

Appendix 1 – Summary of CAL’s work

CAL and its predecessor entities were founded by Simon Birkett, its Founder and Director, in 2006 with a Mission to achieve urgently and sustainably full compliance with World Health Organisation (WHO) guidelines for air quality throughout London and elsewhere. It works closely with other campaign groups and a wider network of supporters and volunteers to identify and build understanding of the most important issues and encourage decisive action on them.

CAL’s immediate priority is to see that air quality laws are enforced rigorously in London in 2014 (and thereafter). CAL believes that if we comply fully with relevant laws Britain can show the world how to tackle successfully air quality, climate change and sustainability issues.

CAL has long campaigned for the Government, Mayor of London and others to issue formal smog warnings to save lives, avoid hospitalisations and build public understanding of air pollution. As part of this work and anyway to warn people as best as possible CAL tries to predict, monitor and warn people about air pollution episodes which occur about a dozen times a year. Air pollution episodes in winter are caused typically by dangerous airborne particles and in summer by Ozone. CAL takes screenshots of air pollution maps, forecasts and monitoring data and posts daily updates on Facebook during smog episodes and on Twitter with some 17,000 and 15,000 followers respectively.

CAL ran a major campaign before the London Olympic and Paralympic Games to raise awareness of air pollution in London and in particular to encourage arrangements to warn athletes of air pollution episodes if necessary. Since then CAL has continued to predict and warn of air pollution episodes including around major endurance events such as marathons and road cycling both in London and nationally. CAL was therefore aware that Ozone air pollution might be a concern over the weekend of 13 and 14 July 2013 and took screenshots at the time which are included as evidence now.

CAL was very likely the first organisation to highlight publicly the so-called “Sahara dust” air pollution episode that received widespread national and international media coverage in April 2014.

CAL is a not-for-profit organisation funded by donations, sponsors and other supporters. It is not a charity in part because a registered charity is not allowed to have political objectives or take part in political lobbying (other than in a generally educational sense). Clean Air in London may wish to participate in such activities.

Simon Birkett is Founder and Director of CAL. He has acted as an expert on air pollution for the European Commission and European Environment Agency and is often interviewed and quoted by London, national and international media.

Clean Air in London is a company limited by guarantee, registered in England and Wales, with company number 7413769 and registered office address 1st Floor, James House, Mere Park, Dedmere Road, Marlow, Bucks SL7 1FJ.

Appendix 2 - Background

As the recipients of this letter will be aware, three soldiers died from suspected overheating after participating in a SAS selection training exercise in the Brecon Beacons which took place on 13 July 2013.

Our client understands that the evidence before the pre-inquest hearings is that L/Cpl Craig Roberts, 24, of Penrhyn Bay, Conwy, and L/Cpl Edward Maher, 31, died from hyperthermia on 13 July 2013 i.e. on the day of the exercise. Cpl James Dunsby, 31, from Bath, died some two weeks later in hospital (30 July). Media reports indicate they were among six men rescued from the mountain during an exercise.

The training exercise took place amid moderately high temperatures. The men were on a 40-mile (64km) hike during which temperatures reached 29.5C (85F).

Our client is aware from press reports that one of the key questions to be answered by the inquest and investigations is why in particular two of the soldiers who had worked in much hotter places than South Wales (serving, for example, in Afghanistan) died from hyperthermia in temperatures of up to 29.5C.

As set out below, the material in the public domain shows that the emphasis of the on-going inquest and investigation into the deaths of the three soldiers is focusing on how the selection process/training exercise was run and the need for steps to be in place to deal with heat illness.

Appendix 3 – effects of Ozone

Ozone is found in two regions of the Earth's atmosphere – at ground level and in the upper regions of the atmosphere. Both types of Ozone have the same chemical composition (O₃). While upper atmospheric Ozone protects the earth from the sun's harmful rays, ground level ozone is one of the main forms of air pollution. Other forms of air pollution arise from particles and nitrogen dioxide.

Tropospheric, or ground level Ozone, is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen and volatile organic compounds. Ozone is likely to reach unhealthy levels on hot sunny days in urban environments. Ozone can also be transported long distances by wind. For this reason, even rural areas can experience high ozone levels.

