Title: Review of Process Guidance for Crematoria **Date**: *26/01/2023* **BRU No:** *N/A* **Lead department or agency:** Department for Environment, Food and Rural Affairs **Other departments or agencies:** Click here to enter text.	De Minimis Assessment (DMA) **Stage**: Consultation **Source of intervention**: Domestic **Type of measure**: Secondary
Summary: Rationale and Options	**Contact for enquiries:** Control.Pollution@defra.gov.uk

Total Net Present Value[1] (2020 prices)	**Business Net Present Value[2]** (2020 prices)	**Net cost to business per year[3]** (EANDCB in 2020 prices)
£23.25m	-£13.09m	£1.59m

Rationale for intervention:

Market failures occur when a market leads to an inefficient or inequitable allocation of resources. There are numerous examples of market failures, including externalities. Externalities are spill over effects of economic activity which are not reflected in the market price. Air pollution is the classic example of a negative externality as the market price does not reflect the costs which air pollution imposes on human health and the environment. In the case of crematoria, the cremation of human remains leads to emissions of mercury, fine particulate matter (PM2.5), hydrogen chloride (HCl), dioxins and furans, volatile organic compounds (VOCs), and nitrogen oxides (NOx)[4]. These pollutants are emitted at scale from unabated crematoria and can enter the human body and natural environment, leading to negative impacts in both areas. Government intervention in this case aims to correct the market failures, safeguarding public health and the environment, thereby enhancing social welfare. In the absence of government intervention, these harmful emissions would continue, as the market does not incentivise crematoria to install abatement equipment, as it would require investment and ongoing costs and thereby lower the profits of crematoria.

In the 25 Year Environment Plan we committed to reduce remaining land-based emissions of mercury to air and water in England by 50% from a 2016 baseline by 2030[5]. However, mercury emissions have been steadily increasing over the last years, aggravated in particular by the pandemic[6]. Therefore, it is important that we take steps to respond to the wider health and environmental impacts of the pandemic and address this trend.

Intended outcomes:

Smaller industrial processes, including crematoria, are regulated by Local Authorities under the Environmental Permitting Regulations for emissions of pollutants to air. Standards for all industry sectors are determined through a process of establishing 'best available techniques' (BAT) as set out in the Process Guidance Notes (PGN) of each particular industry. The Process Guidance Note PG 5/2 (12) for Crematoria[7] is significantly outdated. It was published in September 2012 to ensure pollutant emissions and impacts to the environment from human cremations are minimised.

Defra proposes updating the PGN for crematoria to mandate the installation of mercury abatement equipment at almost every crematorium in the UK. It is not possible for the whole industry to become abated because of space issues in a small number of crematoria. It is intended that 95% of crematoria have mercury abatement equipment installed by 1st January 2027. The implementation date may be subject to final changes as delays in different stages of the delivery of the final guidance may occur.

[1] Using a discount of 1.5% for air quality impacts and 3.5% for all other costs and benefits.
[2] Using a discount rate of 3.5%.
[3] Using a discount rate of 3.5%.
[4] Data available at https://naei.beis.gov.uk/data/
[5] https://www.gov.uk/government/publications/25-year-environment-plan
[6] Data available at https://naei.beis.gov.uk/data/
[7] https://www.gov.uk/government/publications/crematoria-process-guidance-note-52

This is expected to significantly reduce emissions of mercury from crematoria, which will reduce the harmful effects of mercury on ecosystems and human health and assist with our commitment on mercury in the 25 Year Environmental Plan. The abatement technology is also effective at reducing emissions of PM2.5, hydrogen chloride, and dioxins and so reductions in emissions of these pollutants from crematoria are also expected, which will bring wider health and environmental benefits. There should also be climate benefits, as the revised guidance allows for all cremators to reduce their gas consumption, spelling out lower emissions of greenhouse gases. The revised guidance also mandates that crematoria monitor on-site NOx emissions, with the intention of using the data collected to set an emission limit value in the future. This is crucial, as NOx is one of the main pollutants emitted by combustion processes. Without an update to the 2012 guidance, any future pandemics which lead to mass fatalities may cause further spikes in mercury emissions.

Options Considered:

Option 0: Do nothing (maintain 2012 guidance, non-regulatory)

Further mercury abatement may happen when replacing existing (non-abated) equipment due to major repair. This may not be guaranteed as the current guidance only requires that 50% of cremations are required to be abated – which is already more than achieved by industry – and abatement would incur additional costs for crematoria. Even if abatement is addressed in each major replacement, it will take much longer for industry to become fully abated.

The current guidance has also become out of date in relation to other factors that are key in addressing other relevant pollutants, as follows:

- NOx is one of the main pollutants emitted from combustion processes and is one of the key pollutants with statutory targets for 2030. The current guidance provides no advice on NOx and so availability of data is very limited.
- Monitoring Methods – the current guidance does not specify that monitoring equipment, techniques, personnel and organisations employed for the emissions monitoring programme should be accredited.
- Air Quality Assessments and Chimney Height – the current guidance references the calculation of chimney height to a 1993 guideline. The impact of the stack height is particularly important in relation to emissions to NOx and its impact of emissions on local air quality.
- There is no flexibility in the combustion conditions in the current guidance as there is no major consideration to other pollutants (e.g., NOx) other than mercury.

