcycle	Overheating, unknown cause	5
2022	Unknown	Motorcycle	Playing with fire (or heat source)	1
2022	Unknown	Motorcycle	Vehicle crash or collision	1
2022	Unknown	Multiple Vehicles	Combustible articles too close to heat source (or fire)	1
2022	Unknown	Multiple Vehicles	Heat source and combustibles brought together deliberately	3
2022	Unknown	Multiple Vehicles	Overheating, unknown cause	2
2022	Unknown	Other road vehicle	Cooking – chip pan/deep fat fryer	1
2022	Unknown	Other road vehicle	Faulty fuel supplies – Electricity	1
2022	Unknown	Other road vehicle	Heat source and combustibles brought together deliberately	1
2022	Unknown	Other road vehicle	Overheating, unknown cause	2
2022	Unknown	Towing caravan (not on tow or on site)	Heat source and combustibles brought together deliberately	8
2022	Unknown	Trailer (not attached to tractor unit)	Heat source and combustibles brought together deliberately	3
2022	Unknown	Trailer (not attached to tractor unit)	Overheating, unknown cause	3
2022	Unknown	Van	Accumulation of flammable material	1
2022	Unknown	Van	Combustible articles too close to heat source (or fire)	1
2022	Unknown	Van	Fault in equipment or appliance	1
2022	Unknown	Van	Faulty fuel supplies – Electricity	1
2022	Unknown	Van	Heat source and combustibles brought together deliberately	2
2022	Unknown	Van	Other intentional burning, going out of control	1
2022	Unknown	Van	Overheating, unknown cause	8
2022	Unknown	Van	Unable to determine	1
2022	Not recorded on Incident Management System (IMS)	Car	Heat source and combustibles brought together deliberately	1
2022 Total				<b>1,446</b>
2021	Compressed Natural Gas	Other road vehicle	Accumulation of flammable material	1
2021	Diesel/Biodiesel	Bus/coach	Faulty fuel supplies – Electricity	2

2021	Diesel/Biodiesel	Bus/coach	Faulty fuel supplies – Petrol product	1
2021	Diesel/Biodiesel	Bus/coach	Heat source and combustibles brought together deliberately	1
2021	Diesel/Biodiesel	Bus/coach	Overheating, unknown cause	6
2021	Diesel/Biodiesel	Car	Fault in equipment or appliance	1
2021	Diesel/Biodiesel	Car	Faulty fuel supplies – Electricity	10
2021	Diesel/Biodiesel	Car	Faulty fuel supplies – Petrol product	2
2021	Diesel/Biodiesel	Car	Faulty leads to equipment or appliance	1
2021	Diesel/Biodiesel	Car	Heat source and combustibles brought together deliberately	6
2021	Diesel/Biodiesel	Car	Overheating, unknown cause	9
2021	Diesel/Biodiesel	Car	Unsafe use of heat source - due to unsafe disposal	1
2021	Diesel/Biodiesel	Car	Vehicle crash or collision	1
2021	Diesel/Biodiesel	Lorry/HGV	Overheating, unknown cause	2
2021	Diesel/Biodiesel	Lorry/HGV	Unsafe use of equipment or appliance (heat source)	1
2021	Diesel/Biodiesel	Multiple Vehicles	Heat source and combustibles brought together deliberately	1
2021	Diesel/Biodiesel	Other road vehicle	Combustible articles too close to heat source (or fire)	2
2021	Diesel/Biodiesel	Van	Accumulation of flammable material	1
2021	Diesel/Biodiesel	Van	Combustible articles too close to heat source (or fire)	1
2021	Diesel/Biodiesel	Van	Fault in equipment or appliance	1
2021	Diesel/Biodiesel	Van	Faulty fuel supplies – Electricity	2
2021	Diesel/Biodiesel	Van	Faulty fuel supplies – Petrol product	1
2021	Diesel/Biodiesel	Van	Faulty leads to equipment or appliance	2
2021	Diesel/Biodiesel	Van	Heat source and combustibles brought together deliberately	4
2021	Diesel/Biodiesel	Van	Other intentional burning, going out of control	1
2021	Diesel/Biodiesel	Van	Overheating, unknown cause	6
2021	Diesel/Electric Hybrid	Bus/coach	Heat source and combustibles brought together deliberately	1
2021	Diesel/Electric Hybrid	Bus/coach	Overheating, unknown cause	1
2021	Diesel/Electric Hybrid	Car	Accumulation of flammable material	1
2021	Diesel/Electric Hybrid	Car	Faulty fuel supplies – Electricity	1

2021	Diesel/Electric Hybrid	Multiple Vehicles	Heat source and combustibles brought together deliberately	1
2021	Electric batteries	Bicycle	Fault in equipment or appliance	1
2021	Electric batteries	Bicycle	Heat source and combustibles brought together deliberately	1
2021	Electric batteries	Bicycle	Overheating, unknown cause	1
2021	Electric batteries	Car	Fault in equipment or appliance	1
2021	Electric batteries	Car	Faulty fuel supplies – Electricity	1
2021	Electric batteries	Lorry/HGV	Fault in equipment or appliance	1
2021	Electric batteries	Other road vehicle	Fault in equipment or appliance	2
2021	Electric batteries	Other road vehicle	Overheating, unknown cause	1
2021	Petrol	Car	Fault in equipment or appliance	6
2021	Petrol	Car	Faulty fuel supplies – Electricity	15
2021	Petrol	Car	Faulty fuel supplies – Petrol product	14
2021	Petrol	Car	Faulty leads to equipment or appliance	3
2021	Petrol	Car	Heat source and combustibles brought together deliberately	24
2021	Petrol	Car	Overheating, unknown cause	19
2021	Petrol	Car	Pending Fire Investigation Team findings	1
2021	Petrol	Car	Unable to determine	1
2021	Petrol	Car	Unsafe use of heat source - due to unsafe disposal	2
2021	Petrol	Car	Vehicle crash or collision	1
2021	Petrol	Motor Home	Fault in equipment or appliance	1
2021	Petrol	Motorcycle	Faulty fuel supplies – Electricity	1
2021	Petrol	Motorcycle	Faulty fuel supplies – Petrol product	3
2021	Petrol	Motorcycle	Heat source and combustibles brought together deliberately	26
2021	Petrol	Motorcycle	Overheating, unknown cause	1
2021	Petrol	Motorcycle	Playing with fire (or heat source)	2
2021	Petrol	Multiple Vehicles	Heat source and combustibles brought together deliberately	3
2021	Petrol	Multiple Vehicles	Overheating, unknown cause	2
2021	Petrol	Multiple Vehicles	Unsafe use of equipment or appliance (heat source)	1
2021	Petrol	Multiple Vehicles	Vehicle crash or collision	1

2021	Petrol	Other road vehicle	Faulty fuel supplies – Electricity	1
2021	Petrol	Van	Cooking – other cooking	1
2021	Petrol	Van	Faulty fuel supplies – Electricity	1
2021	Petrol	Van	Heat source and combustibles brought together deliberately	1
2021	Petrol/Electric Hybrid	Car	Faulty fuel supplies – Electricity	3
2021	Petrol/Electric Hybrid	Car	Heat source and combustibles brought together deliberately	1
2021	Petrol/Electric Hybrid	Car	Overheating, unknown cause	1
2021	Petrol/Electric Hybrid	Lorry/HGV	Accumulation of flammable material	1
2021	Petrol/Electric Hybrid	Motorcycle	Heat source and combustibles brought together deliberately	1
2021	Unknown	Car	Heat source and combustibles brought together deliberately	7
2021	Unknown	Car	Overheating, unknown cause	2
2021	Unknown	Car	Unable to determine	1
2021	Unknown	Car	Unsafe use of equipment or appliance (heat source)	1
2021	Unknown	Lorry/HGV	Heat source and combustibles brought together deliberately	1
2021	Unknown	Multiple Vehicles	Combustible articles too close to heat source (or fire)	1
2021	Unknown	Multiple Vehicles	Heat source and combustibles brought together deliberately	1
2021	Unknown	Other road vehicle	Overheating, unknown cause	1
2021	Unknown	Trailer (not attached to tractor unit)	Heat source and combustibles brought together deliberately	1
2021	Unknown	Van	Heat source and combustibles brought together deliberately	1
2021	Unknown	Van	Overheating, unknown cause	1
2021	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Combustible articles too close to heat source (or fire)	1
2021	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Faulty fuel supplies – Electricity	2
2021	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Unable to determine	1

2021	Not recorded on Incident Management System (IMS)	Bicycle	Fault in equipment or appliance	3
2021	Not recorded on Incident Management System (IMS)	Bicycle	Faulty fuel supplies – Electricity	5
2021	Not recorded on Incident Management System (IMS)	Bicycle	Faulty leads to equipment or appliance	1
2021	Not recorded on Incident Management System (IMS)	Bicycle	Heat source and combustibles brought together deliberately	3
2021	Not recorded on Incident Management System (IMS)	Bicycle	Overheating, unknown cause	2
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Accumulation of flammable material	1
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Combustible articles too close to heat source (or fire)	1
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Fault in equipment or appliance	3
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty fuel supplies – Electricity	2
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty fuel supplies – Petrol product	2
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Heat source and combustibles brought together deliberately	2
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Natural occurrence	1
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Overheating, unknown cause	21
2021	Not recorded on Incident Management System (IMS)	Bus/coach	Vehicle crash or collision	1
2021	Not recorded on Incident Management System (IMS)	Car	Accumulation of flammable material	10
2021	Not recorded on Incident Management System (IMS)	Car	Bomb/incendiary device	3
2021	Not recorded on Incident Management System (IMS)	Car	Bonfire going out of control	1
2021	Not recorded on Incident Management System (IMS)	Car	Combustible articles too close to heat source (or fire)	24
2021	Not recorded on Incident Management System (IMS)	Car	Fault in equipment or appliance	40

2021	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Electricity	121
2021	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Gas	3
2021	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Petrol product	77
2021	Not recorded on Incident Management System (IMS)	Car	Faulty leads to equipment or appliance	12
2021	Not recorded on Incident Management System (IMS)	Car	Heat source and combustibles brought together deliberately	177
2021	Not recorded on Incident Management System (IMS)	Car	Natural occurrence	1
2021	Not recorded on Incident Management System (IMS)	Car	Other intentional burning, going out of control	3
2021	Not recorded on Incident Management System (IMS)	Car	Overheating, unknown cause	139
2021	Not recorded on Incident Management System (IMS)	Car	Pending Fire Investigation Team findings	1
2021	Not recorded on Incident Management System (IMS)	Car	Person too close to heat source (or fire)	1
2021	Not recorded on Incident Management System (IMS)	Car	Playing with fire (or heat source)	6
2021	Not recorded on Incident Management System (IMS)	Car	Unable to determine	8
2021	Not recorded on Incident Management System (IMS)	Car	Unsafe use of equipment or appliance (heat source)	5
2021	Not recorded on Incident Management System (IMS)	Car	Unsafe use of heat source - due to unsafe disposal	5
2021	Not recorded on Incident Management System (IMS)	Car	Vehicle crash or collision	20
2021	Not recorded on Incident Management System (IMS)	Car	Not recorded on Incident Management System (IMS)	1
2021	Not recorded on Incident Management System (IMS)	Caravan on tow	Heat source and combustibles brought together deliberately	1
2021	Not recorded on Incident Management System (IMS)	Caravan on tow	Unsafe use of heat source - due to unsafe disposal	1
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Accumulation of flammable material	3