Health impacts and mountains

The United States' Environmental Protection Agency (the "**EPA**") provides a summary of the health effects caused by Ozone. The EPA explains that (emphasis added):

"Ozone in the air we breathe can harm our health—typically on hot, sunny days when ozone can reach unhealthy levels. Even relatively low levels of ozone can cause health effects. People with lung disease, children, older adults, and people who are active outdoors may be particularly sensitive to ozone. ...

Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground level ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue.

Ozone can:

- *Make it more difficult to breathe deeply and vigorously.*
- *Cause shortness of breath and pain when taking a deep breath.*
- *Cause coughing and sore or scratchy throat.*
- *Inflame and damage the airways.*
- *Aggravate lung diseases such as asthma, emphysema, and chronic bronchitis.*
- *Increase the frequency of asthma attacks.*
- *Make the lungs more susceptible to infection.*
- *Continue to damage the lungs even when the symptoms have disappeared.*

Ozone is particularly likely to reach unhealthy levels on hot sunny days in urban environments. It is a major part of urban smog. Ozone can also be transported long distances by wind. For this reason, even rural areas can experience high ozone levels. And, in some cases, ozone can occur throughout the year in some southern and mountain regions.

The Appalachian Mountain Club, founded in 1876, states on its website:

Why is ozone higher on mountain tops?

"During an average summer day ozone levels do not change much throughout the day at elevations above about 3,000 feet.

During a pollution event ozone concentrations can reach unhealthy levels at higher elevations but stay relatively lower in an adjacent valley. This mountain top ozone pollution is a result of higher background concentrations, less mixing of the air (that results in elimination of ozone through surface contacts and chemical reactions) and faster transport of pollution from a larger region."

<http://www.outdoors.org/conservation/mountainwatch/ozone-high.cfm>

Daily Air Quality Index – health advice

Defra's website outlines its recommendations and health advice in relation to different air pollution levels covered by the Daily Air Quality Index (see Exhibit 1 attached). Note that the index can be confusing because people may consider (wrongly) that Air Quality is VERY GOOD at 10 out of 10 when the opposite is the case.

At a MODERATE level (4 to 6 out of 10), Defra recommends for at-risk individuals that (bold emphasis in the original; underlined emphasis added):

*"Adults and children with lung problems, and adults with heart problems, **who experience symptoms**, should consider reducing strenuous physical activity, particularly outdoors."*

However, at a HIGH level (7 to 9 out of 10), Defra recommends for at-risk individuals that:

*"Adults and children with lung problems, and adults with heart problems, should **reduce** strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever more often. Older people should also **reduce** physical exertion."*

And for the general population that:

*"Anyone experiencing discomfort such as sore eyes, cough or sore throat should **consider reducing** activity, particularly outdoors."*

Finally, at the VERY HIGH level (10 out of 10), Defra recommends for at-risk individuals that:

*"Adults and children with lung problems, adults with heart problems, and older people, should **avoid** strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often."*

And for the general population that:

*"**Reduce** physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat."*

Athletes and endurance events

In other contexts, the potential impact of air pollution levels on individuals participating in endurance tests has been recognised. In the run up to the London Olympics, for example, the Guardian reported on 16 July 2012 that (emphasis added):¹

"Olympic runners, cyclists, swimmers and even sailors arriving in London on Monday could be taken ill or see their performances impaired by air pollution, health experts have warned.

According to Keith Prowse, respiratory consultant and medical adviser to the British Lung Foundation, a summer smog like any of the five already experienced this year in the capital could lead to some athletes needing medication and experiencing chest pains, sore throats and shortness of breath.

'If there is a smog incident then athletes, especially in the endurance events, will not achieve their top performance and those who have any tendency to asthma will be badly affected. Athletes are exerting themselves to the maximum, taking in a lot of air. If that air is polluted it will inflame the air passages. It could have a significant effect on endurance events like the marathon, anything over 400-800m, even sailing,' said Prowse."

The Independent also reported on 16 January 2012 that (emphasis added):²

"Olympic athletes could suffer impaired performance times and become ill as a result of London's unacceptably high levels of air pollution, leading respiratory scientists are warning.

Fears are growing that during the Games, beginning in July, athletes, who take in much more air than a sedentary person, will take in high levels of pollutants such as particulates, nitrogen dioxide and ozone, and could suffer pulmonary irritation, chest pain and decreased lung capacity. Such a situation would be a disaster for London when the city is on show to the world...

