PE2123: Update air quality standards in Scotland to align with 2021 World Health Organisation guidelines

Submission from Royal College of Physicians of Edinburgh (RCPE) Air Pollution Working group, 27 June 2025

1. **Do you support amending the Air Quality Standards (Scotland) Regulations 2010 to align with the 2021 WHO air quality guidelines? Please explain your reasoning.**

The RCPE strongly supports the adoption of the 2021 W.H.O. air quality guidelines. In Scotland, indeed last year we wrote to the 1st Minister with a similar request to that of Asthma + Lung UK Scotland asking for an immediate reduction of nitrogen dioxide (NO_2) to 20 µg/m^3 from 40 µg/m3, reaching the W.H.O. recommended 10 µg/m^3 by 2035. It is telling that the EU has revised its Ambient Air Quality Directive, introducing stricter limits for various pollutants, including NO_2. Here the new annual limit for NO_2 has been set at 20 µg/m^3 by 2030, down from the previous 40 µg/m^3, with the goal of achieving zero pollution by 2050, according to the European Environment Agency and the European Parliament[1].

In Scotland the largest number of Air Quality Management Areas (AQMAs) have been declared in response to exceedances of NO_2, furthermore NO_2, unlike particulate matter $(PM)_{2.5}$ or PM_{10}, fails to come close to the level advised by the WHO[2]. Thus, we believe one initial priority is for legislation to reduce these regulatory levels of NO_2 as quickly as possible, with an immediate drop to 20 µg/m^3 and a timeline of 10 years to achieve 10 µg/m^3. We consider it unlikely, looking at the current levels, that achieving 10 µg/m^3 at the present time cannot be done without societal and economic upheaval, which in themselves may have adverse effects on livelihoods and health without further measures of compensatory support. Smaller but significant falls in $PM_{2.5}$ should also be planned to take us close to the WHO levels, such as a reduction to 8 µg/m^3 immediately and to the WHO level of 5 µg/m^3 by 2035. and a timeline planned for fully achieving them.

One area to manage better, is to reduce the number of daily exceedances. There are many well designed studies showing that short term air pollution can be dangerous to health[3-6].

There are many relevant publications showing adverse effects on health at the current levels of Scottish air quality, and we have previously outlined these to the committee. A good summary of past data can be found in the English Chief Medical

Officer's annual report[7], however new Scottish data are presented in answer to question 3.

1. What progress has been made in reducing nitrogen dioxide and fine particulate matter in Scotland since 2022/23, when we last sought views on this?

Significant progress has been made such that all Air Quality Management Areas (AQMAs) now in force within Scotland had below regulatory levels. NO_2 in 2023 (Figure 1). Data are shown below from the 2023 annual report from Ricardo[8]. Similar results were seen for $PM_{2.5}$ and PM_{10}. These data show progress has been significant, but more can be done.

Fig 1: 2023 average annual readings for NO_2 in Scotland shown in blue for different AQMAs. The red line is the legal limit of 40 µg/m³.

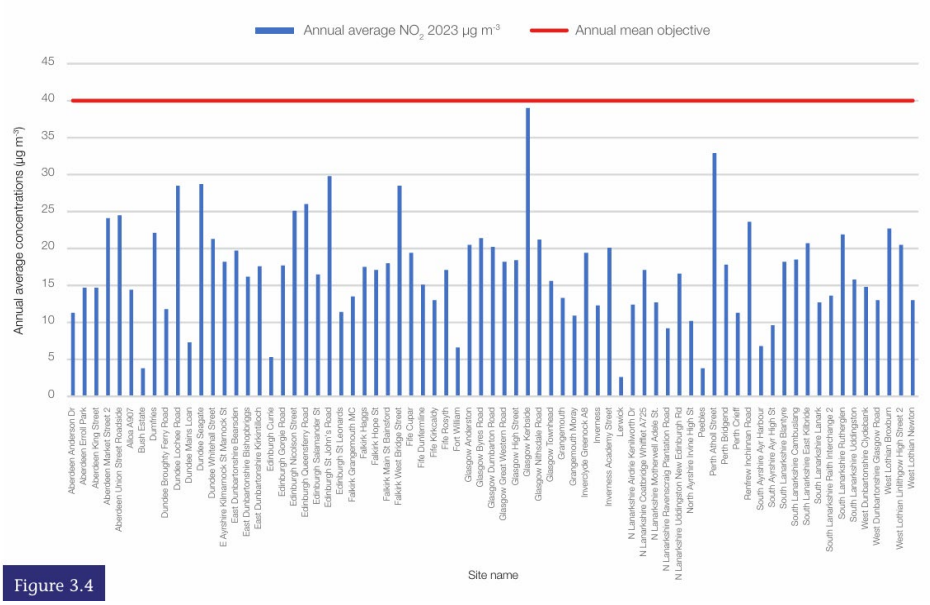


Figure 3.4

Fig 2: 2023 average annual readings for $PM_{2.5}$ (green) & PM_{10} (blue) in Scotland for different AQMAs. The red line is the legal limit of 18 µg/m³ for PM_{10}, the yellow line for $PM_{2.5}$ at 10 µg/m³.

