



Particulates Matter

Are emissions from incinerators safe to breathe?

“There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur.” WHO, 2013

How the Government has misled Parliament by the Particulate Research Group

This report, published in December 2019, is based on an analysis of Government answers to some of almost 70 Parliamentary Questions (PQs) asked by Dr David Drew, then MP, about the particulate matter emitted by municipal waste incinerators (MWIs). The evidence indicates that important cautions have been left unstated, false information given out and inconvenient facts not presented – resulting in criticism that the Government has misled Parliament.

There is widespread public concern about air quality in general and about incinerator emissions in particular. In September 2018, Dr Drew asked the Government about its policy on the safe limit for inhaling particulates. In response, Department of Health and Social Care said, “**Studies have not identified a threshold concentration below which there is no association between exposure to particulate air pollution and adverse human health.**”[1] In other words, adverse effects to human health are caused at all levels of exposure. Despite this, **the government continues to claim that the particulate matter emitted by MWIs is safe for us to breathe.**

Government claim: “[MWIs] contribute very little to emissions of particulate matter.”[2]

What the evidence says: In 2018, for the first time, MWIs were required to report on emissions of highly toxic PM2.5. Some did, in terms of weight. However, as **Defra’s Air Quality Expert Group** (AQEG) points out, measurement of particulate matter is usually given in numbers, not weight.[3] So we converted the weight in tonnes per year into a conservative estimate on the numbers of particulates pumped out per second.[4] (See Table 1)

Table 1. Weight and Numbers of PM2.5 emitted in 2018 [5]			
Site	Tonnes per year	No of particulates emitted per second	Scientific
Allington	16.919	29.1 billion	2.91E+10
Avonmouth	1.076	1.8 billion	1.80E+9
Belvedere	3.8558	6.6 billion	6.64E+9
Coventry	1.9	3.2 billion	3.27E+9
Edmonton	1.085	1.8 billion	1.87E+9
Ferrybridge	5.8355	10.0 billion	1.00E+10
Greatmoor	3.7382	6.4 billion	6.44E+9
Huddersfield	2.6864	4.6 billion	4.63E+9
Marchwood	1.269	2.1 billion	2.19E+9
Newhaven	1.317	2.2 billion	2.27E+9
Nottingham	3.1918	5.4 billion	5.50E+9
Portsmouth	1.893	3.2 billion	3.26E+9
SELCHP	2.5992	4.4 billion	4.48E+9
Sheffield	4.219	7.2 billion	7.27E+9
Stoke	1.052	1.8 billion	1.81E+9
Tyseley	6.01	10.3 billion	1.03E+10

Billions of highly toxic PM2.5 (“fine particles emitted from MWI sites posing a serious threat to human health”[6]) are emitted from these MWIs per second. The Government calls this “very little contribution to emissions of particulate matter.” *Would the people living near the incinerators agree?*

Government claim: “Well-run, regulated MWIs are not a significant risk to public health.”[7]

What the evidence says: The Government based its written response to this and ten other questions on three 2013 reports from experts: **Public Health England** (PHE), the **World Health Organisation** (WHO), and the **Health Effects Institute** (HEI). This seems reassuring – but a closer look at the reports themselves reveals that some important cautions have been omitted.

What other information did these reports provide (that was withheld from Parliament)?

PHE (2013) “We do not, however, know how to interpret measurement of number concentrations of particles in health terms.”[8]
WHO (2013) “There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur.”[9]
HEI (2013) talks of “limitations of the current evidence on the specific role of UFPs.” (These ultrafine particles are the smallest and most dangerous) [10]

The reports are not so reassuring after all, yet these known deficiencies in the Government’s evidence base were not made clear in its responses to Dr Drew’s parliamentary questions.

The truth is that the Government doesn’t know - and it doesn’t seem to care - about the contribution that Municipal Waste Incinerators make to particulate matter in the air that we breathe.

Governance or Negligence?

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Government ignores advice on the need for more information

The Government has repeatedly been told - by the studies it cited in its answers to PQs - that there is a lack of knowledge about particulate matter. We have already noted the 2013 PHE report which said, “We do not... know how to interpret measurement of number concentrations of particles in health terms.”[17] So the Government has based its policy on a report that admitted it ‘did not know’. Other reports, also quoted by the Government, made similar points:

- **The Committee on Medical Effects of Air Pollution (2006)** There is “a strong reason for further work.”[18]
- **WHO (2013):** There are "critical data gaps.”[19]
- **HEI (2013)** There are "limitations of the current evidence on the specific role of UFPs.”[20]
- **Johnson (2016)** There is a "lack of relevant toxicological data on [UFP] mixtures in ambient particulate matter.”[21]
- **DEFRA’s Air Quality Expert Group (2018)** “Few epidemiological studies investigating concentration-effect relationships for UFP are available, because of insufficient measurements of UFP metrics such as particle number concentration...”[22]
- **Parkes (2019):** “Further monitoring of exposures and health outcomes near MWIs appears warranted.”
- **DEFRA website (2019):** “As yet the precise toxicological mechanisms are not clearly understood.”[23]

