WITNESS STATEMENT OF MALCOLM STANTON
(Rule 9, Inquiry Rules 2006)

I Malcolm Stanton say as follows:

1. I joined the London Fire Brigade on 4th September 1967 as a Junior Fireman and on 19th May 1969 was posted to (B22) Lambeth where I stayed until moving to (B23) Southwark in 1974. In February 1993 I left Lewisham fire station to join Southwark Training Centre as a Station Officer Recruit Instructor having spent the preceding years at various stations in the South East of the Brigade.

2. I retired from operational service in July 2001 in that rank and returned 8 days later as a non-operational Station Officer in the Commercial Training Unit also based at Southwark Training Centre. In 2002, I transferred to the Brigade's Special Operations Group at Lambeth HQ's and I worked on introducing an Extended Duration Breathing Apparatus set.

3. In 2003, I participated in the Firefighter Physiological Trials for HM Government and over the next 16 months directed all the trial exercises for mass decontamination, the London Underground, high rise and fires. One of the results from these trials was to nationally increase notional breathing rates as applied to working duration calculation from 40 litres per minute to 50 litres per minute. During these trials I was introduced to the Breathing Apparatus (BA) telemetry system which was used on the fire exercises.

4. In 2005, I was seconded to Protective Equipment Group (PEG) to trial BA telemetry for the Brigade and went on to use this equipment at various prominent buildings around London including the Houses of Parliament, Canary Wharf, Heathrow Underground tube tunnel extension and the Thames river barrier. In 2006, I was transferred to PEG and managed the Respiratory Protective Equipment departments.

5. During my time at PEG I undertook training courses in pressure systems, Face Fitting (face masks), noise reduction in the workplace and attended Draeger to qualify as a BA technician. In 2010, I managed trials of the current Draeger PSS 7000 Standard Duration Breathing Apparatus set (SDBA) used by LFB prior to its introduction in December of that year.

6. Following the introduction of Breathing Apparatus (BA) telemetry in 2011, I have managed all the telemetry data analysis for the Brigade. Since 2013, I have been responsible for training all designated Station Managers with responsibility for Bodyguard data downloading and interpretation.

7. In 2016 I became the Deputy Head of PEG. In June 2017 I was presented with an MBE from the Queen for services to improving firefighter safety and the safety of members of the public.

8. On September 1st 2017, I was seconded to the Grenfell Tower Investigation and Review Team with responsibility for BA and telemetry data gathering and analysis

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The Bodyguard data log:

9. Both the Standard Duration and the Extended Duration Breathing Apparatus sets (SD & EDBA) are fitted with a dater-logger. Each data-logger forms part of the Bodyguard (BG) unit. A data log micro chip is housed in the Bodyguard Unit (BG) which itself is fixed to the Computer Monitoring Unit (CMU) on the back plate of the BA set. The data logger holds up to 5000 lines of data and each line records the following under each column heading:
    i. ID;
    ii. Date and Time;
    iii. Event;
    iv. Pressure;
    v. Breathing Rate; and
    vi. Description.

10. When viewed on a computer or printed report, there is additional information at the top of the data log about the BA set, including the date and time of the download onto the computer program.

11. I now attach as exhibit MS1, a (filtered for 14/06/2017) copy of the data log for SDBA 813 which was the first BA set to be used at the Grenfell Tower Fire. An explanation of the material therein is as follows:
    i. **ID** - this is a numerical number in chronological order for identifying each line of data
    ii. **Date and Time** - this is the date and time each line of data is recorded at 20 second intervals unless there is interaction from either the BA set wearer, who presses one of 3 buttons on the BG or the Entry Control Operative (ECO) who does likewise.
    iii. **Pressure** - the current air pressure, in bars, recorded at that time
    iv. **Breathing Rate** (LPM) - the wearers breathing rate at the time of the data log. This breathing rate, pressure together with the cylinder capacity and other predetermined factors are used by the PSS 7000 Bodyguard unit program to monitor the amount of air remaining and consequently, the amount of usable time available to the wearer.
    v. **Event** - an action that occurs and can be the BA tally removal from the BG or an Alarm such as the Automatic Distress Signal Unit (ADSU) operating
    vi. **Information** - describes an Event i.e. Low Pressure Warning Device (LPWD) operated or low battery warning

12. Uploading a data log from a BA set requires the use of;
    i. A BG cradle in which the BG unit sits and data can be transferred to and from the BG unit via a cable link to a computer having the bespoke Draeger program installed

    ii. A computer with the Draeger PSS 7000 Bodyguard program installed. Detail of the download procedure, including computer screen prints attached in exhibit MS2

Once the data has been uploaded onto a computer it is able to be viewed at this point. However, to view the whole data log or just a part of it; the file format has to be changed.