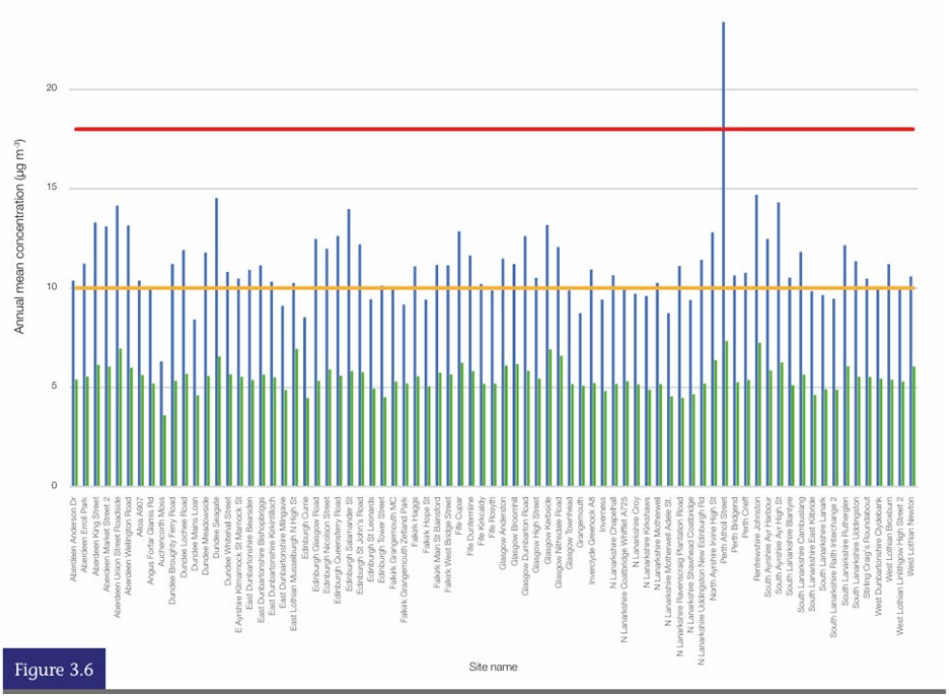


Figure 3.6

3. To what extent has scientific and public health evidence about air quality evolved since the current standards were adopted? In your answer you could refer, for instance, to impacts on nitrogen dioxide or fine particulate matter on particular groups of people, the effect of Low Emission Zones (or other interventions of a similar nature) on air quality, or any new information or data about the effect of burning particular types of fuel.

There are some recent novel pieces of work from Scotland since 2021 addressing air quality, which may help inform the committee. All ages continue to be affected by air pollution. All-cause mortality hazard increased with higher exposure to all air pollutants. PM_{10}, $PM_{2.5}$ and NO_2 were associated with cardio-respiratory and cancer mortality. SO_2, a pollutant commonly linked to powerplants, industrial activity and domestic boilers in the UK, is associated with mental and behavioural disorders mortality[9], and increased mortality risk has been confirmed in both urban and rural areas[10]. We know the lungs and brain are adversely affected by air pollution, and recent work confirms circulatory abnormalities are also related to air quality, with lower limb blood vessel occlusion[11] and hypertension[12]. Air pollution increases hospital admissions[13] and reduces the individuals' life satisfaction through health impairment[14].

Covid still affects our population and there is now clear evidence that $PM_{2.5}$ concentrations are associated with covid-related hospital admissions[10, 15], with a 1µg/m^3 increase in concentrations being associated with between a 7.4% and a 9.3% increase in hospitalisations. In addition, $PM_{2.5}$ concentrations are associated with deaths, with a 1 µg/m^3 increase in concentrations being associated with 2.9% to 10.3% increase in deaths.