Experts say that the risk for the Games is that in certain summer weather conditions – in particular, a "temperature inversion" in which on still, hazy days, a layer of warm air traps pollutants close to the ground – the pollution levels could go so high as to affect athletes' health and performance.

Temperature inversions are common, and affect people more in the summer, according to the Met Office. 'It's not a rare thing. It can happen all the time,' a Met Office spokesman said yesterday. 'If we have a high-pressure temperature inversion period, there may well be high levels of ozone and nitrogen dioxide and these could induce coughs, breathlessness and other problems,' said Professor Sir Malcolm Green, spokesman for the British Lung Association.

Frank Kelly, professor of environmental health at King's College London, said: "If we're unlucky we're going to get bad publicity for our air quality. Athletes, such as marathon runners and cyclists, need to breathe very hard. If it's a high-pollution day, they will be taking in large amounts of pollution. Their chests may tighten up,*

¹ <http://www.theguardian.com/environment/2012/jul/16/olympic-athletes-london-pollution>

² <http://www.independent.co.uk/environment/climate-change/polluted-air-puts-olympic-athletes-at-risk-6290216.html>

they may feel pain and shortness of breath, and for certain conditions such as asthma they may need medication."

* Professor Kelly is Chair of the Committee on the Medical Effects of Air Pollution which provides independent advice to Government departments and agencies on how air pollution impacts on health.

The British Medical Journal published an article by Sophie Arie, a freelance journalist on 24 April 2012 titled "What can we learn from asthma in elite athletes?" (subscription).

<http://www.bmj.com/content/344/bmj.e2556>

<http://group.bmj.com/group/media/latest-news/many-athletes-with-asthma-may-be-using-the-wrong-treatment>

The article stated:

*"As Olympic competitors are told they no longer need authorisation for using the most common inhalers, **Sophie Arie** looks at why asthma seems so common in elite athletes and the lessons that could be of huge benefit to the general public.*

As Olympic athletes prepare for the London 2012 games, there is one thing that many are relieved they won't have to worry about in future. As of this year, those with asthma no longer have to seek authorisation to use the most common inhalers.

Asthma in elite athletes has gradually risen at almost every Olympic Games since the 1970s. At the Atlanta Games in 1996 some 20% of the US team declared problems with asthma and almost 21% of Team GB had asthma in 2004 tests, compared with 8% of the British population."

More on health effects

In 2013, the World Health Organisation ("**WHO**") published two 'state of the art' reports on the health effects of air pollution titled 'Review of evidence on health aspects of air pollution' (REVIHAAP) (Exhibit 2) and 'Health risks of air pollution in Europe' (HRAPIE) (Exhibit 3). Note that these studies are focused on the health effect of air pollution on populations rather than individuals. They can be seen here:

http://www.euro.who.int/_data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf?ua=1

http://www.euro.who.int/_data/assets/pdf_file/0006/238956/Health-risks-of-air-pollution-in-Europe-HRAPIE-project,-Recommendations-for-concentrationresponse-functions-for-costbenefit-analysis-of-particulate-matter,-ozone-and-nitrogen-dioxide.pdf?ua=1

The REVIHAAP report stated on page 59:

What new health evidence has been published in relation to the evidence or likeliness of a threshold below which impacts are not expected?

"In summary, the evidence for a threshold for short-term exposure is not consistent, but where a threshold is observed, it is likely to lie below 90 ug/m³. (45 ppb) (maximum 1 hour)."

In other words, health effects of ozone in populations are likely to occur in humans above a one-hour mean of 90 micrograms per cubic metres ug/m³.

Appendix 4 – evidence of Ozone levels in the area of the Brecon Beacons on 13 July 2013

Our client has collected the evidence described below.

Daily Air Quality Index - bandings

Defra publishes a 'Daily Air Quality Index' which sets out air pollution including Ozone data from over 100 sites across the United Kingdom. Monitors at different sites measure different air pollutants. The alert bandings are shown in Exhibit 4 to this letter with Ozone measured as a running eight-hour mean in $\mu\text{g}/\text{m}^3$. The WHO guideline for Ozone is an eight-hour mean of $100 \mu\text{g}/\text{m}^3$. There is a separate 'Information threshold' for Ozone under UK and EU law at a one-hour mean of $180 \mu\text{g}/\text{m}^3$ (see later). See also:

<http://uk-air.defra.gov.uk/air-pollution/daqi?view=more-info>

Air pollution forecasts

In July 2013, it was Defra's practice to publish updated air pollution **forecasts** for each of 17 regions of the United Kingdom at around 2pm each afternoon for the following day and the 'Outlook' for two or more further days. These forecasts sometimes included an updated forecast for the day the forecast was issued i.e. as opposed to repeating the forecast for that day from the previous day. In April 2014 Defra began publishing more detailed Met Office forecasts. See:

<http://uk-air.defra.gov.uk/forecasting/>

A screenshot of Defra's **forecast** for Sunday 14 July is at Exhibit 5 to this letter. The forecast shows South Wales as green i.e. LOW for the Sunday. The text on the right of the map titled 'Latest forecast summary' includes the latest forecast for 'Today' (which was Saturday 13 July), 'Sunday' and 'Outlook'. Our client does not have a screenshot of Defra's forecast for Saturday 13 July that was issued on Friday 12 July 2013 or of the Met Office's air quality forecast(s) issued on either day for several thousand locations in the United Kingdom including Cwmbran, Pen Y Fan or the Brecon Beacons Visitor Centre. You will see that Defra's most up-to-date forecast for Saturday (i.e. shown as 'Today' in Exhibit 5) did not mention Wales specifically.

Monitored air pollution

In July 2013, it was (and remains) Defra's practice to publish hourly bulletins of **actual** air pollution data monitored at 128 monitoring sites. A 'Summary' map shows the Daily Air Quality Index for the highest monitored level of air pollution at any of the monitoring sites within each of 17 regions of the United Kingdom. The actual underlying data for all the sites is published on a separate webpage. An archive facility, accessed by selecting the 'Custom Date' below the Summary map, allows users to see the Summary map with the highest monitored data for each region on any date since 1 July 1972 at a later date i.e. the date of the Summary data appears above the map and the date of access is shown beside 'Monitoring site summary' on the right of the map. See:

<http://uk-air.defra.gov.uk/latest/>

A screenshot of Defra's **actual** 'Summary' Daily Air Quality Index for the 17 regions issued at 2200 on 13 July 2013 is at Exhibit 6 to this letter. It showed that from the monitoring data collected at that time the level of air pollution was reported at the **upper** end of the MODERATE scale in the South Wales region which includes the area of the Brecon Beacons i.e. 6 out of 10. This data is collected at monitoring sites named Cardiff Centre, Chepstow A48, Cwmbran (Exhibit 7), Narberth, Newport, Port Talbot Margam and Swansea Roadside. Of these, only Cardiff Centre, Cwmbran, Narberth and Port Talbot Margam within South Wales report ozone data.

At Exhibit 8, a further screenshot is attached showing Defra's **actual** 'Summary' Daily Air Quality Index for 13 July 2013 accessed at about 1000 on 8 September 2013 i.e. some two months later. This showed the highest monitored levels of air pollution in each region on 13 July 2013. Again, the air pollution level in South Wales was reported at the **upper** end of the MODERATE scale i.e. 6 out of 10.

At Exhibit 9, a further screenshot is attached showing Defra's **actual** 'Summary' Daily Air Quality Index for 13 July 2013 accessed at about 1800 on 9 June 2014 i.e. some 11 months later. This showed the highest monitored levels of air pollution in each region on 13 July 2013. This time, the air pollution level in South Wales was reported at the **lower** end of the MODERATE scale i.e. 4 out of 10. Here is the link:

<http://uk-air.defra.gov.uk/latest/index.php?date=13%2F07%2F2013&submit=Select#summary>

At Exhibits 10 and 11, our client shows the hourly mean data for each of the 24 hours reported by Defra for each of the following monitoring sites on 13 July 2013 (downloaded from Defra's website on 8 September 2013 and 9 June 2014 respectively) Aston Hill, Cardiff Centre, Cwmbran, Mold, Narberth and Port Talbot Margam. They show small changes in the data between those dates which is typical after Defra ratifies the data through a validation exercise.

It is clear from Exhibits 10 and 11 that the ozone level at Cwmbran was the highest in Wales on 13 July 2013 at a one-hour mean of up to 157 ug/m³. The highest running eight-hour mean ozone used for calculating the Daily Air Quality Index was 114.25 ug/m³. (Exhibit 10) and 114.9 ug/m³.

