

Risk control briefing note 1: E-cigarettes



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1 Introduction

Since legislation prohibiting smoking in the workplace was first introduced in the UK in 2006 there has been a very rapid adoption of electronic cigarettes (or e-cigarettes as they are commonly known). Their use has been motivated by a desire for an alternative to traditional smoking that does not fall foul of 'smoke free' laws and also by becoming an aid to reduce reliance on the habit of smoking.

2 Construction

E-cigarettes produce an aerosol (often referred to as vapour) rather than smoke by the heating of a liquid solution normally consisting of propylene glycol, glycerin and various flavourings, with or without nicotine. Power is supplied to the heating element by a battery.

Early e-cigarettes were designed to resemble conventional cigarettes. Some had a non-rechargeable battery and a cartridge of liquid and were disposable once the liquid was used or the batteries had discharged while others had rechargeable batteries and replaceable liquid cartridges. Activation was triggered by an electronic airflow sensor or by a power button. Some models incorporated an LED to indicate activation.

More recent devices are larger, look less like conventional cigarettes, have a larger capacity rechargeable battery and hold larger volumes of liquid. Some have a USB port which allows them to be used while they are charging although recharging is conventionally carried out with the battery section removed. Additional features may include a circuit to indicate battery status via an LED and a power button that allows for power adjustments.

In essence, the device consists of a coil of resistance wire forming a heating element around a wick that draws up the liquid. The resistance of the coil is commonly between 1.5 – 3.0 ohms.

Many e-cigarettes are powered by lithium-ion (Li-ion) batteries but lithium manganese (Li-Mn) and lithium iron phosphate (LiFePO₄) batteries are also now in common use. The battery normally provides a voltage in the region of 3.7 volts but variable voltage devices are available which provide outputs between 3.0 and 6.0 volts. In all cases batteries are charged via a USB connector but this should be used in conjunction with the specific charger designed for the product or with a laptop or computer. The batteries should not be overcharged to avoid overheating, ejection of the battery material and a serious fire. There have been a number of product recalls and counterfeit batteries and chargers have been identified in the market place. Sub-standard chargers have also been identified that continue to offer a charge to a battery when it is already fully charged. The problems associated with the use of incorrect chargers have been exacerbated by replacement batteries being available without the provision of compatible chargers.

The simplicity of the devices has led to attempts at do-it-yourself measures to enhance the e-cigarette experience but modifications to the power supply and the introduction of do-it-yourself heating coils can introduce major fire hazards.

2.1 The occurrence of fires

A number of fires associated with e-cigarettes has been recorded by fire and rescue services: reportedly some 113 since 2012. Many of these occurred while the e-cigarettes were on charge. Examples include:

'Four fire engines and 21 fire fighters rescued a woman from a ground floor flat shortly after 15:30 on Saturday; she was taken to hospital by ambulance with smoke inhalation and shock. Fire investigators examining the scene said they believe an electronic cigarette had caused the fire while it was plugged into a mains socket.

Two weeks earlier an e-cigarette exploded in a barmaid's face while it was being charged near the bar of a pub. The barmaid managed to turn away from the flames but suffered a burnt arm and dress.'

A number of incidents, however, refer to misuse of the devices. For example:

'A woman was engulfed in flames and suffered severe burns to her head and face when smoking an e-cigarette while on oxygen in a hospital ward.'

Figure 1: Inside an e-cigarette



3 Conclusions

Because e-cigarettes produce an aerosol rather than smoke they are often perceived as being a safe option with regards to fire safety when compared to conventional cigarettes. There have, however, been many fires associated with these devices, most of which have occurred while batteries were being charged.

Best practice advice when using e-cigarettes includes:

- only use, store and charge e-cigarettes in accordance with the manufacturer's instructions;
- take notice of any warnings supplied with the product;
- check that your e-cigarette has not been subject to a recall appeal;
- do not attempt do-it-yourself modifications to e-cigarettes or their chargers;
- when purchasing an e-cigarette look for the CE mark that indicates that the charger complies with European safety standards; avoid buying a substandard product;
- do not attempt to use non-proprietary liquids in e-cigarettes;
- inspect the battery before each period of charge; if it is leaking, discoloured or misshapen it should be replaced;
- only use the charger supplied with the e-cigarette for charging that device;
- unplug the charger or switch off at the socket when the charger is not in use;
- charge the battery on a non-combustible surface away from combustible materials. Wherever practicable there should be a clear area of at least 0.5m around the charger;
- consider using a proprietary fire resistant bag to contain the battery and charger when batteries are being charged;
- do not overcharge the battery;
- avoid leaving e-cigarettes on charge overnight or while unattended;
- do not replace batteries with those not intended as direct replacements even if they are the same physical dimensions;
- do not use multiple batteries unless the e-cigarette is intended to be powered in this manner;
- do not use e-cigarettes in areas where there may be concentrations of flammable liquid or gas or enhanced levels of oxygen in the environment (such as where medical oxygen cylinders may be in use);
- do not use or charge an e-cigarette that has been exposed to water; and
- ensure that you dispose of old or unwanted batteries correctly.



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