2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Combustible articles too close to heat source (or fire)	12
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Fault in equipment or appliance	2
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty fuel supplies – Electricity	3
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty fuel supplies – Petrol product	1
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty leads to equipment or appliance	1
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Heat source and combustibles brought together deliberately	1
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Natural occurrence	1
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Overheating, unknown cause	20
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Unsafe use of heat source - due to knocking over	1
2021	Not recorded on Incident Management System (IMS)	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	12
2021	Not recorded on Incident Management System (IMS)	Minibus	Faulty fuel supplies – Petrol product	1
2021	Not recorded on Incident Management System (IMS)	Minibus	Heat source and combustibles brought together deliberately	2
2021	Not recorded on Incident Management System (IMS)	Minibus	Unsafe use of heat source - due to unsafe disposal	1
2021	Not recorded on Incident Management System (IMS)	Motor Home	Faulty fuel supplies – Electricity	1
2021	Not recorded on Incident Management System (IMS)	Motor Home	Heat source and combustibles brought together deliberately	4
2021	Not recorded on Incident Management System (IMS)	Motor Home	Overheating, unknown cause	2
2021	Not recorded on Incident Management System (IMS)	Motor Home	Unable to determine	1
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Combustible articles too close to heat source (or fire)	3
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Electricity	4



2021	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Petrol product	13
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Heat source and combustibles brought together deliberately	123
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Other intentional burning, going out of control	7
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Overheating, unknown cause	20
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Playing with fire (or heat source)	2
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Unable to determine	2
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Unsafe use of equipment or appliance (heat source)	2
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Unsafe use of heat source - due to unsafe disposal	1
2021	Not recorded on Incident Management System (IMS)	Motorcycle	Vehicle crash or collision	4
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Combustible articles too close to heat source (or fire)	1
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Fault in equipment or appliance	2
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty fuel supplies – Electricity	5
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty fuel supplies – Petrol product	5
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty leads to equipment or appliance	1
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Heat source and combustibles brought together deliberately	20
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Overheating, unknown cause	6
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Playing with fire (or heat source)	1
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Unsafe use of equipment or appliance (heat source)	1
2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Unsafe use of heat source - due to unsafe disposal	1

2021	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Vehicle crash or collision	1
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Accumulation of flammable material	1
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Cooking – other cooking	1
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Fault in equipment or appliance	6
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty fuel supplies – Electricity	6
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty fuel supplies – Petrol product	3
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty leads to equipment or appliance	1
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Heat source and combustibles brought together deliberately	3
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Natural occurrence	1
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Other intentional burning, going out of control	2
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Overheating, unknown cause	3
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Unable to determine	2
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Unsafe use of equipment or appliance (heat source)	2
2021	Not recorded on Incident Management System (IMS)	Other road vehicle	Unsafe use of heat source - due to unsafe disposal	2
2021	Not recorded on Incident Management System (IMS)	Road Tanker	Overheating, unknown cause	1
2021	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Combustible articles too close to heat source (or fire)	1
2021	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Fault in equipment or appliance	1
2021	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Heat source and combustibles brought together deliberately	4
2021	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Unable to determine	1

2021	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Unsafe use of equipment or appliance (heat source)	1
2021	Not recorded on Incident Management System (IMS)	Trailer (not attached to tractor unit)	Accumulation of flammable material	1
2021	Not recorded on Incident Management System (IMS)	Trailer (not attached to tractor unit)	Overheating, unknown cause	1
2021	Not recorded on Incident Management System (IMS)	Van	Accumulation of flammable material	1
2021	Not recorded on Incident Management System (IMS)	Van	Combustible articles too close to heat source (or fire)	7
2021	Not recorded on Incident Management System (IMS)	Van	Cooking – chip pan/deep fat fryer	1
2021	Not recorded on Incident Management System (IMS)	Van	Fault in equipment or appliance	10
2021	Not recorded on Incident Management System (IMS)	Van	Faulty fuel supplies – Electricity	20
2021	Not recorded on Incident Management System (IMS)	Van	Faulty fuel supplies – Petrol product	13
2021	Not recorded on Incident Management System (IMS)	Van	Faulty leads to equipment or appliance	2
2021	Not recorded on Incident Management System (IMS)	Van	Heat source and combustibles brought together deliberately	33
2021	Not recorded on Incident Management System (IMS)	Van	Natural occurrence	3
2021	Not recorded on Incident Management System (IMS)	Van	Other intentional burning, going out of control	2
2021	Not recorded on Incident Management System (IMS)	Van	Overheating, unknown cause	38
2021	Not recorded on Incident Management System (IMS)	Van	Unable to determine	2
2021	Not recorded on Incident Management System (IMS)	Van	Unsafe use of equipment or appliance (heat source)	1
2021	Not recorded on Incident Management System (IMS)	Van	Unsafe use of heat source - due to unsafe disposal	4
2021	Not recorded on Incident Management System (IMS)	Van	Vehicle crash or collision	3
2021 Total				<b>1,427</b>

2020	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Accumulation of flammable material	1
2020	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Fault in equipment or appliance	1
2020	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Faulty fuel supplies – Petrol product	1
2020	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Heat source and combustibles brought together deliberately	1
2020	Not recorded on Incident Management System (IMS)	Bicycle	Combustible articles too close to heat source (or fire)	1
2020	Not recorded on Incident Management System (IMS)	Bicycle	Fault in equipment or appliance	2
2020	Not recorded on Incident Management System (IMS)	Bicycle	Faulty fuel supplies – Electricity	2
2020	Not recorded on Incident Management System (IMS)	Bicycle	Heat source and combustibles brought together deliberately	4
2020	Not recorded on Incident Management System (IMS)	Bicycle	Overheating, unknown cause	1
2020	Not recorded on Incident Management System (IMS)	Bicycle	Unable to determine	1
2020	Not recorded on Incident Management System (IMS)	Bicycle	Unsafe use of heat source - due to unsafe disposal	1
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Accumulation of flammable material	2
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Combustible articles too close to heat source (or fire)	1
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Fault in equipment or appliance	4
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty fuel supplies – Electricity	3
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty fuel supplies – Petrol product	7
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty leads to equipment or appliance	2
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Heat source and combustibles brought together deliberately	5
2020	Not recorded on Incident Management System (IMS)	Bus/coach	Overheating, unknown cause	12

2020	Not recorded on Incident Management System (IMS)	Bus/coach	Playing with fire (or heat source)	1
2020	Not recorded on Incident Management System (IMS)	Car	Accumulation of flammable material	12
2020	Not recorded on Incident Management System (IMS)	Car	Bomb/incendiary device	1
2020	Not recorded on Incident Management System (IMS)	Car	Bonfire going out of control	1
2020	Not recorded on Incident Management System (IMS)	Car	Combustible articles too close to heat source (or fire)	23
2020	Not recorded on Incident Management System (IMS)	Car	Fault in equipment or appliance	47
2020	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Electricity	157
2020	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Gas	1
2020	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Petrol product	83
2020	Not recorded on Incident Management System (IMS)	Car	Faulty leads to equipment or appliance	18
2020	Not recorded on Incident Management System (IMS)	Car	Heat source and combustibles brought together deliberately	258
2020	Not recorded on Incident Management System (IMS)	Car	Natural occurrence	5
2020	Not recorded on Incident Management System (IMS)	Car	Other intentional burning, going out of control	6
2020	Not recorded on Incident Management System (IMS)	Car	Overheating, unknown cause	184
2020	Not recorded on Incident Management System (IMS)	Car	Pending Fire Investigation Team findings	1
2020	Not recorded on Incident Management System (IMS)	Car	Person too close to heat source (or fire)	1
2020	Not recorded on Incident Management System (IMS)	Car	Playing with fire (or heat source)	3
2020	Not recorded on Incident Management System (IMS)	Car	Unable to determine	9
2020	Not recorded on Incident Management System (IMS)	Car	Unsafe use of equipment or appliance (heat source)	4

2020	Not recorded on Incident Management System (IMS)	Car	Unsafe use of heat source - due to unsafe disposal	10
2020	Not recorded on Incident Management System (IMS)	Car	Vehicle crash or collision	25
2020	Not recorded on Incident Management System (IMS)	Car	Not recorded on Incident Management System (IMS)	2
2020	Not recorded on Incident Management System (IMS)	Caravan on tow	Heat source and combustibles brought together deliberately	1
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Accumulation of flammable material	3
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Combustible articles too close to heat source (or fire)	10
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Fault in equipment or appliance	5
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty fuel supplies – Electricity	6
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty fuel supplies – Petrol product	3
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty leads to equipment or appliance	2
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Heat source and combustibles brought together deliberately	2
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Natural occurrence	2
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Overheating, unknown cause	5
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Unsafe use of equipment or appliance (heat source)	2
2020	Not recorded on Incident Management System (IMS)	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	10
2020	Not recorded on Incident Management System (IMS)	Minibus	Faulty fuel supplies – Electricity	1
2020	Not recorded on Incident Management System (IMS)	Minibus	Heat source and combustibles brought together deliberately	1
2020	Not recorded on Incident Management System (IMS)	Minibus	Overheating, unknown cause	1
2020	Not recorded on Incident Management System (IMS)	Motor Home	Faulty fuel supplies – Electricity	2

2020	Not recorded on Incident Management System (IMS)	Motor Home	Heat source and combustibles brought together deliberately	2
2020	Not recorded on Incident Management System (IMS)	Motor Home	Overheating, unknown cause	1
2020	Not recorded on Incident Management System (IMS)	Motor Home	Unable to determine	1
2020	Not recorded on Incident Management System (IMS)	Motor Home	Unsafe use of equipment or appliance (heat source)	1
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Accumulation of flammable material	4
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Combustible articles too close to heat source (or fire)	7
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Fault in equipment or appliance	2
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Electricity	9
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Gas	2
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Petrol product	12
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Heat source and combustibles brought together deliberately	167
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Other intentional burning, going out of control	2
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Overheating, unknown cause	21
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Playing with fire (or heat source)	5
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Unable to determine	5
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Unsafe use of equipment or appliance (heat source)	3
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Unsafe use of heat source - due to unsafe disposal	2
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Vehicle crash or collision	1
2020	Not recorded on Incident Management System (IMS)	Motorcycle	Not recorded on Incident Management System (IMS)	1

2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Combustible articles too close to heat source (or fire)	3
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty fuel supplies – Electricity	3
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty fuel supplies – Gas	1
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty fuel supplies – Petrol product	4
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Heat source and combustibles brought together deliberately	29
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Overheating, unknown cause	5
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Unable to determine	1
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Unsafe use of equipment or appliance (heat source)	1
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Unsafe use of heat source - due to unsafe disposal	2
2020	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Vehicle crash or collision	5
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Combustible articles too close to heat source (or fire)	2
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Cooking – other cooking	1
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Fault in equipment or appliance	3
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty fuel supplies – Electricity	10
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty fuel supplies – Petrol product	2
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Heat source and combustibles brought together deliberately	2
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Other intentional burning, going out of control	1
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Overheating, unknown cause	9
2020	Not recorded on Incident Management System (IMS)	Other road vehicle	Unsafe use of heat source - due to unsafe disposal	4



