



London Ambulance Service NHS Trust

Procedure for Wearing and Use of Electronic Personal Dosimeters

For Use By: All Staff

Introduction

As part of the continuing review of preparedness for the possibility of the deliberate release of Chemical, Biological, Radiological or Nuclear (CBRN) materials in the United Kingdom (UK), the Department of Health (DoH), in collaboration with Police and Fire Services, has identified the need to enhance the safety of Ambulance personnel.

The Thermo Mk2 Electronic Personal Dosimeter (EPD) is already in use with Police and Fire Services throughout the UK and the units issued by the DoH match the specification of those provided to other emergency service colleagues.

Objectives:

1. To provide a standard approach when wearing and use of an EPD.
2. To ensure all staff issued with the EPD understand its purpose, capabilities and actions when activated.
3. To ensure that operational procedures and guidance are implemented to safeguard the health and welfare of LAS staff.

1.0 Background:

1.1 Much work has been undertaken around the provision of Personal Protective Clothing for Decontamination Teams and the DOH now recognises that there is a threat posed to initial responders from the effects of ionising radiation

1.2 The potential threat comes from both deliberate and accidental releases of radioactive materials and could potentially arise from any one of the following scenarios:-

- radioactive materials in transit; industrial waste, medical isotopes, or nuclear weapons,
- fixed civilian installations; radio therapy departments, laboratories, nuclear power stations & re-cycling facilities, production plants for industrial and medical isotopes,
- security checking facilities; vehicle search arches,
- defence establishments,
- unshielded industrial sources,

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- Improvised Radiological Dispersion devices; Dirty Bombs,
- abandoned or orphaned sources,
- transport of patients undergoing radioisotope therapy.

2.0 Purpose of the EPD

2.1 The Thermo MK2 EPD is the most technologically advanced piece of equipment in its field and is standard issue to all UK emergency services; it is also widely used within the nuclear industry. It is multi-functional unit but for the purposes of ambulance staff it will have three primary functions:-

- to alert the wearer to the presence of potentially harmful ionising radiation,
- to record and store the history of the event pre and post activation,
- to provide data for forensic evidence which can be used in any subsequent enquiry or legal proceedings.

3.0 Radiation

3.1 In order to afford LAS staff the best possible protection from the potentially harmful effects of ionising radiation emitted by known or unknown sources, the DoH decided to issue all operational personnel a Thermo Mk2 EPD.

3.2 The DoH recognizes the existence of a threat to frontline staff from the presence of potentially damaging ionising radiation and has issued the EDP with the express purpose of providing operational personnel with an **early warning** of the presence of such radiation.

3.2 Furthermore the decision to introduce this equipment into the ambulance services is based on a need to fulfil a duty of care to staff and not as a direct result in any increase in the threat to personnel from the effects of radiation exposure.

4.0 General and operational terms and definitions - What is radiation?

4.1 The term radiation is very broad and may include radio waves, light and heat. Within this broad range there are two distinct types of radiation; non-ionising and ionising and it is this latter group which may pose a threat to the staff. Naturally occurring ionising radiation presents in three principle forms; '*alpha*', '*beta*' and '*gamma*'.

4.2 **Alpha** particles have the least penetrating power and can be stopped by a sheet of paper and our top, dead layer of skin. As such they do not pose any external threat, they do however pose a threat if '*alpha*' emitting material enters the body and is exposed to living tissue.

4.3 **Beta** particles are more penetrating than alpha particles and can cause damage to unprotected exposed skin and the underlying surface tissue. Beta particles can be stopped by aluminium foil, Perspex sheeting or even thick clothing. As with '*alpha*' particles if '*beta*' emitting material enters the body it can cause damage to living tissue but to a lesser extent than that caused by '*alpha*' particle radiation