Pregnancy remains a vulnerable time, with increased susceptibility to gestational diabetes in patients in areas of high pollution[16]. Exposure as a child can produce permanent affects in later life. A recent paper[17] showed that higher early life $PM_{2.5}$ exposure was associated with limiting long-term illness in mid-to-late adulthood. Air pollution around birth and in young-to-middle adulthood is linked to accelerated epigenetic ageing and telomere-associated ageing in later life[18].

In England associations were stronger among individuals growing up in disadvantaged families, further worsening pre-existing health inequalities[19].

Thus, when children are exposed to poor air quality, we see profound effects in later life. But they are also affected directly whilst still young. Hospital admissions for children are increased on days of high pollution, and they are affected at lower levels of NO_2 than adults[3].

As regards LEZ whilst these are fairly new in the UK, in other countries where the concept is better established, health benefits are being shown in their populations. Tokyo LEZ significantly decreased baby deaths[20]. Children exposed to cleaner air in utero and their first year of life require less medication for the five years studied[21]. Whilst LEZs drop pollution levels within the LEZ, an important finding in the Paris LEZ was that pollution levels dropped almost 40% in a 2.5km penumbra surrounding the area[22] as now compliant commuters drove to the city centre through these areas.

There is also evidence from the UK. Work from the London ULEZ showed substantial improvements in labour productivity, with sick leave reduced by 18.5% from pre-LEZ levels[23]. The ULEZ contributed to enhanced mental well-being, as evidenced by increased feelings of happiness, worthiness and satisfaction, along with a reduction in anxiety[23]. Following the introduction of the London LEZ, there was significant improvement in student test scores, with a positive effect on low-performing schools, demonstrating its potential to reduce educational disparities[24]. Within the London ULEZ children were 4x more likely to cycle or walk to school[25]. The Bradford LEZ showed lower GP attendances[26]. Other benefits are summarised here[27].

Data from the Glasgow LEZ shows significant improvement in air quality, even in the 1st phase. Data from this phase of the LEZ focused on buses and demonstrates air quality improvements in some of the busiest bus corridors in the city centre, emphasising the importance of reducing bus emissions. In its 1st year NO_2 levels in the city centre and LEZ area had dropped by 20% compared to diffusion tube monitoring from the previous year.

We have some provisional data from the Dundee LEZ, analysed as pilot work for a grant application to the Chief Scientist Office, to look at all Scotland's LEZs in terms of air quality and hospital admissions. A cost benefit analyses is also proposed. Please therefore keep these data confidential within the committee.

In Dundee provisional work shows considerable falls in air pollution within the LEZ. The example of NOx (a combination of mostly NO_2 and NO) and NO_2 is provided.

Table 1: The average NOx/NO_2 pollution/day for various study periods, within the area of the Dundee LEZ.

3 Dundee LEZ Monitors	**Dates**	**Mean NOx µg/m3 (sd)**	**NO_2 exceedances above 40 µg/m3 (days/y)**
Pre-lockdown	01/01/2014-23/03/2020	128.1 (64.1)	246
During lockdown	24/03/2020-01/03/2022	55.67 (26.06)	54
LEZ advisory	30/05/2022-30/05/2024	49.24 (21.68)	46
LEZ enforced	01/06/2024-30/05/2025	43.58 (24.19)	15

Furthermore, these falls are seen in a penumbra outside the LEZ. Dundee Lochee Road beside the LEZ IS given below as an example. The fall in levels during covid are confounding, but elsewhere, without a LEZ, there is a rebound in pollution levels, which is not seen in the LEZ. Perth Atholl Street is given as an example.

Table 2: The fall in air pollution in a 'penumbra' street, Lochee Road, and the rebound after covid in Perth where an LEZ has not been introduced.

Time period	Dates	Penumbra round LEZ	
		Dundee Lochee Road Mean (sd)	Perth Atholl street Mean (sd)
Pre-lockdown	01/01/2014-23/03/2020	44.97 (17.94)	41.99 (14.81)
During lockdown	24/03/2020-01/03/2022	30.16 (13.76)	26.97 (10.59)
After lockdown	01/03/2022-31/12/2024	37.40 (17.89)	36.77 (14.89)

Daily exceedances are also very important as mentioned above, as short daily bursts of pollution have been shown to increase hospital admissions in Scotland[11]. As can be seen these are substantially reduced by the LEZ. Seagate is given as an example.

Table 3: Average number of days/year that NO_2 mean daily levels exceeded 40 $\mu g/m^3$.