13. Within the BG program, data is stored as a bespoke HLG file and can only be viewed using this program. There is, however, the ability to export the file and change its format for use in Microsoft's Excel program as a CSV (comma-separated values) file. In this format, the file can be viewed and filtered as required. The reasoning behind the use of the HLG file format is the amount of data memory used.

14. A complete data log file in the HLG format uses approximately 33 kilobytes (KB) of memory. In decimal systems, kilo stands for 1,000, but in binary systems, a kilo is 1,024 (2 to the 10th power). Technically, therefore, a **kilobyte** is 1,024 bytes, but it is often used loosely as a synonym for 1,000 bytes. In **computer** literature, **kilobyte** is usually abbreviated as K or KB.

15. When converted into an CSV file, the memory increases to 330 KB approximately and if converted into a full MS Excel spreadsheet, becomes larger in memory again.

The Merlin Entry Control Board (ECB) data log:

16. The ECB data-logger is built into the structure of the board as part of a printed circuit and stores up to 100hrs of recorded data. The ECB is a battery-powered unit incorporating an integral digital radio transmitter and receiver with associated antenna. The ECB has twelve channel slots each able to accept the encoded tally of an individual BA set.

17. Inserting the tally activates the transmission link monitoring capability between the ECB, the Radio Modem of the BA set and the Bodyguard. Entry Control Boards are individually programmed with the Brigade ID (28 for LFB) and a board identification number (1 – 243). The data transmission link (logon) between the ECB and each BA set radio modem is activated following the insertion of the BA tally (an electronic key with an embedded encoded transponder) into any of the available slots on the ECB. The tally is encoded with the same codes as the corresponding BA set radio modem

18. The ECB identifies the associated BA set radio modem and an on-line radio icon illuminates (green) continuously, confirming a successful radio communication link between the ECB and BA set radio modem. An individual channel screen defaults to show the actual *Time of Whistle information* as hh:mm. An ECB is capable of continuously recording the data to and from up to 12 BA wearers logged onto it.

19. Each logged on BA set is allocated a slot from 1 to 12 on the ECB into which the wearers BA tally is inserted to establish radio contact between the two. The BG arming key is also attached via a split ring to this BA tally. The ECB data log records the following information in columns for each BA set logged onto it:
    i.   **Date** – recorded as the date the BA set tally was inserted into an ECB tally slot in the format 14/06/17 for each line of data added.
    ii. **Time** – recorded as hh:mm:ss for each line of data
    iii. **Slot** – The slot number identified for the inserted BA tally (1 to 12)
    iv. **BID** – Brigade Identification number (LFB is 028)
    v.   **PID** – Portable radio Unit ID (Radio Modem & BA set ID Number) i.e. 124 or 9101for EDBA
    vi. **Event** – an action that occurs such as Tally in or PU Data (information received from a BA set radio modem)
    vii. **Pressure (bar)** – current pressure recorded as 264.52 for example, when PU data is received
    viii. **TTW** – Time To Whistle in minutes and recorded as mm (24 for example), when PU data is received
    ix. Temp (°C) – this data is not available on the PSS 7000 Bodyguard Unit and therefore not recorded
    x.   **Information** – such as (RadioLoBat), this BA sets battery has reached the 1st stage warning of reduced voltage or (Whistle)where the wearer's Electronic Low Pressure Warning Device has operated. This occurs when 84 bars pressure is reached and the warning is continuous until the BA cylinder is shut down
    xi. **Elapsed** – the time in minutes between the BG being switched on and the BA tally being inserted into an ECB slot and logged on.
    xii. **Capacity** – the cylinder capacity in Litres of the BA set logged on (8.00 for SDBA and 6.88 for EDBA)
    xiii. **Rating (bar)** – the cylinder pressure (maximum) that the cylinder is charged to as a standard i.e. 8 litre 300bar (single) or 6.8 twin 300bar
    xiv. **Whistle (bar)** –the logged on BA sets Low Pressure Warning Device setting (84 bar for both SDBA and EDBA sets)

20. Unlike the BG data log, to upload data from an ECB requires a dedicated PC lead to plug into a data port provided at the rear of the ECB. Upload also requires a computer with Draeger's dedicated ECB program installed onto it

21. When the data log is uploaded, it is automatically put into an MS Excel CSV file format for viewing. I attach as exhibit MS3 an example of an ECB data log.