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- 4.4 **Gamma** rays are not particles, they are similar to radio waves or light but at much higher energies. *Gamma* rays have a much higher penetrating power than ‘*alpha*’ or even ‘*beta*’ particles and materials such as lead and concrete are required to absorb their energy and, therefore, provide shielding. *Gamma* rays have equal potential to cause damage if they are emitted from material outside or inside the body as they will penetrate clothing
- 4.5 In any event the potential for damage to human health is directly related to strength and type of the radiation source, and the length of time to which a person has been exposed.
- 4.6 The overriding rule therefore when providing radiation protection is;
- TIME** – Minimising the **TIME** spent near to a source of ionising radiation will minimise the dose received
- DISTANCE** – Maximising the **DISTANCE** from a source of ionising radiation will minimise the rate of exposure, as you double the distance from the source you quarter the rate of exposure.
- SHIELDING** - Where appropriate **SHIELDING** can be used to reduce or stop the amount of rays or particles that are trying to penetrate the body. As a rule of thumb the thicker and more dense the shield the better it is at stopping the radiation.
- 4.7 **Background radiation** is the level of radiation to which the population is continually exposed from natural sources. It consists of radiation from outer space, rocks, air, soil and substances within the human body and from food. This natural radiation accounts for 85% of the annual average dose received by the population (The remainder comes from fallout, occupational exposure, weapons testing, medical exposure and other discharges). Staff should not wear their EPD’s when travelling on commercial aircraft.
- 4.8 **X-rays.** It is important to distinguish between natural and man-made radiation. X-ray radiation (in Radiology Departments) is created using electricity and can be easily controlled by removing the electrical supply. Radiology departments in hospitals are strictly controlled and should not pose a risk to staff.
- 4.9 **Patients receiving treatment from Nuclear Medicine Units** may emit low levels of radiation for a few hours after their examination. Although Ambulance Trust policies differ in some regions, emergency responders may have to deal with such patients. In these cases it is unlikely that the EPD should activate but Trusts should take this into account and consider taking advice from radiation physicists and radiographers.
- 4.10 It is important to know therefore that the sensitivity of the EPD is set to detect the presence of potentially damaging levels of ionising radiation just above those of normal background and as such will alert the wearer to the presence abnormal levels of ‘*beta*’ and ‘*gamma*’ radiation.
- 4.11 Equally important is the need to understand the difference between **irradiation** and **contamination**.

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- 4.12 **Irradiation** occurs when you are exposed to any form of radiation, for example, when you have an X-Ray.
- 4.13 **Contamination** is the result of radio-active debris i.e. dusts from an explosion/fires such as Chernobyl, landing on your skin or other surfaces. As with any other physical material, radioactive contamination can be spread and can potentially enter the body unless precautions are taken. The use of a simple paper mask, gloves and safety goggles will reduce the hazard considerably, if available. This is also referred to as deposition and all persons affected will require decontamination either by the Ambulance Services or the Ambulance Services and Fire and Rescue.

5.0 EPD Settings and Description:

- 5.1 Radiation can be measured as either the absorbed (received) dose or as the accumulated dose and can be expressed in a number of different forms e.g. Grays, Becquerel's, and Sieverts.
- 5.2 For simplicity's sake the Emergency Services and the Military have agreed with the Atomic Weapons Establishment (AWE) that the energy from the source will be measured in Becquerel's and that the dose will be measured and recorded in Sieverts. The Sievert is a very large unit and as such fractions of thousandths (milli Sievert mSv) and millionths (micro Sievert μ Sv) are often used.
- 5.3 The EPD is therefore capable of measuring:
- **Personal Dose Rate** (Dose Rate) in either micro sieverts/hour (μ Sv/h) or milli - sieverts/hour (mSv/h). This is the default setting and is displayed as micro-sieverts (μ Sv) or milli-sieverts (mSv), switching automatically between the two depending on the level of the recorded dose.
 - **Personal Dose Equivalent** (Accumulated Dose) in either micro-sieverts (μ Sv) or milli-sieverts (mSv).
- 5.4 The level of alert is pre-set by the manufacturer to nationally agreed levels common across the emergency services and cannot be altered by the user.
- 5.5 To aid identification, the emergency services have agreed that all Fire & Rescue Service dosimeters will be red, Police will be yellow (except for some specialist units) and the Ambulance Service will be NATO green.
- 5.6 With the exception of the casing colour, the EPD's issued to the Emergency Services are all calibrated to exactly the same specification and capability

6.0 Alert Signals

- 6.1 The EPD has three pre-set alert tones each of which sounds when radiation at the pre-determined levels are detected by the dosimeter.

