



Incident Investigation Team Community Prevention Dept

E-Cigarettes.

Merseyside Fire and Rescue Service Current Position June 2014.

Compiled by Ian Mullen
Community Prevention Department,
Merseyside Fire and Rescue Service.
0151 296 4635.
ianmullen@merseyfire.gov.uk

Merseyside Fire & Rescue Service
Service Headquarters Bridle Road Liverpool L30 4YD
Telephone: 0151 296 4000. Fax: 0151 296 4333.

Executive Summary

Merseyside Fire and Rescue Service have seen a rise in fires in domestic properties since 2012 with the direct cause being due to a failure of the battery pack whilst on charge. A fatal fire incident has been reported in another County due to a fire from an exploding battery pack.

1. E-cigarettes

A recent and sudden increase of e-cigarette users in the UK has been noted.

Common names for e-cigarettes include:

- An electronic cigarette (e-cig or e-cigarette)
- Personal vaporizer (PV)
- Electronic nicotine delivery system (ENDS)

They are a battery-powered vaporiser which simulates tobacco smoking by producing an aerosol, commonly called vapour that resembles smoke.

It uses a heating element known as an atomiser (clearomiser). This vaporises a liquid solution known as e-liquid. E-liquids usually contain a mixture of propylene glycol, vegetable glycerine, nicotine, and flavourings, while others release a flavoured vapour without nicotine.



2. Types

There are different types with two main power packs, ones with single use batteries and ones with lithium-ion batteries which are rechargeable.



Single use batteries will work for a given period of time and once the charge is exhausted then the unit is disposed of. They are non rechargeable units.



Rechargeable Lithium-ion batteries can be recharged using a universal serial bus (USB) connector that is usually supplied with the kit when purchased.



3. Lithium-Ion Battery Failure

Batteries made from lithium-ion can be recharged but can fail whilst on charge with explosive force. Several factors can lead to battery failure including:

- Use of incorrect charger.
- Battery which has been damaged by dropping or impact.
- USB lead plugged into non approved mains power transformer.
- Poor manufacturing of battery.
- Some E-Cigarette batteries do not have over charge / over heat protection.

4. Battery failures resulting in fires

Merseyside Fire and Rescue Service (MF&RS) have responded or are aware of 10 incidents since Oct 2012 where failure of the battery pack has resulted in a fire. It is believed many more have occurred that have not been reported to MF&RS. Each incident which is classed as a house fire requires two fire appliances and an investigation officer to attend.

Incidents:

| Date | Time | Locality | Cause | Incident No & Type |
|------------|---------|-----------|-----------------|------------------------------|
| 10/06/2014 | 20.30 | LIVERPOOL | E-Cig on charge | 08230 – House Fire |
| 24/03/2014 | 17.18 | LIVERPOOL | E-Cig on charge | 43823 – House Fire |
| 20/12/2013 | 01.04 | WIRRAL | E-Cig on charge | 35270 – House Fire |
| 25/08/2013 | Evening | LIVERPOOL | E-Cig on charge | NHS Hospital – late firecall |
| 17/07/2013 | 16.02 | LIVERPOOL | E-Cig on charge | 15807 – House Fire |
| 28/06/2013 | 16.56 | ST HELENS | E-Cig on charge | 12982 – House Fire |
| 21/05/2013 | 22.55 | KNOWSLEY | E-Cig on charge | 08246 – House Fire |
| 26/04/2013 | 15.24 | KNOWSLEY | E-Cig on charge | 04857 – House Fire |
| 13/11/2012 | 17.47 | ST HELENS | E-Cig on charge | 26435 – House Fire |
| 13/10/2012 | 02.47 | SEFTON | E-Cig on charge | 21954 – House Fire |

5. National Incidents

MF&RS first reported e-cigarette failures and subsequent fires to all Fire and Rescue Services in the UK via a national reporting system (FINDS) in 2012. Since then numerous Fire Services have reported increased occurrences of fires where the suspected cause is due to e-cigarettes.



April 2014 – Buck Inn Hotel, Richmond, N Yorkshire. An 18 year old barmaid is working behind the bar and whilst serving customers an e-cigarette battery explodes whilst on charge. The incident was captured on CCTV.

Video footage is available on Youtube:
<https://www.youtube.com/watch?v=z-aWGW-6o2I>



Fatal Fire – Oct 2013 – Derbyshire Fire and Rescue Service were called to a fire in a care home just after midnight on Sunday 13th October. The suspected cause was an e-

cigarette battery left on charge in a single bedroom whilst the occupier slept. This ruptured and started a localized fire which then involved an aerosol canister which also ruptured with explosive force. Although the 68 year old lady was rescued she sadly died.

6. Merseyside – Case Study 1

Fire Service was called to an incident in the Wirral at 01.04 on 20 December 2013. This was as a result of a lithium-ion battery being left on charge. On investigation this was the second battery failure that had occurred in the premises within 3 weeks.