2020	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Fault in equipment or appliance	1
2020	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Faulty fuel supplies – Petrol product	1
2020	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Heat source and combustibles brought together deliberately	8
2020	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Overheating, unknown cause	1
2020	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Unable to determine	2
2020	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Unsafe use of heat source - due to unsafe disposal	1
2020	Not recorded on Incident Management System (IMS)	Trailer (not attached to tractor unit)	Fault in equipment or appliance	1
2020	Not recorded on Incident Management System (IMS)	Trailer (not attached to tractor unit)	Heat source and combustibles brought together deliberately	1
2020	Not recorded on Incident Management System (IMS)	Trailer (not attached to tractor unit)	Unsafe use of heat source - due to unsafe disposal	2
2020	Not recorded on Incident Management System (IMS)	Van	Accumulation of flammable material	4
2020	Not recorded on Incident Management System (IMS)	Van	Bomb/incendiary device	1
2020	Not recorded on Incident Management System (IMS)	Van	Combustible articles too close to heat source (or fire)	11
2020	Not recorded on Incident Management System (IMS)	Van	Fault in equipment or appliance	9
2020	Not recorded on Incident Management System (IMS)	Van	Faulty fuel supplies – Electricity	29
2020	Not recorded on Incident Management System (IMS)	Van	Faulty fuel supplies – Gas	1
2020	Not recorded on Incident Management System (IMS)	Van	Faulty fuel supplies – Petrol product	11
2020	Not recorded on Incident Management System (IMS)	Van	Faulty leads to equipment or appliance	5
2020	Not recorded on Incident Management System (IMS)	Van	Heat source and combustibles brought together deliberately	53
2020	Not recorded on Incident Management System (IMS)	Van	Natural occurrence	1

2020	Not recorded on Incident Management System (IMS)	Van	Overheating, unknown cause	31
2020	Not recorded on Incident Management System (IMS)	Van	Unable to determine	2
2020	Not recorded on Incident Management System (IMS)	Van	Unsafe use of equipment or appliance (heat source)	1
2020	Not recorded on Incident Management System (IMS)	Van	Unsafe use of heat source - due to unsafe disposal	7
2020	Not recorded on Incident Management System (IMS)	Van	Vehicle crash or collision	1
2020 Total				<b>1,481</b>
2019	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Accumulation of flammable material	2
2019	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Combustible articles too close to heat source (or fire)	1
2019	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Faulty fuel supplies – Electricity	1
2019	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Faulty leads to equipment or appliance	1
2019	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Heat source and combustibles brought together deliberately	1
2019	Not recorded on Incident Management System (IMS)	Agricultural vehicle	Overheating, unknown cause	2
2019	Not recorded on Incident Management System (IMS)	Bicycle	Accumulation of flammable material	1
2019	Not recorded on Incident Management System (IMS)	Bicycle	Combustible articles too close to heat source (or fire)	1
2019	Not recorded on Incident Management System (IMS)	Bicycle	Faulty fuel supplies – Electricity	5
2019	Not recorded on Incident Management System (IMS)	Bicycle	Heat source and combustibles brought together deliberately	5
2019	Not recorded on Incident Management System (IMS)	Bicycle	Other intentional burning, going out of control	1
2019	Not recorded on Incident Management System (IMS)	Bicycle	Overheating, unknown cause	2
2019	Not recorded on Incident Management System (IMS)	Bicycle	Unsafe use of heat source - due to unsafe disposal	4

2019	Not recorded on Incident Management System (IMS)	Bus/coach	Combustible articles too close to heat source (or fire)	2
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Fault in equipment or appliance	6
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty fuel supplies – Electricity	5
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty fuel supplies – Petrol product	7
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Faulty leads to equipment or appliance	1
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Heat source and combustibles brought together deliberately	2
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Natural occurrence	1
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Overheating, unknown cause	23
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Playing with fire (or heat source)	1
2019	Not recorded on Incident Management System (IMS)	Bus/coach	Unsafe use of heat source - due to unsafe disposal	1
2019	Not recorded on Incident Management System (IMS)	Car	Accumulation of flammable material	6
2019	Not recorded on Incident Management System (IMS)	Car	Bomb/incendiary device	1
2019	Not recorded on Incident Management System (IMS)	Car	Combustible articles too close to heat source (or fire)	36
2019	Not recorded on Incident Management System (IMS)	Car	Fault in equipment or appliance	67
2019	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Electricity	189
2019	Not recorded on Incident Management System (IMS)	Car	Faulty fuel supplies – Petrol product	116
2019	Not recorded on Incident Management System (IMS)	Car	Faulty leads to equipment or appliance	29
2019	Not recorded on Incident Management System (IMS)	Car	Heat source and combustibles brought together deliberately	390
2019	Not recorded on Incident Management System (IMS)	Car	Homicide/attempted: setting fire to other person/s	1

2019	Not recorded on Incident Management System (IMS)	Car	Natural occurrence	4
2019	Not recorded on Incident Management System (IMS)	Car	Other intentional burning, going out of control	6
2019	Not recorded on Incident Management System (IMS)	Car	Overheating, unknown cause	210
2019	Not recorded on Incident Management System (IMS)	Car	Pending Fire Investigation Team findings	2
2019	Not recorded on Incident Management System (IMS)	Car	Playing with fire (or heat source)	1
2019	Not recorded on Incident Management System (IMS)	Car	Suicide/attempted: setting fire to self	1
2019	Not recorded on Incident Management System (IMS)	Car	Unable to determine	11
2019	Not recorded on Incident Management System (IMS)	Car	Unsafe use of equipment or appliance (heat source)	10
2019	Not recorded on Incident Management System (IMS)	Car	Unsafe use of heat source - due to unsafe disposal	14
2019	Not recorded on Incident Management System (IMS)	Car	Vehicle crash or collision	34
2019	Not recorded on Incident Management System (IMS)	Car	Not recorded on Incident Management System (IMS)	4
2019	Not recorded on Incident Management System (IMS)	Caravan on tow	Combustible articles too close to heat source (or fire)	1
2019	Not recorded on Incident Management System (IMS)	Caravan on tow	Faulty fuel supplies – Electricity	1
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Accumulation of flammable material	8
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Combustible articles too close to heat source (or fire)	6
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Fault in equipment or appliance	3
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty fuel supplies – Electricity	7
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty fuel supplies – Petrol product	3
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Faulty leads to equipment or appliance	1

2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Heat source and combustibles brought together deliberately	1
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Natural occurrence	2
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Other intentional burning, going out of control	1
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Overheating, unknown cause	25
2019	Not recorded on Incident Management System (IMS)	Lorry/HGV	Unsafe use of heat source - due to unsafe disposal	9
2019	Not recorded on Incident Management System (IMS)	Minibus	Combustible articles too close to heat source (or fire)	1
2019	Not recorded on Incident Management System (IMS)	Minibus	Faulty fuel supplies – Petrol product	1
2019	Not recorded on Incident Management System (IMS)	Minibus	Heat source and combustibles brought together deliberately	2
2019	Not recorded on Incident Management System (IMS)	Motor Home	Combustible articles too close to heat source (or fire)	1
2019	Not recorded on Incident Management System (IMS)	Motor Home	Faulty fuel supplies – Electricity	1
2019	Not recorded on Incident Management System (IMS)	Motor Home	Faulty fuel supplies – Petrol product	2
2019	Not recorded on Incident Management System (IMS)	Motor Home	Heat source and combustibles brought together deliberately	1
2019	Not recorded on Incident Management System (IMS)	Motor Home	Overheating, unknown cause	1
2019	Not recorded on Incident Management System (IMS)	Motor Home	Unable to determine	1
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Accumulation of flammable material	1
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Combustible articles too close to heat source (or fire)	5
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Fault in equipment or appliance	3
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Electricity	11
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Gas	1

2019	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty fuel supplies – Petrol product	15
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Faulty leads to equipment or appliance	1
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Heat source and combustibles brought together deliberately	231
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Other intentional burning, going out of control	5
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Overheating, unknown cause	23
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Playing with fire (or heat source)	3
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Unable to determine	1
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Unsafe use of equipment or appliance (heat source)	1
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Unsafe use of heat source - due to unsafe disposal	3
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Vehicle crash or collision	3
2019	Not recorded on Incident Management System (IMS)	Motorcycle	Not recorded on Incident Management System (IMS)	2
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Accumulation of flammable material	1
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Combustible articles too close to heat source (or fire)	3
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Fault in equipment or appliance	4
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty fuel supplies – Electricity	9
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty fuel supplies – Petrol product	3
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Faulty leads to equipment or appliance	1
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Heat source and combustibles brought together deliberately	37
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Overheating, unknown cause	5

2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Unable to determine	1
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Unsafe use of equipment or appliance (heat source)	2
2019	Not recorded on Incident Management System (IMS)	Multiple Vehicles	Vehicle crash or collision	6
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Accumulation of flammable material	3
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Combustible articles too close to heat source (or fire)	3
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Fault in equipment or appliance	3
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty fuel supplies – Electricity	8
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty fuel supplies – Petrol product	3
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Faulty leads to equipment or appliance	1
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Heat source and combustibles brought together deliberately	2
2019	Not recorded on Incident Management System (IMS)	Other road vehicle	Overheating, unknown cause	9
2019	Not recorded on Incident Management System (IMS)	Road Tanker	Overheating, unknown cause	1
2019	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Bomb/incendiary device	1
2019	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Cooking – other cooking	1
2019	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Heat source and combustibles brought together deliberately	8
2019	Not recorded on Incident Management System (IMS)	Towing caravan (not on tow or on site)	Overheating, unknown cause	2
2019	Not recorded on Incident Management System (IMS)	Trailer (not attached to tractor unit)	Fault in equipment or appliance	1
2019	Not recorded on Incident Management System (IMS)	Trailer (not attached to tractor unit)	Unsafe use of heat source - due to unsafe disposal	1
2019	Not recorded on Incident Management System (IMS)	Van	Accumulation of flammable material	3

2019	Not recorded on Incident Management System (IMS)	Van	Combustible articles too close to heat source (or fire)	8
2019	Not recorded on Incident Management System (IMS)	Van	Cooking – chip pan/deep fat fryer	2
2019	Not recorded on Incident Management System (IMS)	Van	Fault in equipment or appliance	14
2019	Not recorded on Incident Management System (IMS)	Van	Faulty fuel supplies – Electricity	26
2019	Not recorded on Incident Management System (IMS)	Van	Faulty fuel supplies – Petrol product	14
2019	Not recorded on Incident Management System (IMS)	Van	Faulty leads to equipment or appliance	13
2019	Not recorded on Incident Management System (IMS)	Van	Heat source and combustibles brought together deliberately	63
2019	Not recorded on Incident Management System (IMS)	Van	Natural occurrence	3
2019	Not recorded on Incident Management System (IMS)	Van	Overheating, unknown cause	23
2019	Not recorded on Incident Management System (IMS)	Van	Playing with fire (or heat source)	4
2019	Not recorded on Incident Management System (IMS)	Van	Suicide/attempted: setting fire to self	1
2019	Not recorded on Incident Management System (IMS)	Van	Unsafe use of equipment or appliance (heat source)	2
2019	Not recorded on Incident Management System (IMS)	Van	Unsafe use of heat source - due to knocking over	2
2019	Not recorded on Incident Management System (IMS)	Van	Unsafe use of heat source - due to unsafe disposal	4
2019	Not recorded on Incident Management System (IMS)	Van	Vehicle crash or collision	1
2019 Total				<b>1,898</b>
<b>Grand Total</b>				<b>7,310</b>

Please see further details below in relation to the location data:

**Location data**



We publish details of every incident attended by the London Fire Brigade since 1 January 2009. This information can be accessed via the following link:

<https://data.london.gov.uk/dataset/london-fire-brigade-incident-records>

As mentioned above, we do record the address of incidents attended but we do not record a breakdown of the "*situation*" of the vehicle "*ie charging, parked or moving*".