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- 6.2 The first tone or **Primary Alert Signal** is an **intermittent double “fast” chirp** and the **light emitting diode (LED)** will illuminate **RED** and indicates the presence of a level of radiation just above background.
- 6.3 This tone will also sound whenever the battery is replaced and is a function of the auto test process. It also acts as a reminder of the alerts for the wearer. The user should be aware of this facility and is advised **NOT** to change batteries at incident sites. **The Primary Alert Signal should be the only alarm that the wearer will ever hear whilst performing their duties.**
- 6.4 The second tone, the **Secondary Alert Signal** is a **slow two tone alarm** and indicates a level of radiation approximately equivalent to that received annually by normal means.
- 6.5 Under normal circumstances where this level of radiation is present, Ambulance staff will not be committed forward to assist casualties.
- 6.6 In the unlikely event that the EPD activates in this manner the wearer must remove themselves from the incident scene whether the task has been completed or not. Where the wearer has received this dose level, they must not knowingly be deployed to another radiation incident for a further twelve months.
- 6.7 The third alert tone, the **Tertiary Alert Signal** is a continuous tone similar to that heard from an ECG machine when a patient arrests. This tone indicates that the wearer has been exposed to a potentially significant or high dose.
- 6.8 There is a low **battery alarm** which is an intermittent slow tone. This indicates there is about ten hour’s battery life left (the data in the EPD will be stored for about a month without a battery.) This alarm should sound every 3 to 5 months depending on the type of battery used.
- 6.9 In all cases where an alert sounds, the information recorded on the EPD will be downloaded and the wearer referred to OHD or other appropriate medical professional for follow up. In any event, assistance can be sought at the scene from the Fire and Rescue Scientific Advisors, or the Health Protection Agency (HPA) Chilton Site, or the Atomic Weapons Establishment, Aldermaston (AWE) via police.

7.0 Operating Procedures

- 7.1 The EPD will be personal issues to all members of staff and is to be regarded as a piece of personal safety equipment. Staff are strongly advised to wear their EPD at all times when on duty. However the wearing of the EPD is discretionary and being without a EPD is not just cause for being unavailable to attend a call.
- 7.2 Each unit will be allocated individually to staff and a unique serial number will be assigned and recorded before issue in order that any exposure records can be linked to the individual. **It is therefore imperative that under no circumstances do staff borrow a colleague’s EPD**

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- 7.3 Prior to initial use a new battery should be inserted. **To switch on** – remove the battery cover, insert the battery, replace and lock the battery cover then press the operating button.
- 7.4 Once the EPD has been switched on, it will provide continuous protection until the battery needs to be changed. **Under no circumstances should the battery be removed before it needs to be replaced.**
- 7.5 After switching on a confidence test should be carried out. From the default display screen press and hold the operating button until “test” is displayed.
- 7.6 Double press the operating button to initiate the **confidence test**, which confirms operation of visual display and the visual and audible alarms. The display screen will show all icons at once, the audible alarm will sound and the visual indicator will flash.
- 7.7 The EPD will then automatically reset after about 12 seconds and the default screen will be displayed.
- 7.8 The EPD should be worn outside of clothing and can be attached to either the wearer’s belt or one of the radio loops on uniform shirts, fleeces, jumpers, body armour, Hi-visibility jackets/tabards or any other uniform issue worn. When attending a known radiation incident the EPD should be worn on the front of the upper torso in order to maximise its effectiveness with the Operating button and orange disc facing away from the body.
- 7.9 Decontamination trained staff when undertaking clinical decontamination of a suspected radiologically contaminated patient and such patient care in the warm zone should wear their EPD outside the Personal Protective Clothing.
- 7.10 Specifically for decontamination incidents, a system of pre-decontamination assessment needs to be adopted to identify persons approaching the unit emitting high levels of radiation. Steps to protect ambulance staff should then be put in place (i.e. removal of clothing or rudimentary decon) and casualties re-checked before entering the decontamination unit. Immediately on exit to the clean side casualties should be re- checked and if still found to be emitting high levels of radiation they should be returned to the dirty side and decontaminated again. These activities should only be performed by services with the appropriate equipment and expertise, including Accident and Emergency Departments and trained staff within the LAS, and such an assessment is **NOT the function of the EPD.**
- 7.11 All wearers should be aware there are commercial radioactive sources, e.g. photography developers, dentists transport consignments (dose rates at the side of a vehicle transporting radioactive materials could be as high as 2 mSv/h legitimately), Dept of Transport road survey units (x-ray) are used safely on a daily basis in public places and that staff in close proximity to these sources may find that their EPD activates.