Study period	Dates	Seagate
Pre-lockdown	01/01/2014-23/03/2020	246.2
During lockdown	24/03/2020-01/03/2022	53.7
LEZ introduced but not enforced	30/05/2022-30/05/2024	46.4
LEZ enforced	01/06/2024-31/12/2024	25.5

Of relevance to proposals to reduce NO_2 to the WHO recommended level of 10 ug/m^3, the table below indicates how difficult this would be within a LEZ with traffic-based strategies alone, and a staggered approach from 40 to 20 $\mu g/m^3$ with a future target date of 10 $\mu g/m^3$, as previously suggested could be appropriate.

Table 4: Average number of days/year that NO_2 mean daily levels exceeded 20 $\mu g/m^3$.

Study period	Dates	Seagate
Pre-lockdown	01/01/2014-23/03/2020	356.3
During lockdown	24/03/2020-01/03/2022	270.5
LEZ introduced but not enforced	30/05/2022-30/05/2024	292.1
LEZ enforced	01/06/2024-31/12/2024	232.6

We are already seeing some provisional reductions in hospital admissions, not seen in Perth with no LEZ.

Table 5: Mean hospital admissions/day with standard deviation from Dundee LEZ and Perth city centre (Postcodes: P1, P2).

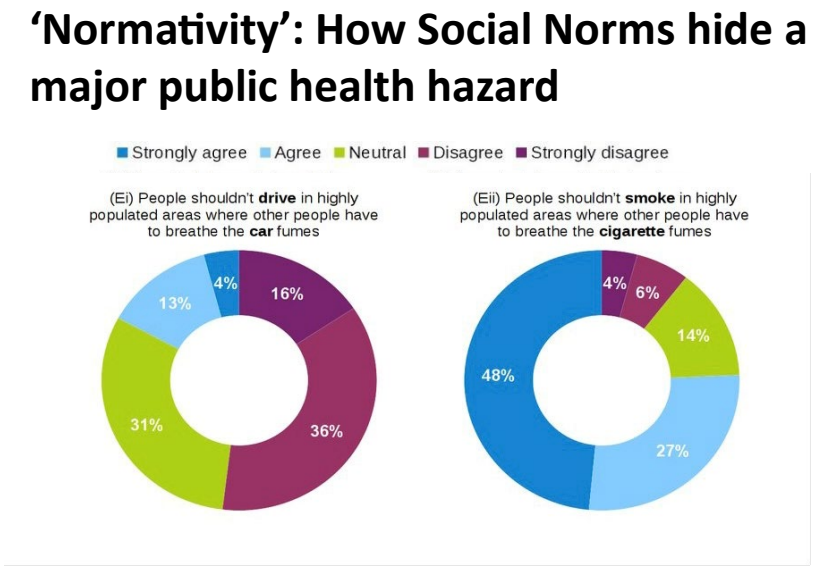
Study period	Dates	Perth Any admission	Dundee LEZ postcode admissions
Pre-lockdown	01/01/2014-23/03/2020	47.67 (17.51)	19.86(7.68)

During lockdown	24/03/2020-01/03/2022	32.77 (11.19)	11.38 (4.44)
LEZ enforced	01/03/2022-31/12/2024	42.01 (16.67)	9.00 (7.39)

In conclusion, Scottish data confirms the harms caused by air pollution, however evidence shows the introduction of low traffic areas improves air quality and provides health benefits.

4. The Scottish Government is currently reviewing the CAFS2 strategy with the goal of establishing a long-term policy framework to replace the strategy once it expires. What practical steps can the Scottish Government set out in its new strategy to reduce nitrogen dioxide and fine particulate matter levels?

1**. Public engagement**. This is a key area. Often it is a vocal minority who express concern regarding low emission zones, and the majority of the public when given facts, respond well. However, as air pollution is invisible, the benefits are not easily seen. The example given below illustrates this.



Walker I, Tapp A, Davis A. https://academic.oup.com/bjc/advance-article/doi/10.1093/bjc/azac102/7022236

A focus on children and their harms is often a good way to get parents involved. Signage, such as we see for speed restrictions, showing instead pollution levels, were shown to reduce idling round schools in Australia.

The use of portable sensors to measure air quality is a promising approach for the management of urban air quality given its potential to improve public participation in environmental issues and to promote healthy behaviours[27]. These could be introduced in schools as 'citizen science' projects, and we have already had some enthusiasm from schools to take part in such a scheme.

Key to engagement seems to be making the evet enjoyable[28]. Diverse communities need representation in climate/air pollution policymaking. One size does not fit all: different activities attracted different demographics. Activity enjoyment was significantly positively correlated to understanding. Understanding was significantly positively correlated to behaviour change intent. Policymakers should plan enjoyable activities to enable social learning between groups.