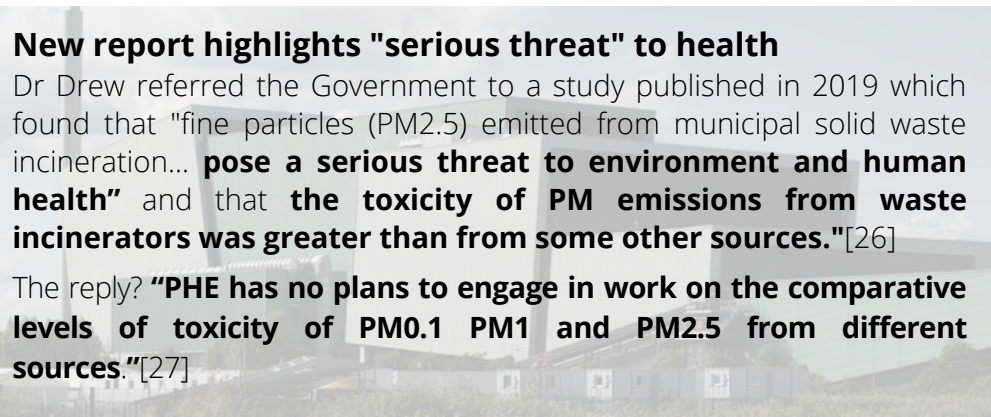
So Dr Drew asked if the Department of Health or PHE would carry out the research that had been recommended. The Government’s response was clear: “Currently, PHE has no plans to engage in work on the effects of PM1 and PM0.1 particles on human health over the coming year.”[24]

This lack of engagement was emphasised again in the Government's answers to eight other PQs. [25]

New report highlights "serious threat" to health

Dr Drew referred the Government to a study published in 2019 which found that "fine particles (PM2.5) emitted from municipal solid waste incineration... **pose a serious threat to environment and human health**" and that **the toxicity of PM emissions from waste incinerators was greater than from some other sources.**"[26]

The reply? **“PHE has no plans to engage in work on the comparative levels of toxicity of PM0.1 PM1 and PM2.5 from different sources.”**[27]



Dr Drew asked about more "recent research"[32] than the 2013 reports. He was referred to a 2019 report which concluded that **“living closer to the incinerators was associated with a very small increase in risk of some birth defects.”**[33] To explain this away, the PQ answer continued, “As acknowledged by the authors, this finding may be because the study could not fully adjust for factors such as other sources of pollution around MWIs or deprivation.”

The answer **did not mention** that the report also said, “Small increased risks (2-7%) with proximity to the nearest MWI were observed for **all congenital anomalies combined, congenital heart defects** and **genital anomalies**, specifically hypospadias [and...] it is not possible from these data to exclude a **potential causal effect.**”[34]

In other words, Parliament was told only part of the truth. The Government did not even mention the conclusions of two other recent studies into the health effects of waste incineration:

- An analysis of the 2013 PHE report published in the December 2018 *Journal of Biological Physics and Chemistry*, which concluded: **“It is doubtful whether the suggestion that there was no significant risk to public health was scientifically justifiable at the time; subsequent advices make it even less so.”**[35]
- A study in the 2019 *Journal of Hazardous Materials*, which concluded: “Fine particles (PM2.5) emitted from [MWIs] ... **pose a serious threat to environment and human health.**”[36] The study also found that: “MWI PM2.5 caused more serious cell injuries [than PM2.5 from some other sources], as indicated by the lower viability, higher ROS generation, and DNA damage.”

Parliament was NOT told of those recent research papers.

Parliament not told the whole story

In view of the repeated advice that more information is needed, especially about UFPs (ultrafine particles: PM0.1 and smaller), David Drew tabled numerous questions pressing the Government on the adequacy of their assessments, current research and planned research into UFPs.

The Government replied saying: **“Although no separate assessment of the impact of PM1 and PM0.1 components of particulate air pollution have been produced PM1 and PM0.1 are included within the PM10 and PM2.5 fractions, on which assessments are usually based.”**[28]

This reply was repeated in replies to nine other PQs.[29]

But particulate size does matter

Whereas it is true to say that PM2.5 includes all particles up to 2.5 microns in size, and thus by definition PM2.5 includes PM1 and PM0.1, that does not mean that their properties and behaviours are the same.

In fact **the smallest particles**, which are absorbed into the bloodstream through the lungs, and also permeate the food chain by falling on animals and crops, are precisely those that **are most hazardous to health**. The bag filter systems on municipal waste incinerators cut out the larger particles and produce an aerosol of these smallest particles, which is **likely to have long-term health impacts on communities** in the vicinities of waste incinerators.