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7.12 When the EPD audible alert activates the following procedures are to be adopted:

Primary Alert Tone; No casualties present

- Stop all current activities.
- Rapidly assess the area from that position and then withdraw back along the entry route until the EPD audible alert stops.
- Withdraw a further 100 meters (if possible up wind) and report the incident to ambulance control using CHALETS or METHANE as appropriate and include the dose rate from the EPD. Ensure the wearer can differentiate between the micro (μ) and (milli (m) symbols (located to the left of the Sv symbol).
- Request via Ambulance Control ; the immediate attendance at the RVP of;
 - LAS Tactical Support Officer (TSO)
 - Fire & Rescue Service with radiation survey equipment
 - the Police
 - the **nearest available** Ambulance service supervisor
- Act on the advice of the Fire Officers, TSO and/or Team Leader/supervisor
- Ensure that the EPD is available to communicate the displayed information which is then to be made available to the Police, the Fire, TSO and Ambulance supervisor on scene
- Complete the Incident report form in accordance with the Incident Reporting procedure (LA52)
- The Ambulance supervisor will ensure that the necessary support and welfare arrangements are put in place to support any member of staff who has been involved in this incident.

7.13 **Primary Alert Tone; Casualties present**

- Read the dose rate from the dosimeter screen. Ensure the wearer can differentiate between the micro (μ) and milli (m) symbols (located to the left of the Sv symbol).
- Report the incident to ambulance control using CHALETS or METHANE as appropriate; also include the dose rate reading from the EPD
- Control will facilitate or feedback time critical information about how long staff can stay with the casualty(s).
- Rapidly assess the area from that position
- Request via Ambulance Control ; the immediate attendance at the RVP of;
 - LAS Tactical Support Officer
 - Fire & Rescue Service with radiation survey equipment
 - the Police
 - the *nearest available* Ambulance service supervisor
- Act on the advice of the Fire Officers, TSO and/or Team Leader/supervisor
- Ensure that the EPD is available to communicate the displayed information which is then to be made available to the Police, the Fire, TSO and Ambulance supervisor on scene.
- Complete the Incident report form in accordance with the Incident Reporting procedure. (LA52)

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- The Ambulance supervisor will ensure that the necessary support and welfare arrangements are put in place to support any member of staff who has been involved in this incident.

7.14 Secondary & Tertiary Alert Tones;

- Stop all current activities
- Read the dose rate from the dosimeter screen. Ensure the wearer can differentiate between the micro (μ) and milli (m) symbols (located to the left of the Sv symbol).
- Immediately withdraw back along the entry route until the EPD alert tone stops.
- Withdraw a further 100 meters (if possible up wind) and report the incident to Control using CHALETS or METHANE as appropriate; also include the dose rate reading from the EPD
- Request via Control the immediate attendance at the RVP of;
 - LAS Tactical Support Officer
 - Fire & Rescue Service with radiation survey equipment
 - the Police
 - the **nearest available** Ambulance supervisor
- Consider the possibility of contamination and DO NOT allow any other staff to come into contact with you; tell them to remain at a safe distance
- Act on the advice of the Fire Officers, TSO and/or Team Leader/supervisor
- Ensure that your EPD is available to download the data which is then to be made available to the Police, the Fire Service, TSO and Ambulance supervisor on scene
- Complete the Incident report form in accordance with the Incident Reporting procedure (LA52)
- The Ambulance supervisor will ensure that the necessary support and welfare arrangements are put in place to support any member of staff who has been involved in this incident

8.0 Maintenance

8.1 Although technically advanced, the EPD has no user serviceable or adjustable parts and therefore requires no maintenance other than:

- Daily check to ensure the “heartbeat” icon is flashing and the low battery warning is not displayed
- Replacement of the “AA” size battery every three months for Alkaline cells and six months for Lithium cells (the low battery warning activates when there are approximately ten hours of battery life remaining)
- Annual reset of counter

8.2 The EPD can be decontaminated but it is only splash proof and should not be immersed in water.

8.3 Routine maintenance, including re-calibration and software upgrades will be carried out by the manufacturer as and when required but generally the unit will

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serviced and reset every 18 to 24 months by in service personnel. However, in the event that an EPD develops a fault or is damaged the unit should be returned to the manufacturer through the normal procedures employed by the LAS.

References: LAS: Incident Reporting Procedure (LA52).

A handwritten signature in black ink, appearing to read 'P Bradley', with a large, stylized initial 'P' and a long, wavy horizontal line extending to the right.

Signature:

**Peter Bradley CBE
Chief Executive Officer**

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