BA Data Log Events after the Grenfell Tower Fire

22. On the 15th June 2017, BA sets and ECB's used at Grenfell were starting to be being returned to PEG at Croydon for servicing or repair. Eventually, over the subsequent months the following were identified as being used at Grenfell up to 2000hrs on 14th June 2017:
    i. 10 x ECBs
    ii. 221 x SDBA sets
    iii. 127 x EDBA sets
    iv. 36 x AAAB (PEG Reserve EDBA sets)

23. On 16th June 2017 I started the process of uploading all the data logs from the ECB's and BA sets received at PEG by that date. I started with the ECB's data logs as these would identify which BA sets had been logged onto each ECB. Early on, a total of 4 ECB's were identified as being damaged by heat. I attach as exhibit MS4 images of ECBs damaged by the heat.

24. Two of the damaged ECB's (MTB 201 & MTB 142), sustained such damage that I was unable to upload the data log from them. This required the help of the manufacturer (Draeger) to see if it was possible to extract the data by another method. I visited Draeger's HQ's in Blyth, Northumberland on 27th June 2017 with all 4 ECB's. A detailed examination of MTB 201 and MTB 142 ECB's followed. At the conclusion of this visit, the data from all 4 ECB's had been retrieved.

25. Also used as a BA and ECB reference was the Incident Log from Brigade Control (Inc – 76029 Grenfell Tower) which provided the appliances and their order of arrival time. To manage all this data, I created a folder for each BA set and each ECB using their prefix, ID number and station name i.e. SDBA 813 – North Kensington or MTB 3 – Kensington.

26. Within each BA set folder the following documents would eventually be placed:
    i. An original HLG file of the Bodyguard download.
    ii. A MS Excel CSV copy of the HLG file.
    iii. A filtered (14/06/2017 date only) MS Excel spreadsheet copy of the BG downloaded file.
    iv. A photocopy, if available, of the BA sets Log Book and the pages that captured the testing confirmation of the BA set on the evening of 13th June 2017 to confirm and identify the wearer.
    v. A graph or graphs of the BA wear or wears taken from the original HLG data log.

    In the case of PEG reserve EDBA sets used at Grenfell -

    vi. Photos of the wearer's name on the BA sets Tally.

    In the case of the ECB's data logs, the following documents were added to each ECB folder created:

    vii. Original MS Excel CSV file.

    viii. A filtered date (14/07/2017) Excel spreadsheet copy of the original CSV file.

27. In establishing the first ECB on scene to be used (MTB 153 – North Kensington's) it become clear that some BA BG data from earlier on in the incident was missing. Upon investigation, it was established that the data log on this ECB had become full (118 BA sets were logged onto this ECB during its use on 14/06/2017) and some of the initial data had been overwritten.

28. The first recorded data line started at 01:44:27hrs on 14/06/2017. This information prompted the uploading and recovery of the data from every BA set that was at every fire station on 13/14th June 2017. To undertake this task, Service Standard Support Officers (SSSO) who were trained in uploading of BG data logs, were asked to visit assigned fire stations and undertake the task of uploading the data from every BA set at the station and photograph respective BA Log Book entries for 13/14th June 2017, using their

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mobile phones. On completion, the SSSO's would email the data logs and photos to me at PEG.

29. Upon completion and including those BA sets that were returned to PEG via the van service as part of their normal service schedule, I had BG data logs for 970 BA sets of both types and 193 ECBs.

Analysing a Bodyguard Data Log

30. The task of analysing each individual BG data Log was undertaken using the following process. At the time of uploading the data log from the BG unit, I made a CSV copy. This process was also undertaken by the SSSO's when they undertook the task.

31. This CSV copy was initially checked to see if the BA set was used at Grenfell by 'filtering' out the dates other than 14/06/2017. If no data was present that reflected the BA sets use at Grenfell (i.e. data recorded for a BA wear) then this BA sets data and folder was transferred to another folder for BA sets named 'Not Used' [at Grenfell]. If data was present for a BA wear or multiple wears, then I would analyse this data by

    i.   Separating the multiple BA wears if there were more than one, by putting the data onto separate spreadsheets within the Excel workbook. I attach as exhibit MS5 an extract from SDBA 148 .

    ii.   I colour coded the respective spreadsheet tabs Yellow for SDBA and Orange for EDBA to better identify these BA sets when put into a BA Time Line spreadsheet for the Grenfell teams use later

    iii.   Because Draeger's BG program uses concatenation to combine the Date & Time fields on the data log, I added another column to the right of the date and time column.