Battery pack connected to USB charger point next to USB plug with scorching on rug.



Image shows the battery pack and burns to the carpet. The end cap had failed under force and molten metal was ejected causing local heating to the fitted carpet.



The top battery has not failed whereas the middle battery failed whilst on charge and the pressure ruptured the end cap. The bottom battery was a replacement for the smaller battery and this also failed whilst on charge causing burning to the rug purchased to cover the original fire damage.

7. Merseyside – Case Study 2

A fire call was received on 13 November 2012 to a detached property in St Helens due to reports of smoke inside the property. Two fire appliances responded and requested specialist fire investigation officer to assist with determining the cause. On investigation it was found that an e-cigarette was placed on charge in the bedroom and left to charge up.



The e-cigarette was ordered as a kit on the internet and had delivered to the property in the morning. It was placed on charge in the bedroom and the occupier left the property. On returning the occupier opened the front door and immediately noticed smoke in the property.

The investigation found the remains of an e-cigarette still on charge had ruptured and ejected molten metals across the bedroom landing on the double bed.



The double bed ignited and the fire spread across the bed.

Due to the occupier being out at the time no injuries were sustained however the whole property was damaged by fire, heat or smoke.

8. Suppliers Advice

Suppliers of e-cigarette equipment give varying levels of advice with regard to the charging of batteries.

One company do give advice as follows:

- ü Do use correct charger.
 - ü Do remove from charge when complete.
 - ü Do dispose of batteries correctly.
 - ü Do use fire retardant bags.
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- ✗ Never leave a battery on charge unattended.
 - ✗ Do not drop, strike or subject battery to impact.
 - ✗ Do not use if battery has signs of damage.
 - ✗ Do not over charge battery.
 - ✗ Do not use if wet or exposed to water.
 - ✗ Do not over tighten atomiser or when connecting to charger.

9. Protective Bags

Specialist fire retardant bags are available for a cost of approximately £5.00 which can be used when batteries are being charged.

The bags are deigned to contain the battery and charger whilst on charge.



10. Retailer Responsibility

The active promotion of the dangers of lithium-ion batteries is not fully embraced by retailers on their websites. Several sites viewed by the author also fail to promote safe use of lithium-ion batteries.

11. MF&RS position

It is strongly believed that greater awareness and advice plus guidance can be offered by suppliers regarding the safe practice of charging lithium-ion batteries.

In Merseyside 80 accidental fire deaths have occurred over the past 10 years (April 2004 to April 2014). Of the 80 deaths, 44 have been reported to be as a result of careless use of smokers materials.

Due to the relative newness of the products it is not yet known how effective e-cigarettes will be at changing the fire statistics as a result of smoking.

Across Merseyside 10 separate fires have been reported to the Fire Service as a direct result of e-cigarette batteries exploding whilst on charge.

The safety of the devices varies due to the wide range of suppliers, and availability of cheap batteries via the internet. Lithium-Ion batteries for most E-cigarettes do not have circuit overload/overheat protection which is found in more expensive batteries used to power laptops.

As with all electrical items, care should be used when charging the devices and only fully certified items should be used as per manufacturer's instructions and always under supervision. The correct supplied charger should only be used.

Similar risks exist from e-cigarettes for oxygen users when compared to normal cigarettes due to heating of the vapour in an atomiser.

12. Emerging trends and considerations

E-cigarettes are being diversified for other uses such as used to simulate illegal substances such as marijuana and e-spliff and e-joints are being sold on the internet.



Alternative uses of e-cigarettes are now emerging online.

13. Flavoured atomizer liquids which are child friendly.

It has been noted that an increasing number of atomizer flavours used in e-cigarettes are available via the internet. Some retail at very cheap prices as low as £1.50 per liquid bottle and come in a wide range of flavours. Some flavours would possibly be favoured by a younger generation if selecting a flavour such as bubblegum, watermelon or chocolate flavor.



Flavours over the internet are increasing and are more varied with more child friendly flavours emerging.



14. Atomiser liquids which simulate illegal substances

Recent demand has allowed for the production and sale of cannabis type liquids to be used in e-cigarette atomisers.

Like the child friendly flavours there is a potential for users to obtain this type of 'flavour' and hide the fact they are being used which could result in the mis-use of the device or the mis-use of it being correctly charged. This could lead to fires occurring by the failure to follow best practice.



15. Summary

MF&RS are seeing an increase in battery failures and resulting fires due to increase in use of lithium-ion powered e-cigarettes.

A fatality has occurred in Derbyshire as a result of an e-cigarette battery rupturing whilst on charge.

Merseyside Fire and Rescue Service will give additional home safety advice when carrying out home safety audits with regard to electrical safety if e-cigarettes are identified during a visit.

Merseyside Fire and Rescue Service support the tightening of control of sales, use and promotion of e-cigarettes of all types.