If you download the incident data spreadsheets accessible via the link above, you can see the address and address qualifier recorded for vehicle fire incidents by sorting by the following:

Column F '*IncidentGroup*' to '*Fire*', column I '*PropertyCategory*' to '*Road Vehicle*'. You will see the '*AddressQualifier*' in column K that details location of actual incident relevant to recorded '*PropertyType*' in column J. Address information is recorded in columns L-AA.

*3) Please confirm official fire safety guidance for installation of EV chargers within close proximity of a residential homes. In particular any specified distance from charging bay /charger to a residential property.*

I have attached a copy of the LFB Fire Safety Information & Guidance Note (FSIGN) 430: Electric Vehicle Charging and Battery Energy Storage Systems. The purpose of this FSIGN is to highlight considerations for fire safety officers when undertaking fire safety activities involving alternative fuel sources but it also includes signposts to useful statutory guidance.

*4) I understand that the method of extinguishing an EV fire differs from that of a petrol fire due to the nature of the lithium battery. Please can you confirm the protocol in place for dealing with an EV fire at an EV charging hub on a residential street.*

I have attached a copy of the LFB '*Standard Operating Procedure: PN977a*' for Lithium-ion batteries. This policy note also refers to '*Policy number: 977: All incident considerations*'. I have also attached the section of this policy (pages 47-58 of 81) which provides further information in relation to alternative energies.

We have dealt with your request under the Freedom of Information Act 2000. For more information about this process please see the guidance we publish about making a request [on our website](#).

# Electric Vehicle Charging and Battery Energy Storage Systems

## FSIGN 430

*Old Inst.: N/A*

*Issue date: August 2021*

*400 Series: Occupancy & Hazards*

## Summary

The London Fire Commissioner (the Commissioner) is the fire and rescue authority for London. The Commissioner is responsible for enforcing the Regulatory Reform (Fire Safety) Order 2005 (as amended) in London.

This Note is intended for internal use, providing information and guidance on Electric Vehicle Charging and Battery Energy Storage Systems.

This Note is one of a series produced by Fire Safety Regulation HQ Policy Groups to provide additional advice and guidance to officers and Fire Safety Teams on various subjects related to their role.

Where appropriate this Note should be used for learning and staff development purposes.

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# 1 Introduction

- 1.1 The emergence of alternative fuel sources will change how we power our vehicles and the buildings we occupy. These alternative fuel sources range from simple battery technology, to electric vehicle charging points and energy storage systems. With these alternative fuel sources, comes new hazards and risks, not just to relevant persons but to firefighters and other emergencies responders. As the technology becomes more widespread, there is a need for Responsible Persons (RP), in buildings to which the [Regulatory Reform \(Fire Safety\) Order 2005](#) (as amended) applies, to consider any alternative fuel sources in their Fire Risk Assessments (FRA).
- 1.2 The purpose of this FSIGN is to highlight considerations for fire safety officers when undertaking fire safety activities involving alternative fuel sources and signpost to useful guidance. It has been produced using the experience and knowledge of London Fire Brigade (LFB) officers and is not intended to replace existing guidance and/or legislation.  
**NOTE:** This FSIGN should be read in conjunction with [FSIGN 422](#) and the [NFCC Mobility Scooter Guidance for Residential Buildings](#), to address the risks associated with mobility scooters that use alternative energy sources.
- 1.3 Whilst there are risks associated with these alternative fuels sources, there are also undoubted benefits. LFB is embracing this technology with the introduction of electric vehicles into our fleet and the installation of charging points at fire stations. Alternative fuels offer energy efficient technology that supports sustainable development. Fire safety officers should take a proportionate approach when assessing risk, as while the severity from an incident is very high, the likelihood is relatively low when considering the vast quantities of lithium-ion battery products in use.

## 2 Risks associated with Lithium Ion Batteries in Electric Vehicles, charging equipment and Battery Energy Storage Systems

- 2.1 Electric Vehicle Charging Equipment (EVCE) may present a hazard as a potential ignition source that can cause a fire from over/under charging or short-circuiting the lithium-ion battery (LIB) within an Electric or Hybrid Vehicle. This, as well as other incidents that crush or puncture a LIB such as road traffic collisions, can lead to a process known as 'thermal runaway'.
- 2.2 Thermal runaway of LIBs used in electric and hybrid vehicles is a chain reaction where heat is produced inside the battery faster than it can be dissipated, leading to fire and possibly explosion. Temperatures of up to 900°C can be reached and the battery can produce flammable, toxic gases. The resulting fire can engulf the vehicle and its surroundings very rapidly. The fire is difficult to extinguish by conventional means as both fuel and oxidant are contained together in the battery.
- 2.3 LIBs are generally a sealed unit within electric or hybrid vehicles, which may make it difficult to detect a fire until flames/smoke is visible, by which time thermal runaway has usually reached an irreversible phase. This also has the potential to prevent or hinder normal firefighting techniques from getting water to the source of the fire (See Operational Considerations in Section 6 below).
- 2.4 When an electric or hybrid vehicle battery is involved in a fire, it can initially produce large plumes of white smoke. (NB: This white smoke is highly toxic and must not be mistaken for steam). In certain environments, this toxic white smoke may be non-buoyant, resulting in escape routes becoming untenable or effecting the efficiency of the smoke control systems that have not been designed for such fires. The initial temperature of the white smoke plumes may not be sufficient

to trigger traditional heat dependent alarm systems and so additional detection systems may be required to mitigate against this risk. Designers of ventilation systems should consider this specific hazard and ensure that the risk to occupants has been adequately reduced.

**NOTE:** Post incident, decontamination of walls and vents is the responsibility of the building owner.

- 2.5 LIBs are a firefighter hazard due to the potential exposure to the very high temperatures they burn at, toxicity, potential to explode and risk of electrocution, especially at close proximity. Following an initial incident, LIBs can rekindle making it difficult to determine when a fire has been fully extinguished and 'safe'. Re-kindling of LIB can occur hours, days or even weeks after the initial incident.
- 2.6 Battery Energy Storage Systems (BESS) capture energy and store it in a large LIB for use at a later time e.g. they charge over night during low power usage times in order to supplement power usage during the day at high usage times. These systems complement other sources of energy such as wind and/or solar power in an attempt to balance energy production and consumption. As BESS use LIB technology they are also prone to thermal runaway if involved in a fire incident. Therefore, consideration should be given to the control of ignition sources in close proximity to BESS equipment and that adequate isolation points are available.
- NOTE:** BESS may also be referred to as 'BULK energy storage systems'.
- 2.7 The selection of firefighting equipment needs careful consideration based upon a suitable assessment of the risks. Carbon dioxide (CO<sub>2</sub>), usually recommended for electrical hazards are ineffective against LIBs because CO<sub>2</sub> cannot penetrate the battery casing and LIBs are self-oxidising making removal of oxygen with CO<sub>2</sub> difficult. Instead, water is the preferred media for tackling LIB fires. However, due to the risks associated with thermal runaway, copious amounts of water will be needed to tackle a fire where LIBs are involved. It is therefore unlikely that portable firefighting equipment would successfully suppress or extinguish a fire. Due to the potentially aggressive nature of LIB fires, the risk of explosion, thermal runaway and highly toxic smoke production, our advice should be for occupants to make their escape and not attempt to tackle the fire.
- 2.8 LFB are aware that some manufactures are marketing lithium-ion battery extinguishers; subject to manufacturer recommendations and a suitable FRA, these may be suitable for small LIB fires (e.g. mobile phones, laptops etc.). However, it is LFB opinion that these are not normally suitable for use on electric or hybrid vehicles due to the large volume of water typically required when dealing with fires in these types of vehicles.

### 3 Building Control Consultations

- 3.1 All building control consultations (D-Jobs) should be undertaken in accordance with [FSIGN 501](#) and [the Building Regulations and Fire Safety Procedural Guidance](#).
- 3.2 Where an IO/FSA receives D-Jobs that include EVCE, BESS and/or where car parks are part of the consultation, they should consider the impact of these on the general fire precautions. Where appropriate, the standard paragraphs in Appendix 1, as provided by the Fire Engineering Group (FEG) may be included in the response.
- 3.3 If further advice on the installation of these systems is needed during the 'D' Job process, IO/FSA should discuss them with the duty fire engineer. The duty engineer details can be found via the Brigade Duty Officer (BDO) or Team Contact Officer (TCO).

## 4 Auditing

- 4.1 All audits should follow the principles in [FSIGN 201](#).
- 4.2 When auditing premises where EVCE and/or BESS are installed, IO/FSA should assess their impact on the general fire precautions and record any observations or deficiencies under Art 8, 9, 10, 11 and any other articles deemed relevant. IO/FSA should also record details of the installation in the 'Additional Detail' box in the 'Location Detail' page of the audit form.
- 4.3 The installation of these systems are considered as a significant change to the risk in the premises and should trigger a review of the FRA. A failure to review the FRA should be regarded as a failing under Art 9(3). A FRA that has been reviewed, but does not adequately assess the risks from these systems and their impact on fire safety systems (e.g. smoke control, fire detection and fire alarm systems, signage and AFSS etc.) and the means of escape should be regarded as not suitable and sufficient.
- NOTE:** Referrals should be made to the Local Authority Environmental Health Office or the HSE (depending on the premises) regarding any issues with the installation or maintenance of EVCE, as they are responsible for enforcing [The Electricity at Work Regulations 1989](#). IO/FSA should check [The Health and Safety \(Enforcing Authority\) Regulations 1998](#) to determine the correct authority to liaise with.
- 4.4 IO/FSA should assess that the preventative and protective measures implemented by the RP are enough to reduce the risk of a fire and mitigate the effects of fire and the spread of fire. Observations on these measures and the fire safety arrangements should be made as appropriate under Art 10 and 11.
- 4.5 Where EVCE are retrofitted into existing buildings, the installation of the chargers and associated electrical cabling may breach compartmentation and/or any fire stopping solutions maybe inappropriate. This could allow the spread of fire and smoke, especially in blocks of flats where the power supply maybe taken from individual flats rather than a communal feed. If issues with the installation of these systems are identified during an audit (e.g. a failure to maintain or breaches in compartmentation), these should be recorded under Art 8.
- 4.6 Where sprinklers have not been installed in the premises, IO/FSA should give consideration to recommended these in accordance with the LFB Automatic Fire Suppression Systems Position Statement. Any sprinkler system should be in accordance with the relevant British Standards e.g. BS EN 12845.
- 4.7 If a Premises Risk Assessment form under [PN 800](#) is received by the local fire safety office with regard to EVCE, BESS or Photovoltaic (PV) installations for a particular premises, the details should be entered on the file for the premises and the Team Leader should give consideration to raising an FS01 Job.

## 5 Enforcement

- 5.1 All enforcement action should be taken in accordance with [FSIGN 308](#), our [Enforcement Policy Statement](#) and [Enforcement Service Standard](#).
- 5.2 Where IO/FSA have identified that, the general fire precautions in relation to EVCE and/or BESS are inadequate and enforcement action is required, the enforcement approach in Appendix 2 should be followed.