(Exhibit 11). Both these results put ozone levels in the MODERATE band at 4 out of 10 suggesting that the **actual** summary (Exhibit 6) and archived summary (Exhibit 8) may have overstated the Daily Air Quality Index at the upper end of MODERATE at 6 out of 10. Exhibit 9 appears to show the correct summary for eight-hour mean Ozone on 13 July 2013 i.e. MODERATE 4 out of 10.

Ozone levels close to requiring "Pollution warning"

As mentioned earlier, the WHO guideline for human exposure to Ozone is an eight-hour mean daily maximum of 100 ug/m³. According to Defra's ratified data this level was **exceeded** at Cwmbran on the afternoon of 13 July 2013. Perhaps more significantly, the maximum one-hour mean of 157 ug/m³ reported at 1800 on 13 July 2013 was just 12.8% below the 'Information threshold' of 180 ug/m³ under UK and EU law (see Annex XII of Directive 2008/50/EC). When that level is exceeded, Defra issues a 'Pollution warning' as it did for example shortly before the London 2012 Olympics. See:

http://www.euro.who.int/data/assets/pdf_file/0003/78681/E91399.pdf and

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF>

As far as our client has been able to determine, one-hour mean ozone of 157 ug/m³ reported at Cwmbran at 1800 on 13 July 2013 was the **highest recorded in any hour anywhere** in the United Kingdom that day on Defra's Automatic Urban and Rural Monitoring Network (see Exhibit 12). Such levels are rarely seen in the United Kingdom.

It seems likely that the level of Ozone air pollution increased as the soldiers climbed the Brecon Beacons and that it was consistently highest at the top of the hills.

i. Other evidence about Ozone levels on and around 13 July 2013

The UK experienced a serious air pollution episode between 11 and 27 July 2013 that included the weekend of 13 and 14 July 2013.

At Exhibit 13, a further screenshot is attached showing Defra's actual 'Summary' Daily Air Quality Index for 12 July 2013 accessed at about 1700 on 8 August 2014. This shows the highest monitored levels of air pollution in each region on 12 July 2013. Air pollution in South Wales was reported at the lower end of the MODERATE scale i.e. 4 out of 10.

At Exhibit 14, the table shows ratified one-hour mean Ozone at Cwmbran on 12 July 2013. It shows that the WHO guideline for eight-hour mean Ozone was exceeded during the afternoon at 101.75 ug/m³. with peak one-hour mean Ozone reaching 116 ug/m³ at 1800.

At Exhibit 15, a further screenshot is attached showing Defra's actual 'Summary' Daily Air Quality Index for 14 July 2013 accessed at about 1700 on 8 August 2014. This shows the highest monitored levels of air pollution in each region on 14 July 2013. Air pollution in South Wales was reported in the LOW band of the scale i.e. 3 out of 10.

Separately, our client had investigated the loss of monitoring data and/or failure to report air pollution at several Defra sites during that summer including at Charlton Mackrell on 14 July 2013. Defra's response is attached as Exhibits 16 to 18. Exhibit 18 is redacted but our client would be pleased to provide the original.

Appendix 5 – CAL’s previous attempts to draw the Ozone levels evidence, and relevant background information, to the attention of the Coroner and the Police

On 8 September 2013, our client contacted DC Dave Gilbert at Dyfed-Powys Police providing him with the Ozone evidence (Exhibits 1, 5, 6, 7, 8 and 10) with an explanation.

After further media coverage of the incident on 1 July 2014, our client wrote to the Coroner on 2 July bringing to her attention the fact there is evidence to suggest that Ozone air pollution may have caused or contributed to the deaths of the three soldiers. Our client attached substantially the same Ozone evidence previously sent to Dyfed-Powys Police together with some further information.

In his email, our client referred to the media coverage explaining that primary responsibility for the investigation had passed to the HSE.

On 21 July 2014, the Coroner’s office responded stating that: *"The Coroner suggests you contact HSE yourself. I am afraid that the Coroner is not able to help you further with this."* It would therefore appear that the Coroner is not going to take account of the Ozone evidence, or investigate whether the Ozone levels on 13 July 2013 caused or contributed to the deaths of the soldiers.

Later that same day, our client wrote to the HSE providing the same evidence as he had to the Coroner. To date he has had no response beyond an acknowledgement of receipt email on 22 July 2014.