    iv.   I colour coded this column and called it Time Only

    v.   I used two different methods to separate the time only from the concatenated Date & Time column depending on which program version the data log was uploaded with

    vi.   The added column was required by me to enable all 'Time Only' references to be used when analysing the data

    vii.   I then highlighted (in yellow) the following information for reference purposes by the Grenfell Investigation team

        a.   The Time the BA set vehicle charger was disconnected (*Charger disconnected*)

        b.   The Time the BA set was turned on via the BG unit (*On*)

        c.   The Time the BA tally was removed from the BG unit (*Tally out*)

        d.   The Pressure recorded at this time period (*292.96*)

        e.   The Time the BA set was logged onto an ECB (*Logged on to ECB*)

        f.   The highest recorded Breathing rate during this BA wear (*73.4*)

        g.   The Time the wearer stopped using the BA set to breathe at the end of the BA wear

        h.   The Pressure remaining when the wearer stopped using the BA set to breathe at the end of the BA wear

        i.   The Time the BA Tally was inserted back into the BG unit (*Tally in*)

        j.   The Time the BA set was switched off [*Switch-Off (Tally)*]

        k.   The Time when the BA set was logged off from the ECB (*Logged off/Modem shutdown*)

    viii.   This process was followed for every BA set worn at Grenfell.

32. This information helped produce the initial BA Time Line spreadsheet and when this information was presented to Group Manager Greg Ashman, Lead Investigator, Operational Response, Grenfell Tower Investigation and Review Team [GTIRT]. He asked me to divide the data into chronological time order and sub-divide it into 30 minute segments:

33. Each 30 minute segment contained the following
    i.   A spreadsheet numbered and named BA Time Line (1) 0100 – 0130 containing all the information in (**vii a – k**) above. Plus an additional two columns containing the total Air Used and total Duration of wear. In addition this spreadsheet had the BA set ID, its location on 14/06/2017 and the wearer ID if known

    ii.   A corresponding copy of the BG data Log for the BA set used during this time period

34. The Time Line chronological order was based on the tally out time (**7c**) above taken from all BG Data Logs. There ended up being 38 BA Time Line segments, which took the total time sequence up to 2000hrs on the evening of 14th June 2017.

Bodyguard analysis – Date and Time anomalies

35. The PSS 7000 Bodyguard is powered by a rechargeable battery fitted into the back plate of the BA set. This battery is normally charged from a connection point adjacent the BA sets stowage bracket when mounted on the fire appliance. There is no data available on the length of time a battery will last which is due to uncontrolled factors that influence the charge remaining in the battery.

36. The data log for each BA set has its date and time set when it is serviced at PEG Croydon. This process is undertaken by a PEG technician and involves connecting the BG unit to a cradle and then connecting this to a computer. When connected in this way, interaction can take place between the BG unit and computer and the date and time are updated by the BG program utilising the computers built-in date and time clock.

37. Therefore, a BG's date and time reference is just a specific point in the data log where all the data that is added thereafter, reflects a point corresponding to the Date and that was set by PEG. However, if power from the battery is drained to exhaustion, the Date and Time reference point set by PEG is lost and the BG program defaults to a date and time in the past i.e. ="27/06/1905 12:04:17". Kindly note that all other data recorded is still in chronological order. Therefore, a reference point has to be established to 'correct' the date and time anomaly.

BG Data - Date and Time anomalies – types of reference points obtained

38. These reference points fall into the following:
    i.   The BA set in question was logged onto an ECB and therefore, I can use this date and time reference to correct the anomalies.
    ii.   A replacement charged battery was fitted and the BG unit attached to a computer. As long as the computers date and time are correct, these will be uploaded to the BG unit and the correct date and time established from this point in the data log. This will then give a reference point to work back from.
    iii.   As a last option, I have resorted to finding a reference point that coincides with the BA set being tested previously, at its parent station.

    This last undertaking requires the following actions;

a. Establish from the PEG database which ECB or boards were at that station on or before 14/06/2017.

b. Analyse the ECB(s) data to establish if the BA set ID is recorded on the ECB's data log.

c. If it is there, locate the test data nearest to the 14/06/2017.

d. Identify from this data some unique reference points from within the test data, such as the cylinder pressure upon start up and log on.

e. Cross reference these reference points with those on the BA set BG data by going back in time from the establish BA wear (on 14/06/2017) and matching, as far as possible, these reference points on both sets of data.

f. Having establish a reference date and time on the ECB, use these as a reference point on the BG data log and insert a calculation to update the date and time to match.

g. If possible this can be corroborated by looking at a BA partner's BG Data to establish similarities.

39. As can be appreciated, this process is very time consuming and was undertaken after most of the complete data logs were analysed.

40. The calculation I used in MS Excel was to use the correct Date and Time and the reference date and time; then by subtracting the earliest from the latest, I would end up with the result as a number. This number would then be added to the date and time anomaly to bring it up to date.

41. I attach as exhibit MS6 the data log for EDBA 9167 1st wear as an example of these calculations. Kindly note that I have entered all the highlighted, bold entries and line breaks in the data logs. However, an original Excel CSV complete copy of the data is included with each individual data log.

Statement of truth

I believe that the facts stated in this witness statement are true.

M.R. Stanton _____ Dated: _31st May 2018_____