2. Reduce Travel by Car by improving Public Transport & Active travel. There are many strategies for reducing car travel, the most successful is by improving cheap and reliable public transport. Disappointingly the Scottish government dropped a key target to cut car use in Scotland by 20% by the end of the decade. Studies show people enjoy not using the car so much, but a 3-week car free experiment underlined the need for good public transport to achieve this[29].

Active travel, either on foot, wheels or cycle have been shown to improve health and reduce air pollution. Funded strategies should continue to support this. Importantly 'protected' cycle routes are safest and encourage children to cycle. In one study cities with dedicated bike lanes had 44% fewer deaths and 50% fewer serious injuries[30] interestingly white line lanes were found to be less safe than none at all. If a child enjoys cycling in childhood, they are more likely to continue active travel as an adult[31].

3. Electric buses, new or reconditioned. The Glasgow LEZ was showing excellent results pre-LEZ as bus companies brought their buses into permitted emissions for LEZ. The Previous Scottish Government had a generous grant scheme to facilitate this. The importance of bus emissions cannot be underestimated. An analysis from Spain[32] showed that by gradually replacing the current fleet of diesel buses with electric buses over 10 years), CO2 emissions would be reduced by up to 92.6%. We know from speaking with senior bus company executives that, as the Council school bus rates as low, the oldest diesel buses are used for school runs, not only polluting the children, but also the morning rush our commuter. Changing all school buses to electric has significant benefits[33]
A similar scheme could be provided for taxis, as has already been offered in some cities pre-LEZ.

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4. Removing freight from the road: In the EU, road transportation is responsible for producing more than 72% of greenhouse gases in the transportation sector. The road is followed by air transportation with 13.3%, marine with 12.8%, and rail transportation with about a 0.5% share in emissions[34]. The assessment of re-opening lines, or duelling single track hold ups, along with the promotion of rail transport for freight, would also reduce air pollution. Grants to hauliers to make this transition could be effective.

5. Promoting the use and purchase of electric vehicles (EVs) and improving charging infrastructure:. Further incentives to promote the purchase of

EVs is required. The home charger subsidy was useful, but the attenuation of the road tax could disincentivise. Grants to purchase second hand EVs would help the less well off.
Wider availability of chargers is key. Those who live in flats are particularly disadvantaged. Specifying a required number of charging spots, by law, as is done for disabled parking, would be helpful. These should be owned by the Council and the electricity cost the same as home charging, with only a small supplement added for maintenance.

6. **Targeting areas where vulnerable people congregate:** Low traffic areas round hospitals, care homes and schools are also important. More low traffic areas round schools will help protect our children, as will the adoption of mitigation strategies, such as 'Tredges', trellised hedges with hairy laved plants. Busing to school should be avoided, where possible, and this can be mediated via planning applications to ensure '30 min schools are available'.

Monitoring and reducing air pollution round our hospitals and schools should be undertaken, so that reduction strategies can be undertaken when high levels are detected. Care homes and community centres are also public spaces where potentially susceptible individuals may congregate.

7. **Targeting other sources of air pollution distinct from that related to traffic**.

Transport is currently the most significant source of many key air pollutants in urban areas. Although emissions from transport have declined over the years, the rate of decline has started to level off. Without additional measures to tackle transport-related air pollution, it is possible that emissions will begin to increase again. Sources other than transport are not inconsiderable. Table 3 below shows 2021 emission sources. Air pollution from domestic combustion sources such as wood fires, biomass boilers and wood stoves is becoming an increasingly large proportion of emissions, as sources from other sectors continue to be controlled and reduced. Non-mobile Secondary pollutants from agriculture also makes a substantial contribution to PM pollution even in cities.

The UKHSA has highlighted that it will be essential for a range of approaches to be employed in order for significant reduce air pollution and protect health [30]. We encourage the Scottish Government to perform, and make available, air pollution modelling all key air pollutants (NO_2, PM_{10}, $PM_{2.5}$, O_3, and ideally ultrafine particles and black carbon) and cost-benefit assessment for different air quality interventions to influence them. Figures from the Scottish Government below, show domestic heating emissions come close to equating transport emissions in recent years, with wood burning in the home cited as a major contributor of PM2.5 to air pollution in the UK[35].