**NOTE:** The enforcement approach in Appendix 2 is not intended to cover all possible enforcement scenarios. IO/FSA should use their professional judgement when taking

enforcement action. Further advice can be found by contacting the Central Regulation Enforcement Group (CREG).

## 6 Operational Considerations

- 6.1 To ensure effective planning for firefighting where EVCE and BESS are installed on or near the premises, the details of the installation, any isolation points, if they are connected to PV panels, smoke control overrides and AFSS should be included in a [SFS A020 a2a](#) Station Notification form in accordance with [FSIGN 113](#) and [PN 784](#), so it can be added to the Operational Risk Database (ORD).
- 6.2 IO/FSA should ensure that appropriate information for firefighters is included in any Premises Information Boxes (where installed) and should advise the RP to provide suitable information and/or signage on the isolation of any EVCE/BESS, especially where these may isolate other life safety systems.
- 6.3 All emergency isolation equipment and switches should be clearly identifiable to firefighters, readable in low light conditions and marked to show the direction of isolation.

## 7 Document History

### Impact assessments

Equality	xx/mm/yyyy	Sustainability	xx/mm/yyyy
Health, Safety & Welfare	xx/mm/yyyy	Risk Assessment	xx/mm/yyyy

### Audit trail

Listed below is a brief audit trail, detailing amendments made to this policy/procedure.

Page/para nos.	Brief description of change	Date
All	New FSIGN	03/08/2021
Summary, 1.1	Updated to reflect (RR(FS)O has been amended	01/05/2022

## Appendix 1 – Standard Paragraphs for D-Jobs

All responses to D-Jobs should be undertaken in accordance with the [S500–D: Building control consultations](#) procedure. When responding to the Building Control Body, IO/FSA should use the FS\_D\_01 letter template (available in the letter wizard). This appendix contains some standard model paragraphs that may be used when commenting on D-Jobs containing EVC installations in car parks.

NOTE: Whilst the paragraphs refer to car parking areas, they may also be adapted for use when responding to installations in other premises types e.g. bus depots or garages.

### Electric vehicle charging units – car parks:

We note that the proposals include enclosed car parking areas. We recommend that consideration is given in relation to electric vehicle (EV) charging units together with the potential fire risk posed by electric vehicles which may be within the parking areas.

We would expect consideration to be given to the following:

- Independent EV charging point isolation equipment and controls, accessible for use by firefighters.
- Provision of suitable premises information and signage for firefighters to indicate positions of EV charging points, power supply isolation controls, water supplies etc.
- Water resistance of charging points, including where located in indoor car parks, taking into account firefighting media use (i.e. potentially large quantities of water at high pressures for a prolonged period).
- Suitable means of smoke ventilation: natural ventilation conforming to the minimum recommendations of regulatory guidance may not be sufficient to assist firefighters responding to a vehicle(s) fire involving lithium-ion batteries.
- Provision of suitable automatic water fire suppression systems, including where these may not be required to meet the minimum recommendations of regulatory or design guidance for the proposed premises or car parking configuration.
- Provision of water supplies for firefighting sufficient to meet or exceed the minimum requirements of regulatory or design guidance, taking into account the fact that fires involving vehicles with lithium-ion batteries are likely to require large quantities of water over a protracted period when compared to vehicle fires involving conventional and some other alternative fuel vehicles.
- Enhanced structural fire protection to account for structural failures as a result of prolonged lithium-ion battery vehicle fires. Current structural fire protection does not account for the future extensive use of EVs.
- Location of EV charging equipped spaces in closer proximity to firefighting access points compared to standard parking spaces, where reasonably practicable.
- Suitable protection to surfaces and drainage to facilitate post-incident clean-up and environmental protection.

This list is not intended to be exhaustive. However, it covers some of the areas of consideration that we would expect to be addressed by the project design team. We would also recommend liaising with the relevant insurance provider as they may have their own requirements.

This review should also form part of the Qualitative Design Review (QDR) process as defined within BS 7974, depending upon the height/complexity of the development in question.

## Appendix 2 – Enforcement Approach

**Scenario 1: If the building has EVCE, but there is no consideration of the potential risks posed to relevant persons within the FRA, IO/FSA should use Art 9(1) as the FRA is not suitable and sufficient.**

**Failure:** At the time of the audit the fire risk assessment for your premises was not suitable and sufficient. It was found that the potential risks to the premises from the installation of electric vehicle charging equipment has not been adequately considered.

**Remedy:** The fire risk assessment should be reviewed, with specific consideration given to the impact from the installation of electric vehicle charging equipment on relevant persons in case of fire.

**Scenario 2: If the building has installed EVCE, where the cabling has breached compartmentation lines and the RP has not taken appropriate fire-stopping measures to make good the installation, IO/FSA should use Art 8, as the general fire precautions are inadequate.**

**Failure:** At the time of the audit the FIRE RESISTING separation in your premises was inadequate. It was found that there were breaches in compartmentation made by the cabling used for the installation of electric vehicle charging equipment.

**Remedy:** Provide suitable FIRE RESISTING separation by repairing any holes in (list where the holes are e.g. ground floor riser) made during the installation of electrical vehicle charging equipment to provide XX minutes fire separation.

**Scenario 3: If a building has installed EVCE but there are deficiencies in the current fire safety measures or arrangements.**

**Approach** – Enforcement action would have to be directed the deficiencies noted on a case by case basis. The potential articles and text to be used will depend on the circumstances found. IO/FSA may find the following examples useful:

Art 9: If the FRA has not been reviewed to assess the risk to relevant people in case of fire resulting from the installation of EVCE, then the FRA is not suitable and sufficient. IO/FSA should detail exactly why they are of the opinion that the FRA needs reviewing.

Art 8: If the FRA is suitable and sufficient and has recommended appropriate control measures with regard to the installation of EVCE, but the RP has not put them in place, then Art 8 should be used for not implementing the significant findings of the FRA.

Art 11: If the RP has not planned, organised, controlled monitored or reviewed (where necessary) the preventative and protection measures in relation to ECVE e.g. they have not installed suitable safety signage, this should be addressed under Art 11.

Art 13: if an appropriate method of giving early warning of fire has not been provided, this should be dealt with under Art 13(1). For example, where a fire alarm is not typically installed such as a car park, and a fire could break out from the EVCE and prejudice the means of escape from occupied part(s) of the premises.



## Appendix 3 – Glossary of terms

**Alternative fuels:** are fuels/energy sources derived from means other than from fossil fuels to provide power supplies. Common examples include electricity, hydrogen and biofuels.

**Battery Energy Storage Systems (BESS):** A collection of batteries that store energy to be used at a later time.

**Electric Vehicle:** Vehicles powered by one or more electric motors for propulsion.

**Electric Vehicle Charging Equipment (EVCE):** any equipment designed for the purpose of re-charging electric vehicles from a fixed installation.

**Off Gassing / Gassing:** were flammable/toxic vapours vent after a breakdown of a lithium-ion battery electrolyte.

**Lithium-Ion Batteries (LIBs):** A rechargeable battery that uses Lithium-Ion technology. Common uses include powering mobile telephones, laptops and electric vehicles.

**Overcharging:** occurs from excessive charging of a battery causing gassing and may lead to thermal runaway, explosion or fire.

**Re-kindling:** Where an item on fire does not extinguish and then spontaneously ignites.

**Thermal Runaway:** exothermic chemical reaction generating more heat than is being dissipated.

## Appendix 4 – Further Guidance and Reading

Fire safety officers can find further information on fire safety in car parks, electrical vehicle charging and other alternative fuels from the following resources:

- BS 7974: Application of fire safety engineering principles to the design of buildings – Code of practice.
- BS 7346: Part 7: Design of car park ventilation systems for a fire condition.
- BS EN 12845: Automatic sprinkler systems – Design, installation and maintenance.
- Fire Protection Association's LPC rules for automatic sprinkler installation incorporating BS EN 12845.
- [Fire Protection Association risk control document RC59 – Fire safety when charging electric vehicles.](#)
- [Fire Industry Association – Guidance on Li Ion battery fires](#)
- [Merseyside Fire & Rescue Service \(2018\) - Kings Dock Car Park Fire Report.](#)

### Electrical installations:

- [The Electricity at Work Regulations 1989.](#)
- [HSE HSR 25 - The Electricity at Work Regulations 1989](#)
- BS 7671:2018: Requirements for Electrical Installations. IET Wiring Regulation (18th Edition).
- [IET Code of Practice and Guidance notes for electric vehicle charging \(4<sup>th</sup> Edition\).](#)

### Signage Standards:

- [The Health and Safety \(Safety Signs and Signals Regulations\) 1996.](#)
- [HSE L64 - The Health and Safety \(Safety Signs and Signals\) Regulations 1996 \(Third Edition\).](#)
- BS ISO EN 7010: Graphical symbols – Safety colours and safety signs – Registered safety sign
- BS 5499: Part 10: Guidance for the selection and use of safety signs and fire safety notices

# Lithium-ion batteries

## Official

## Lithium-ion batteries

### Introduction

Lithium-ion batteries are rechargeable batteries (as opposed to non-rechargeable lithium batteries) that use lithium-ions as the primary component of their electrolyte.

The term "battery" can be used to describe an assembly of "cells" and "modules". Lithium-Ion batteries (LiB's or Li-ion) may contain cylindrical cells, slightly larger than an AA battery; prismatic cells, about the size of two cigarette packs; or pouch cells, about the area of an A4 sheet of paper and 1cm thick. The cells are packaged together into modules, and a group of modules can form a battery pack. A large battery can consist of thousands of cells grouped into many modules.

### Planning

Ensure that Site-Specific Risk Information (SSRI) includes details of PV systems, including battery storage, such as details of isolation switches and updated as per Policy number 800 - Management of operational risk information.

Crews to be familiar with the location, recognition, hazards, and control measures relating to Battery Energy Storage Systems (BESS).

BESS sites and Li-ion batteries in general - (use of the interactive mapping in the links section will assist in identification of BESS sites).

BESS's are not at present notifiable sites and so may not have detailed operational risk information.

Incidents involving Lithium-ion batteries should be treated as Hazardous Materials incidents and a Hazardous Materials and Environmental Protection Officer (HEMPO) must be requested.

## Hazards (Li-Ion)

### General hazards of Lithium-ion batteries (LiB's)

Batteries vary in size and configuration depending on their use and application. Larger batteries may be found in Energy Storage Systems (ESS) these may contain LiBs and or traditional lead batteries or found in other methods of transportation i.e., trains etc.

Whilst smaller batteries are used in most electronic items such as laptops and mobile phones and can be dealt with relatively easier by submersion or isolation, however the larger LiB's will require an alternative approach as access is often hindered by chassis and other protective means. Batteries are arranged in series to increase voltage, and in parallel to increase capacity.

Larger batteries may contain many hundreds, even thousands of individual cells and the electrolyte is made from flammable organic solvents. Li-ion batteries can develop design or manufacturing faults; if abused through overheating, physical damage or overcharging. Battery cells may become unstable at temperatures as low as 70°C.

## Hazards can include:

### Thermal runaway

When Lithium-ion batteries are compromised, its normal electro-chemical processes are replaced by chemical reactions generating gases and heat. Heat speeds up the reactions, so more and more gases and heat are produced. When the (exponential) heat gains and exceeds the (linear) heat dissipation, the cells involved are in thermal runaway. Thermal runaway within a single battery cell can spread to neighbouring cells as the protective membrane in the cells are compromised resulting in an escalation of toxic vapour production, increasing fire and explosion risk.