It is incorrect for the Government to tell Parliament that because they are studying the behaviour of PM10 and PM2.5 they need not also study PM1 and PM0.1. And **the Government knows this, as its expert advisors have told it so.**

According to Defra’s own Air Quality Expert Group, “As the sources and behaviour of ultrafine particles in the atmosphere differ in substantial ways from the main component particles contributing to PM2.5... their spatial patterns and temporal trends cannot be inferred from PM2.5.”[30]

The Air Quality Expert Group explained, **“The behaviour and impacts of UFP in the atmosphere can differ from those of the substantially fewer, larger particles that dominate the currently regulated PM2.5 and PM10 size fractions.”**[31]

Despite such unambiguous statements from Defra’s Air Quality Expert Group, the Government maintained in 10 PQ replies that there was no need to study PM1 and PM0.1 as studies of PM2.5 already included the smaller UFPs. This is simply not an adequate answer to repeated questions on a serious matter of public health concern.

The Government's assurances on the health effects of particulate matter emitted from incinerators do not stand up to scrutiny.

In other words, the Government does not know - and it has no intention of trying to find out.

Endnotes

1 Government response to PQ No 174612 (15.10.18)
2 Government response to PQ No 215078 (08.02.19)
3 *Ultrafine particles in the UK* AQEG 2018
4 Using the formula tonnes*0.0000317/(2250*(2.5*0.000001)^3*Pi()/6), as per Reeks (2019)
5 Environment Agency *Pollution Inventory* 2018: <https://ea.sharefile.com/share/view/s26ce2ef6793486f8>
6 Yu Shang et al Vol 367 (2019) pp 316-324
7 PHE statement on modern municipal waste incinerators (MWIs) study, 2013
8 *The Impact on Health of Emissions to Air from Municipal Waste Incinerators* 2009 and 2013 p5
9 Review of evidence on health aspects of air pollution – REVIHAAP Project Final Technical Report 2013 p1
10 *Understanding the health effects of ambient ultrafine particles* HEI review panel 2013 p6
11 Answers to PQs 215205 (05.02.19); 215078 (08.02.19); 213917 (06.02.19); 213205 (05.02.19); 213202 (05.02.19); 213201 (05.02.19); 213202 (05.02.19); 213918 (06.02.19)
12 Answer to PQ No 213201 (05.02.19)
13 Answers to PQs Nos 135442 (20.04.18) and 174613 (12.10.18)
14 Answer to PQ 213913 (06.02.19)
15 *Characterisation of elemental in PM2.5 in a medium sized Swedish city dominated by a modern waste incinerator plant*, Aboh et al, 2006
16 Answer to PQ 213204 (01.02.19)
17 *The Impact on Health of Emissions to Air from Municipal Waste Incinerators* 2009 and 2013 p5
18 *Cardiovascular Disease and Air Pollution* February 2006
19 Review of evidence on health aspects of air pollution, REVIHAAP Project Technical Report p168

20 *Understanding the Health Effects of Ambient Ultrafine Particles* HEI Review Panel 2013 p6
21 *Journal of Hazardous Materials* Vol 320 August 2016, cited in answer to PQ 216917 (11.02.19)
22 *Ultra-Fine Particles in the UK* AQEG 2018
23 DEFRA particle numbers and concentrations network 2019 uk-air.defra.gov.uk
24 Answer to PQ 206215 (16.01.19)
25 PQ 212589 (01.02.19); PQ 213200 (05.02.19); PQ 213205 (05.02.19); PQ 213917 (06.02.19); PQ 213916 (06.02.19); 213918 (06.02.19); 213913 (06.02.19); 218744 (18.02.19)
26 *Cytotoxicity comparison between fine particles emitted from the combustion of municipal solid waste and biomass* Yu Shang, Meiying Wu, Jizhi Zhou, Xing Zhang, Yufang Zhong, Jing An, Guangren Qian, *Journal of Hazardous Materials* 367 (2019) pp 316-324
27 Answer to PQ 213913 (06.02.19)
28 Answer to PQ No 174612 (15.10.18)
29 PQs Nos 213202 (05.02.19); 213200 (05.02.19); 213199 (05.02.19); 213914 (04.02.19); 133899 (22.01.18); 272727 (12.07.19); 133899 (29.03.18); 206215 (16.01.19); 133899 (29.30.18)
30, 31 *Ultra-Fine Particles in the UK* (2018) p12, Key points
32 PQ No 268356 (02.07.19)
33, 34 Parkes et al 2019 Conclusion p 8
35 Vol 18 (2018) pp 164-166 by Jeremy J Ramsden, Clore Laboratory University of Buckingham
36 Yu Shang et al Vol 367 (2019) pp 316-324