Table 3: Emission Sources in Scotland 2021

Figure 24 – $PM_{2.5}$ Emissions in Scotland[12]

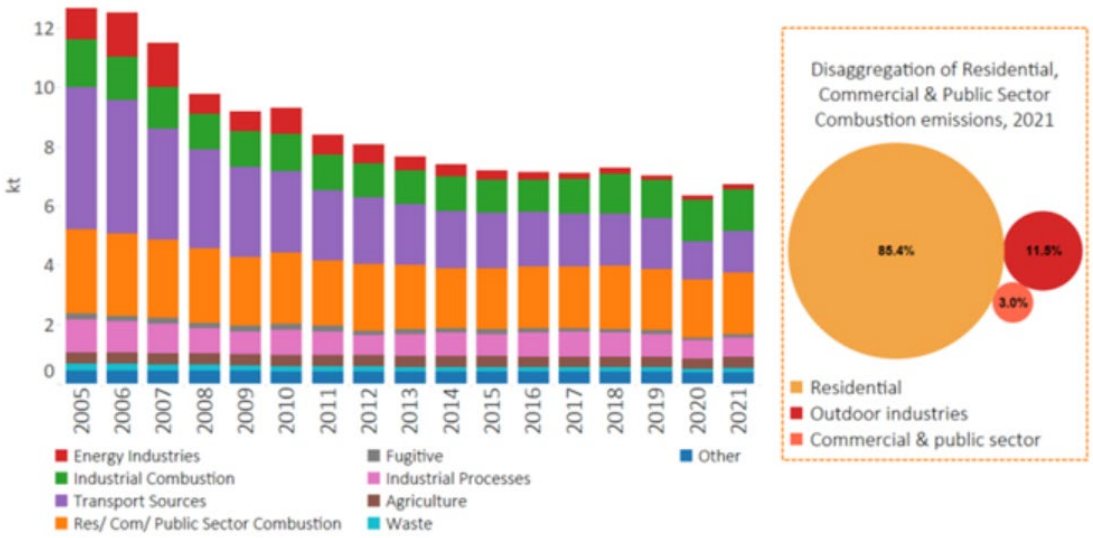
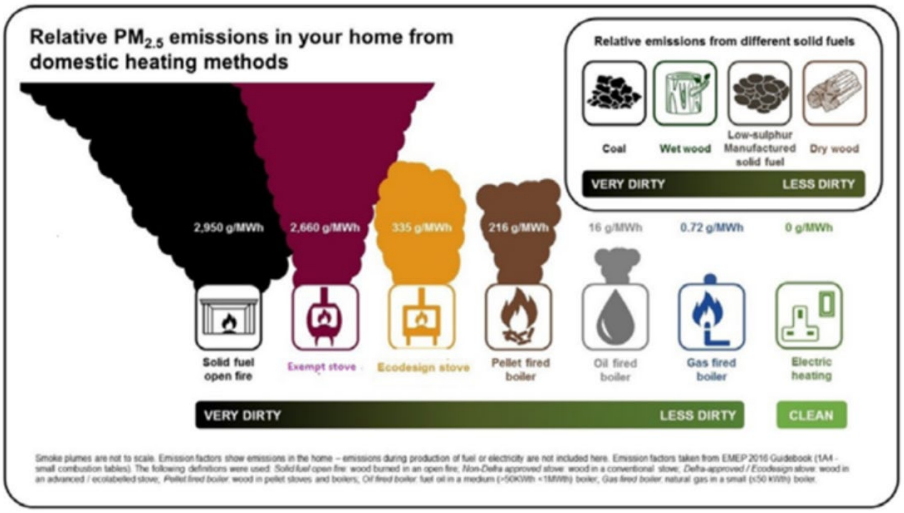


Table 4 below shows the emissions from various heating sources. As can be seen a real target for reduction of emissions is the burning of wood. Whilst emissions are reduced in the so called ‘eco stoves’ they still produce significant $PM_{2.5}$ pollution. We recommend that reconsideration of wood stoves being permitted in new builds be reconsidered, along with supporting households and businesses in transitioning to low-carbon heating solutions.

Table 4: $PM_{2.5}$ Emissions from Various Heating Sources



lative $PM_{2.5}$ emissions from different types of domestic appliance - **Cleaner Air for Scotland 2 - wards a Better Place for Everyone**

Conclusion

We strongly support Asthma + Lung Scotland proposals to reduce air pollution to levels recommended by the WHO and encourage the Scottish Government do

design a roadmap of implementation measures to achieve them. By doing so the Government will improve the health of the nation whilst addressing the inequality poor air augments[36]

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