### White vapour gases

All Lithium-ion batteries produce white vapour when in thermal runaway. This vapour can easily be mistaken for steam (especially if visible flames have been extinguished) or smoke. In fact, the products are an explosive, corrosive toxic mixture of up to 50% hydrogen, plus carbon monoxide, carbon dioxide, hydrogen cyanide, acid gases, small hydrocarbons such as methane and ethane, and droplets of solvent which can be hazardous to health.

Personnel exposed may be subjected to solvent droplets from within the cloud condensing upon them. Advice should be sought from the HEMPO or Scientific Advisor (SA).

- LiB's may be pressurised under thermal runaway or fire conditions and can present a high risk of injuries from blasts and shrapnel from molten metal which can be ejected explosively over several metres.
- Large LiB fires can burn for protracted periods requiring large amounts of water to cool and extinguish. Even after extinguishment LiB are prone to re-ignition hours, days or even weeks later.
- Due to the construction of the battery cells, it is possible for the battery to retain an electrical charge during or after a fire. Therefore, a risk of electrocution or electrical arc remains throughout the incident. This is sometimes referred to as "stranded electrical energy" with an arc flash explosion producing temperatures of up to 14,000°C.
- A battery in thermal runaway and contained within chassis or other storage solutions can create conditions that lead to an explosion hazard due to the white vapour and flammable gases.

### Examples of circumstances where this could occur are:

- Electric Vehicle (EV) Road Traffic Collisions (RTC's).
- Domestic and Industrial BESS.
- Fires in LiB storage warehouses.
- LiB manufacturing plants.
- Transportation of EV battery packs by road and rail.
- Underground car parks.
- Basements.
- Tunnels.
- Railway arches.

- Garages.
- Charging points (domestic and commercial).
- Any unventilated premise.

### **Additional hazards for crews to consider when dealing with LI-ion, LiB's**

- The need to recognise LiB's are involved or likely to be involved.
- Potential for impact on any life risk i.e., fire below a flat, office, high rise.
- Uncontrolled or unpredictable vehicle movements (RTC's).
- Gases, Vapours, toxic substances, and the potential for explosive reactions.
- High-voltage systems – the residual charge in these systems may remain for up to ten minutes after isolation.
- Difficulty gaining access to safety cut offs or applying firefighting media.
- Other Hazardous materials, including liquid petroleum gas (LPG) and lithium-ion cells.
- Electrolytes leaking from battery cells.
- Damage to surrounding infrastructure and or the environment.

## **Operational considerations**

- Potential for impact on any life risk. Incident Commander (IC) to carry out Dynamic Risk Assessment (DRA) and consider if evacuation is required.
- Crews to check Operational Risk Database (ORD) information, Mobile Data Terminal (MDT) and look for supplementary information QR, warning information notices. Check MDT for crash data and utilise. Ensure correct search term is used, i.e., "Lithium Ion". Additionally, the DVLA website can be used DVLA vehicle checker.
- Firemet, Chemdata will help identify projected vapour cloud movement, components of the vapour are heavier than air.
- Full structural PPE and RPE.
- Consider Thermal Imaging Camera (TIC) to assist situational awareness (360), identification of battery pack and continual monitoring.
- Request HMEPO, SA or onsite SME for specialist advice if available.
- LiB's are prone to thermal runaway. Do not mistake the explosive, toxic white vapour for smoke or steam.
- Establish an appropriate incident command structure and required cordon
- Confirm tactical priorities.
- Consider utilisation of defensive firefighting - taking into account building occupancy, construction, wind direction and water run-off.
- Consider if smaller batteries (phones, laptops, etc.) can be allowed to burn under control. If safe to do so they should be removed to fresh air, contained in a berm of non-flammable material i.e., open metal container, soil, sand and have a risk assessed cordon applied for 24 hours prior to disposal. Alternatively, they could be immersed in an external container of water, such as a bucket, minimum 12 hours, preferably 24 hours, this period of monitoring prior to disposal would be down to the Responsible Person (RP) once

the initial fire has been extinguished and handed over to the RP and recorded on the Key Decision Log (KDL).

- Ultimate disposal is the responsibility of the RP. HMEPO can advise on disposal of the contaminated water, but it is ultimately down to the RP. Confirm duty of care with a handover and record on the KDL.
- When in thermal runaway, one or two cells alight may give the impression of the whole module or battery being alight. Extinguishing these flames will not prevent the whole of the unit being in thermal runaway. Re-ignition can easily occur.
- Extinguishment of LiB's requires large quantities of water, crews to consider FF media, specialised equipment and the use of the MDT on CRS (CRASH data) for information required for location and access to battery packs as they may be encased in a protective casing or form part of the chassis.
- Consider water run-off to prevent environmental damage – early use of National Environmental Risk Assessment, HMEPO advice and Environment Agency liaison.
- Consider controlled burn as this will render the battery safe.
- All batteries present the risk of explosion. The size of explosion is proportional to the size of the battery and the environment it's contained within and or near.
- Danger of re-ignition batteries hours, days or even weeks later.
- Movement of a damaged battery that is not fully discharged may result in re-ignition and or damage to other items.
- Stranded electrical energy presents risk of electrocution or arc flash explosion.
- Fire suppression systems may be in place may not extinguish a LiB in thermal runaway.
- Early request for additional resources, including consideration of a Bulk Media Advisor (BMA), Hose Layers, neighbouring brigades water carriers or alternative water supplies and Light Weight Pumps (LWPs) where supplies may be poor.
- Outer cordons and 'warn and inform' media messages to the public.
- Early sharing of information with external agencies (use of METHANE).
- IC to assess if temperature monitoring of the affected units, post-extinguishment is safe to undertake

## **Considerations for incidents involving commercial LiB-BESS sites**

- OIC to risk assess and establish a cordon and implement safety officers full structural PPE, RPE, consider electrical gloves if not involved in fire, consideration of the potential for evacuation of populated areas.
- Establish contact with on-site specialist and ascertain if containers can be flooded through fixed installation access points.
- Be aware of nearby high voltage transformers and cables (overhead, buried).
- Identify the containers in which lithium-ion cells are in thermal runaway.
- There may be flames or white vapour present.
- Thermal image cameras may show increased temperatures on one or more walls of the container if no apparent fire.
- Contact the site operator (if representative not on site) and ask if there is telemetry data available, as this can be useful if the units are secured. Inform the IC as to the situation inside the unit.
- Do not open any container doors or enter unless it is certain that any gases have ignited.

- Even if on fire, assume batteries are fully energized and present an electrocution/arc flash hazard.
- In the absence of signs of fire or obvious vapour cloud, assume there is a vapour cloud inside the container, presenting an explosion hazard. Utilise remote venting if the site has this capability. If venting, remove all personnel from the inner cordon. Consider defensive firefighting utilising fog sprays to dilute gases emitted.
- If venting is not possible, crews could flood the units via dedicated access points commonly known as dead pipes. IC to consider defensive firefighting if there are no suitable access points. Be aware of the potential massive production of hydrogen and oxygen and hence explosion hazard due to direct contact of water with high voltages.
- Post incident, the site should be secured and protected from the elements to allow post-incident investigation.
- Decommissioning of the stranded electrical energy should be carried out by experts and will take weeks or even months.

## Considerations post event

- Handovers to a RP should be done on a KDL which allows the capturing of risks, hazards, and recommended actions (monitoring periods) this is important due to the potential for reignition, and the hazards associated with LiB's.

## Reference information and further reading

- The Hub.
- All incidents foundation document.
- Hazardous materials.
- Policy number 808 - Hazardous materials and environmental protection - mass decontamination.
- Policy number 793 - Compartment Firefighting.
- Policy number 796 - HAZMATS; fires and incidents involving hazardous substances.
- Policy number 956 - Respiratory protective equipment – respirator – technical information.
- Policy number 839 - Incidents involving solar panels.
- Policy number 769 - Incidents involving electricity.
- Policy number 979b - Road traffic collisions - rescue - SOP.
- Roadways: Alternative fuel vehicles.
- Associated SOPS.
- Any incident involving solar panels should be managed in accordance with Policy number 839 – Incidents involving solar panels.
- For further information regarding wind turbines, see Policy number 769 – Incidents involving electricity.

## Relevant National Operational Guidance

- Utilities and Fuel.
- Hazard – Rechargeable batteries.

- Control measure – Identify presence and type of rechargeable batteries.
- Control measure – Isolate rechargeable batteries.
- Control measure – Safe system of work: Rechargeable batteries.
- Scenario – Fire in Electrical Installation.

### Other links:

- Renewables map: <https://www.mygridgb.co.uk/map/>



This Standard Operating Procedure should be read with:  
PN977 - All incident considerations - NOG: Dated 6 March 2023



## Alternative energy

- 16.38 Due to the effects of fossil fuels on the climate and the need to reduce carbon emissions whilst complying with legislative targets, alternative energy sources are being developed at an increasing pace and utilised in every aspect of power generation. These alternative energies are utilised in everything from small mobile devices, to powering vehicles or large gigawatt storage plants, which can present additional hazards to the public and operational staff dealing when dealing with them.
- 16.39 The five primary alternatives to fossil fuels are renewable energy, nuclear power, hydrogen, biomass, and geothermal energy. Renewable energy is defined as power derived from natural sources that can replenish themselves, such as wind, solar, tidal or hydroelectric.
- 16.40 Alternative energy sources can also include gaseous fuels such as hydrogen, natural gas, and propane; alcohols such as ethanol, methanol, and butanol; vegetable and waste-derived oils. All sources can be encountered in a variety of settings i.e., generation, infrastructure, transport and storage.
- 16.41 Additionally, radiation sources are being utilised to generate power, although these are usually encountered at the generation point and strictly controlled, see LFB Hub Utilities and fuel | NFCC CPO (ukfrs.com).
- 16.42 This 'context guidance' has been developed to assist fire and rescue services in identifying hazards and implementing control measures at operational incidents where alternative energy needs to be managed or controlled.
- 16.43 Because of similarities in the production, storage and distribution of utilities, this section of guidance also covers generic hazards for alternative energy. However, in accordance with the structure of the National Operational Guidance framework, any hazards relating to specific fuel types will be dealt with in the guidance for hazardous materials, alternative fuels, utilities and fuel sections see LFB Hub - Utilities and Fuel.
- 16.44 This guidance does not deal with fire and rescue service operations such as incident command, fires and firefighting, performing rescues or environmental protection, other National Operational Guidance deals with those activities.
- 16.45 This guidance is supported by supplementary information that provides further detail on individual subject areas see LFB hub - Utilities and Fuel Supplementary Information.

## Hydrogen

- 16.46 Hydrogen is the lightest gas that occurs in nature and is colourless and odourless. Hydrogen atoms pair up to produce diatomic molecules. Hydrogen has the chemical formula  $H_2$  is highly flammable and a very low ignition energy. It can be ignited by a static discharge, rubbing, friction, heating or even a mechanical shock. Spontaneous ignition upon sudden release or depressurisation is possible.

### Hydrogen at refuelling stations

- 16.47 At refuelling stations, hydrogen is stored at pressures in excess of those found in the fuel tanks of vehicles, so will therefore be above 1000 bar. The cylinder pressures in vehicles can range from around 350 to 700 bar.
- 16.48 After being manufactured at a remote steam reformation site, hydrogen is often transported to refuelling sites by road tankers as a cryogenic liquid.

### Hydrogen fuel cells

- 16.49 Hydrogen fuel cells are found in:
- Fixed installations.

- Industrial sites.
  - Refuelling stations.
  - Vehicles.
- 16.50 Hydrogen fuel cells can also be found at installations such as wind farms, where they can be operated in reverse to manufacture hydrogen.
- 16.51 Hydrogen fuel cells chemically combine hydrogen gas supplied under pressure with oxygen, usually supplied from air at atmospheric pressure, to generate electricity. The fuel cell is linked via specialist pipework to a high-pressure hydrogen cylinder, which should be fitted with a temperature pressure relief device (TPRD).
- 16.52 Hydrogen fuel cells are normally stacked; hundreds of individual cells, each producing a small voltage, are combined to supply large DC voltages. These can range from around 300V to 600V. These voltages are the main hazard associated with the hydrogen fuel cell itself, although these voltages drop to zero immediately the hydrogen supply is stopped. However, high voltages may still be present in linked components, such as cabling or batteries.
- 16.53 Fuel cells only ever contain very small amounts of residual hydrogen, which should be treated with caution, although this is not excessively dangerous. For further information regarding fuel cells in transport, refer to LFB Hub - Transport – Roadways: Alternative fuel vehicles.

## Hazards

- 16.54 These hazards are unique to hydrogen:
- Hydrogen burns with an almost invisible flame. When released under pressure a jet like flame several metres in length can be produced that is almost impossible to see with the naked eye.
  - Very cold saturated hydrogen can pool or flow horizontally at ground level; this can be difficult to see unaided but may be detected by using thermal imaging.
  - Burning hydrogen radiates far less heat than carbonaceous or hydrocarbon fuels, which can make the flames very difficult to detect. Personnel may only be able to feel these flames if in direct contact, which can cause serious harm.
  - Leaking hydrogen can ignite or reignite with ease, especially if under pressure and even in the absence of an ignition source.
  - Because hydrogen is the smallest molecule it can over time slowly penetrate, or travel through, container walls, resulting in 'embrittlement'. This type of damage may take many years, but can eventually affect the structural integrity of cylinders, pipework, connectors, and valves.
- 16.55 The following hazards relate to hydrogen and are common to many other gases under pressure:
- A leak from a high-pressure hydrogen cylinder can be loud enough to cause damage to hearing.
  - Hydrogen and oxygen gas are often stored at high pressures.
  - Oxygen rich atmospheres may be found where hydrogen is being manufactured using electrolysis.
  - Hydrogen is often stored or transported as a cryogenic liquid.
  - High-voltage equipment is used with hydrogen fuel cells and in electrolysis.
  - Some electrolysis equipment may contain a high temperature alkaline potassium hydroxide solution.
  - Hydrogen fuel cells are silent, and personnel may not be aware of their presence.

- It may be necessary to use thermal imaging to detect or monitor fire spread if it involves gases, such as hydrogen, that burn with an invisible flame; for further information refer to LFB Hub - Thermal imaging or scanning.

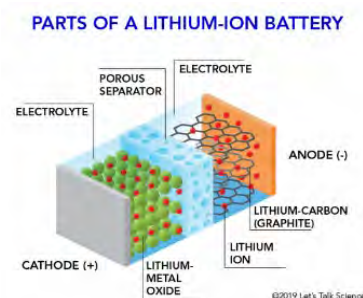
16.56 For more information refer to LFB Hub:

- Hazardous materials
- Gases under pressure
- Oxygen-enriched atmosphere
- Cryogenic materials
- Inaccurate situational awareness: Hazardous materials
- Roadways: Alternative fuel vehicles
- Policy number 979b – Road Traffic Collisions – Rescue – SOP

## Lithium-ion Batteries

### Introduction

- 16.57 Lithium-ion batteries are rechargeable batteries (as opposed to non-rechargeable lithium batteries) that use lithium-ions as the primary component of their electrolyte.
- 16.58 The term "battery" can be used to describe an assembly of "cells" and "modules". Lithium-Ion batteries (LiB's or Li-ion) may contain cylindrical cells, slightly larger than an AA battery; prismatic cells, about the size of two cigarette packs; or pouch cells, about the area of an A4 sheet of paper and 1cm thick. The cells are packaged together into modules, and a group of modules can form a battery pack. A large battery can consist of thousands of cells grouped into many modules.
- 16.59 For safety reasons, lithium-ion batteries include a protective membrane or separator. This prevents the electrodes of the battery's cells from touching each other. But if this separator gets ripped or damaged, the electrodes can touch. Once there are flames in one cell, they can quickly spread to others.



### Background

- 16.60 No other battery type compares to the energy density of LiB's, resulting in a growing range of uses. These range from small mobile electronic devices, through to powering electric vehicles of all sizes including trains and Battery Energy Storage Systems (BESS).
- 16.61 LiB's introduce new unique hazards, requiring different responses and tactics for operational crews.
- 16.62 With advancements in solar-powered domestic and commercial photovoltaic systems, BESS is becoming an economically viable option for households and businesses if the surplus electricity isn't transferred to the National Grid.
- 16.63 There are generally two types of batteries utilised storage, lithium-ion and lead-acid batteries. Normally located near the system's inverter, often found in utility rooms, garages or similar locations.

**Note: DC current is not identified by the voltage detector as this only detects AC current.**

16.64 There are two main ways of linking a battery storage system into a PV system:

- **Direct Current (DC) coupled** - Batteries are installed the same side of the inverter as the PV panels, they charge from the panels, and their DC is only converted to AC when used.
- **Alternating Current (AC) coupled** - Batteries are installed grid side, where the DC from the PV panels has already been converted to AC. A separate inverter converts the AC back to DC for storing in the battery. When the battery discharges, the same separate inverter converts the DC back to AC.

16.65 BESS systems are becoming more popular, and the presence of PV panels does not always indicate if BESS are present. BESS is used to store power from the grid at cheaper rates.

16.66 If the premises owner or occupier is unsure regarding the location of the panel controls and inverter, consideration should be given to requesting a 'competent person' i.e., the system installer.

16.67 Locations of identified sites can be found at renewables map: [www.mygridgb.co.uk/map/](http://www.mygridgb.co.uk/map/).

16.68 These images are of typical installations found in premises:



Figure 1 Small scale domestic BESS

Figure 2 DIY domestic BESS

Figure 3 Industrial scale BESS

16.69 For further information about, battery storage, refer to BRE and RECC (2016) Batteries and Solar Power: Guidance for domestic and small commercial consumers.

16.70 For further information about the components of photovoltaic systems, refer to BRE's Fire safety and solar electric/photovoltaic systems.

## Thermal runaway

16.71 Lithium-ion (Li-ion) battery thermal runaway occurs when a cell(s), or area within the cell, reaches elevated temperatures due to:

- Thermal failure.
- Mechanical failure.
- Internal/external short circuiting.
- Electrochemical abuse.

16.72

- 16.73 When Lithium-ion batteries are compromised, its normal electro-chemical processes are replaced by chemical reactions generating gases and heat. Heat speeds up the reactions, so more and more gases and heat are produced. When the (exponential) heat gains and exceeds the (linear) heat dissipation, the cells involved are in thermal runaway. Thermal runaway within a single battery cell can spread to neighbouring cells as the protective membrane or separator in the cells are compromised resulting in an escalation of toxic vapour production, increasing fire and explosion risk.
- 16.74 Impact or movement can lead to thermal runaway or deterioration in the condition of already damaged battery(s); crews should consider this when releasing a trapped casualty, stabilising a vehicle or a when a vehicle is required to be recovered.
- Note: Crews may need to have a presence and agree a tactical fire plan whilst the vehicle is recovered.** Additionally, crews may need to put in place watching brief(s), re inspections, and consider the need to accompany the affected vehicle to its final destination (if within London area). An in-depth handover to the Responsible Person (RP) will be required.
- 16.75 The presence of reactive metals, such as lithium can cause the release of explosive gases and alkaline solution, caused by chemical reduction of water, for example lithium hydroxide (LiOH) and hydrogen (H<sub>2</sub>). This can appear like steam and crews need to be mindful that this will need monitoring and advice from a HEMPO.
- 16.76 Sensitivity to charging and discharging regimes, mechanical shock, and localised temperature gradients which can lead to thermal runaway, rapid unexpected release.
- 16.77 Due to the popularity of LiB's and the need to charge and store the various uses of these systems more and more locations are being utilised often without specific notification or planning. Crews will need to recognise the surrounding risks and the control measures required to protect themselves, and the public from fire and explosion risks associated with LiB's see hazard section below.
- 16.78 Crews may have to evacuate buildings in close proximity and for potential extended periods, due to the thermal runaway, gases and explosion risks.
- 16.79 A Lithium-ion battery hazard video is available on Hotwire via [Working here > Health and Safety > Lithium-ion battery hazards](#).

## LiBESS (Lithium-ion Battery Energy Storage Systems)

- 16.80 Lithium-ion battery energy storage systems come in the form of one or more containers, resembling ISO shipping containers. There may not be a label identifying the contents as lithium-ion batteries. Even one container, when the lithium-ion cells inside are fully charged, contains a very large amount of energy in a relatively small space. They are often used to store grid electricity or even support the National Grid. (Note UKPN do not use LiBESS within the London area at this time see section Batteries Non Li-io). Pouch cells and prismatic cells are commonly used in LiBESS.
- 16.81 The McMicken LiBESS in Surprise, Arizona contained 10,584 such cells, only 392 of which went into thermal runaway. Despite that, the resulting explosion when a container door was opened severely injured two firefighters. Further reading can be found in the McMicken incident final report available online.



Figure 5 LiBESS installation on Merseyside that exploded in September 2020

- 16.82 The venting vapour cloud produced by cells in thermal runaway may or may not ignite; if it does it will produce jet-like flames coupled with toxic gases and fumes.
- 16.83 Previously fires without oxygen, would extinguish themselves. But when a Li-ion battery is on fire, one of the by-products is oxygen, so even in an enclosed environment, a battery(s) will keep burning resulting in thermal runaway often with explosive effects. In the event of ignition not occurring (e.g., the activation of fire suppressant systems, insufficient air in the container or cells having a low State of Charge [SOC]) the cascading thermal runaway will produce gases over a substantial period of time – way beyond the scope of most suppressant systems. Cells have the potential to ignite hours, days or even weeks after the initial event.
- 16.84 If the vapour cloud is present in a LiBESS container and the door is opened, the mixture could turn from rich to ideal, swirl and ignite resulting in a vapour cloud explosion.
- 16.85 The challenges posed by LiBESS are replicated in lithium-ion cell or battery manufacturing and storages facilities, large transport vehicles, goods trains, etc.
- 16.86 Further information can be found in the Policy number – 979a - Lithium-ion batteries - all incident considerations – SOP.

## Hazard knowledge - Hazards (Li-Ion)

### 16.87 General Hazards of Lithium-ion Batteries:

- Batteries vary in size and configuration depending on their use and application. Larger batteries may be found in Energy Storage Systems (ESS) or vehicles including trains etc. Whilst smaller batteries are used in most electronic items such as laptops and mobile phones and can be dealt with relatively easier by submersion or isolation, however the larger LiB's will require an alternative approach as access is often hindered by chassis and other protective means.
- Batteries are arranged in series to increase voltage, and in parallel to increase capacity. Larger batteries may contain many hundreds, even thousands of individual cells.

### 16.88 Hazards can include:

- All Lithium-ion batteries produce white vapour when in thermal runaway. This vapour can easily be mistaken for steam (especially if visible flames have been extinguished) or smoke. In fact, it's an

explosive, corrosive toxic mixture of up to 50% hydrogen, plus carbon monoxide, carbon dioxide, hydrogen cyanide, acid gases, small hydrocarbons such as methane and ethane, and droplets of solvent.

- Personnel exposed may be subjected to solvent droplets from within the cloud condensing upon them. These droplets contain a mixture of chemicals. Advice should be sought from the HEMPO.
- Li-ion batteries can develop design or manufacturing faults; if abused through overheating, physical damage or overcharging. Battery cells may become unstable at temperatures as low as 70°C. The electrolyte is made from flammable organic solvents.
- LiB's may be pressurised under thermal runaway or fire conditions and present a high risk of injuries from blasts and shrapnel. Molten metal can be ejected explosively several metres.
- Large LiB fires will burn for protracted periods requiring large amounts of water to extinguish and cool. They are then prone to re-ignition hours, days or even weeks later, and may do so several times.
- Due to the construction of the battery in cells, it is possible for the battery to retain an electrical charge during or after a fire. Therefore, a risk of electrocution or electrical arc remains throughout the incident. This is sometimes referred to as "stranded electrical energy". Arc flash explosion can produce temperatures of up to 14,000°C.
- In a confined space a battery in thermal runaway will create an explosion hazard due to the white vapour and flammable gases. Examples of circumstances where this could occur are:
  - Electric Vehicle (EV) Road Traffic Collisions (RTC's).
  - Domestic and Industrial BESS.
  - Fires in LiB storage warehouses.
  - LiB manufacturing plants.
  - Transportation of EV battery packs by road and rail.
  - Underground car parks.
  - Basements.
  - Tunnels.
  - Railway arches.
  - Garages.
  - Charging points (domestic and commercial).
  - Any unventilated premise.

#### 16.89 Additional hazards for crews to consider when dealing with LI-ion, LiB's:

- The need to recognise LiB's are involved or likely to be involved.
- Potential for impact on any life risk i.e. fire below a flat, office, high rise.
- Uncontrolled or unpredictable vehicle movements (RTC's).
- Gases, Vapours and toxic substances.
- High-voltage systems – the residual charge in these systems may remain for up to ten minutes after isolation.

- Difficulty gaining access to safety cut offs or applying firefighting media (vehicle may need jacking).
- Fuel cell explosion.
- Other Hazardous materials, including liquid petroleum gas (LPG) and lithium-ion cells.
- Electrolytes leaking from fuel cells.
- Pressurised systems.
- Damage to surrounding infrastructure and or the environment.
- Possibility of re-ignition (hours, days after the event).

## Hazard knowledge - Hazards (Alternative Fuel Vehicles)

- 16.90 The term 'alternative fuel vehicles' (AFV) refers to vehicles powered by fuels other than petrol or diesel. The hazards and control measures for incidents involving AFVs should be considered in conjunction with those that apply to other road vehicles. AFVs may be difficult to identify from the exterior.
- 16.91 The following features could also indicate the vehicle has a high voltage system:
- Registration plate with a green band (from December 2020 onwards).
  - Orange cables – all high voltage cables and connectors on EVs are orange in colour.
  - Large HV components, such as the battery pack, motor or inverter.
  - Warning stickers on components, usually yellow with the ISO electrocution symbol.
  - Electrical charging socket, this could be under the vehicle symbol on the front grille, or under a "fuel cap" cover on the side or rear of the vehicle.
  - Vehicle has a charging cable stored in it.
  - Lack of an exhaust pipe, although hybrids will still have an exhaust pipe.
  - Electric vehicles don't use a manual gearbox, so the gear lever is likely to look more like the selector of an automatic model.
- 16.92 If it is safe to enter the vehicle or you can see through the windows from outside, the vehicle dashboard and instruments may show information relating to the high voltage system:
- "Ready" light or EV indicator.
  - EV power mode switches.
  - Rev counter replaced with a power flow indicator.
  - Battery State of Charge (SOC) information.
  - HV diagnostic lights.
- 16.93 Vehicles without any of these features may still have a high voltage system.
- 16.94 When a vehicle is powered by two or more fuel sources, it is referred to as a hybrid. The term most commonly refers to hybrid electric vehicles, which combine internal combustion engines, electric motors, rechargeable batteries, and high voltage systems.
- 16.95 AFVs can be powered by:
- High voltage fuel cells (batteries).



- Compressed natural gas (CNG).
- Liquid natural gas (LNG).
- Biofuels.
- Hydrogen fuel cells.
- High voltage systems.
- Rechargeable batteries.

16.96 Where a vehicle is powered by two or more fuel sources, it is referred to as a hybrid. The term most commonly refers to hybrid electric vehicles, which combine an internal combustion engine and one or more electric motors. However, this term includes other mechanisms to capture and use energy.

16.97 AFVs may not show signs that the engine is running, such as engine noise or exhaust gases, emitting, particularly when stationary. Although these hazards are not unique to AFVs they are more likely to be present than in older vehicles or those powered by petrol or diesel.

16.98 AFVs affected by collision, fire or submersion may present hazards including:

- Uncontrolled or unpredictable vehicle movements.
- Gases.
- High-voltage systems – the residual charge in these systems may remain for up to ten minutes after isolation.
- Fuel cell explosion.
- Hazardous materials, including liquid petroleum gas (LPG) and lithium-ion cells.
- Electrolytes leaking from fuel cells.
- Pressurised systems.

These hazards may also result from operational activity.

## Rechargeable batteries in alternatively fuelled vehicles

16.99 New style rechargeable batteries are often found in alternatively fuelled vehicles, for more information refer to LFB Hub - Rechargeable batteries. Vehicle markings vary and can be misleading if they have been modified. Designs and locations of batteries vary widely, so it is not possible to provide a guide here to all types.

16.100 Many vehicles contain interchangeable trays of batteries, and the type of battery itself can be changed so that some contain, for example, a mixture of nickel cadmium and lithium ion. Batteries can be present in their thousands in trays located under a vehicle's floor and, in total, can be as heavy as 500kg or more.

16.101 It may not be difficult to identify which individual battery, or group of batteries, has overheated or is leaking electrolyte. Access to battery trays in a vehicle that is damaged may be limited. Personnel should seek specialist advice or consider the manufacturer's handbook or guidelines for information about appropriate firefighting media, access and isolation.

## Batteries (non Lithium-ion)

16.102 In addition to Lithium-ion batteries there are a number of other battery solutions widely used and continually under development. For example, UK Power Networks (UKPN) use at their grid and primary sites a combination of valve regulated sealed lead acid (VRLA) or wet cell (Plante) batteries.

The batteries are anywhere between 24 – 110V and are required for a small amount of capacity in a Blackstart or similar event to bring the network equipment back online.

- 16.103 The batteries are usually situated in a small, well-ventilated room on dedicated racking or designed cabinets, with SCADA linked temperature alarms fitted to the charger units.
- 16.104 UKPN have fire risk assessments noting the hazards that relate to these battery systems and other areas of special fire hazard, and where required specific measures put in place to control these risks. For example, fire detection and alarms may be extended/upgraded to cover these areas or air conditioning units installed to deal with peak summer temperatures that are cause temperature alarms.
- 16.105 Compared to other battery storage applications, such as industrial and commercial battery storage facilities or fast charging lithium battery charging stations. The VRLA and Plante systems are considered to be lower of significant and uncontrolled battery fire than other battery storage solutions.
- 16.106 The hazards listed below are specific to incidents involving batteries (non lithium-ion) or are generic hazards for working in or around batteries involved in incidents. The list is not exhaustive, and ICs should always be aware of additional hazards when formulating their objectives and plan.
- 16.107 A battery is a chemical device that stores electrical energy in the form of chemicals and by means of electrochemical reaction, it converts the stored chemical energy into direct current (DC) electric energy.
- 16.108 Simply speaking there are two main types of battery:
- Primary (non-rechargeable)
  - Secondary (rechargeable)
    - Lead acid/nickel iron batteries
    - Nickel Cadmium batteries (Ni-Cd)
    - Nickel–Metal Hydride batteries (Ni-MH)
    - Lithium–ion batteries
    - Sodium Sulphur batteries

### **Characteristics and hazards of Batteries**

- 16.109 All types of battery present significant hazards, including risk of explosion and the potential for production of corrosive and/or toxic gases if damaged through impact or fire.

### **Lead acid/nickel iron batteries**

- 16.110 These are the most popular and most used type of rechargeable battery. They are available in several different configurations like small, sealed cells with capacity of 1Ah (typical AAA) to large cells with capacity of 12,000Ah. They are likely to be found in vehicles with internal combustion engines, hybrids and fully electric vehicles (EV).
- 16.111 Other applications include energy storage, emergency power, communication systems and emergency lighting systems.
- 16.112 If involved in fire the products of combustion will contain droplets of sulphuric acid which is corrosive and poisonous. Salt water should not be used on fires involving lead-acid batteries, since under certain conditions chlorine gas may be generated. Hydrogen is released during the charging of these batteries, which can lead to a risk of explosion.

### **Sodium Sulphur batteries**

- 16.113 If battery is damaged sufficiently (for example in a significant road traffic collision (RTC) or involved in fire, toxic sulphur dioxide and hydrogen sulphide will be given off.
- 16.114 Crews should be alert to this risk and should consider deploying a gas monitor, particularly if any person reports the characteristic 'rotten egg' aroma of hydrogen sulphide, noting that this gas is heavier than air.
- 16.115 A fire originating inside this type of battery can take up to 30 minutes to become apparent, will be very difficult to extinguish, and can burn for up to 2 hours.

### **Ni-MH (Nickel-Metal Hydride) batteries**

- 16.116 Following significant physical stress, the electrolyte (made from potassium hydroxide) may leak.

## **Hazard knowledge - Hazards associated with batteries**

16.117 The release of:

- Hydrogen gas.
- Carbon Monoxide.
- Sulphur Dioxide.
- Sulphur Trioxide.
- Hydrogen Sulphide.
- Lead fumes and vapour.
- Corrosive acidic electrolytes, such as sulphuric acid.
- Poisonous alkaline electrolytes, such as potassium hydroxide.
- Release of stored energy.
- Toxic or irritating water based liquid electrolytes, such as copper sulphate.
- Corrosive acidic electrolytes, such as sulphuric acid.
- Poisonous alkaline electrolytes, such as potassium hydroxide.
- Very high discharge or surge currents, for example in a road vehicle battery.
- Non-precious metals like lead or copper; elevated temperatures and fires can cause these metals, when in the presence of electrolytes, to react or release vapours.
- Release of hydrogen gas or oxygen gas during charging, which can ignite or explode.

16.118 Further information can be found in:

- Policy number 808 - Hazardous materials and environmental protection - mass decontamination
- Policy number 793 - Compartment firefighting.
- Policy number 956 - Respiratory protective equipment – respirator – technical information.
- Policy number 839 – Incidents involving solar panels.
- Policy number 769 – Incidents involving electricity.
- Policy number 979b – Road traffic collisions – rescue – SOP.

- LFB Hub - Roadways: Alternative fuel vehicles.