Option 1: Publish an updated process guidance note for crematoria (preferred option)

Evidence from the review of current standards has demonstrated that emission levels of most pollutants are significantly lower in abated cremators. New guidance proposes that 95% of industry will be abated by January 2027, which will significantly reduce emissions.

The review of the guidance started in June 2021. This has been led by the Environment Agency's Local Authority Unit, following a series of invitations to relevant technical experts, industry, regulators, and other interested parties to participate in a Technical Working Group (TWG). The review process has been open and participative, data and evidence led, and consensus-based decision making has led to agreed standards for the new guidance.

Abatement technology (known as "flue gas treatment system") was originally introduced to reduce emissions to air of mercury. However, this system is also effective in reducing other major pollutants (particulate matter (PM), dioxins and acid gases). The impact on particulate matter and dioxins will be even greater. Mass emissions data collected during the review of this guidance indicates that the flue gas treatment removes almost 96% of particulate emissions and around 83% of acid gases. If the level for flue gas treatment can be raised from 70% to

95%, emissions of particulates and dioxins will be reduced by 71%. Emissions of mercury and acid gases will be reduced by 47%.

Other main changes that the new guidance proposes are:

- Monitoring of NOx (NO and NO2) emissions for all cremators with an emission limit value set in 2027 for abated cremators, including measurement of ammonia slip.
- More flexibility on combustion conditions (temperature and residence time) in the secondary combustion chamber provided all ELVs can be achieved. Carbon monoxide is also now a performance measure rather than emission limit value.
- Requirement to report on carbon emissions arising from the use of fuel, electricity consumption, and the combustion of coffins including any fittings.
- Requirement for all emissions monitoring, equipment, techniques, personnel, and organisations employed to be accredited to EN ISO/IEC 17025 or MCERTS. These are technical accreditations that provide an independent and authoritative declaration that the organisation carrying out the emissions monitoring undertakes the activity professionally and competently. This will raise emissions monitoring standards.
- Requirement to carry out an assessment of emissions on local air quality, replacing the use of current chimney height calculation (D1), which is out of date.

The revised draft guidance makes a substantial step forward in reducing the environmental impact of the cremation sector through its emissions to air. It enjoys a high level of support from all parts of the industry and from regulators.

The United Kingdom ratified the Minamata Convention into law in 2018[8]. This entails a number of measures designed to tackle mercury deposition, including phasing down the use of amalgam fillings[9]. However, the use of dental amalgam in the UK is an ongoing practice and so abatement at crematoria is necessary to mitigate emissions of mercury from the cremation process.

Other Options:

Non-regulatory options were considered. For instance, we discussed an accreditation scheme, similar to the Red Tractor scheme for food and drink[10], whereby crematoria compliant with the guidance could signal themselves as being less environmentally damaging than those without accreditation. The idea of accreditations is that consumers can discern between products based on their environmental impact and make more sustainable purchases. We deemed this unlikely to be effective given that crematoria are sparsely located across the UK and so customers are likely use their local crematorium and not 'shop around' based on environmental impact.

We also considered a code of good practice – in effect, making the guidance optional rather than statutory. However, there is no reason to believe that an optional approach would succeed in increasing abatement uptake as the 2012 guidance has led to uptake plateauing at slightly over 70%. Uptake has been stagnant at this level for some time.

With the issues associated with the above two non-regulatory options in mind, we identified proceeding with the guidance review as our preferred option.

[8] https://www.mercuryconvention.org/en/parties

[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/731998/TS_9.2018_Minamata_Convention.pdf

[10] https://redtractor.org.uk/about-red-tractor/

Rationale for DMA rating

The Equivalent Annual Net Direct Cost to Business (EANDCB) of this measure is £1.59m/year, which is under the threshold of £5m/year[11]. This figure includes the following direct costs and benefits to business. For costs, these are: the equipment, reagent, servicing costs, and electricity consumption. The sole direct benefit to businesses is the reduction in gas consumption. The analysis explained in this document is proportionate to the policy being proposed.

In further satisfaction of the requirements of a de minimis assessment, this policy is not expected to have:

- Significant distributional impacts between sectors, as it focuses solely on crematoria. There will be reductions in harmful emissions close to crematoria, bringing benefits to local populations and ecosystems, but this is simply a consequence of the policy targeting crematoria;
- Significant gross impacts despite net impacts being under £5m. All costs and benefits associated with this policy are proportionate to the policy being proposed;
- Disproportionate burdens on small businesses. This policy is focused on crematoria, which are all likely to be small businesses, so it is not the case that some in scope small businesses are impacted whilst others are not. On this basis, exemptions or mitigations to alleviate the burden on small businesses are not compatible with achieving a large part of the intended benefits of the measure.
- Significant wider social, environmental, financial, or economic impacts. The policy targets emissions of mercury and generates wider benefits associated with emissions of other pollutants and greenhouse gases, though these are relatively modest versus those associated with other interventions;
- Any novel or contentious elements. Mandating the installation of abatement equipment at an industrial source is not a novel approach, nor is it believed to be contentious.

Will the policy be reviewed? No		If applicable, set review date:		
Are these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** No

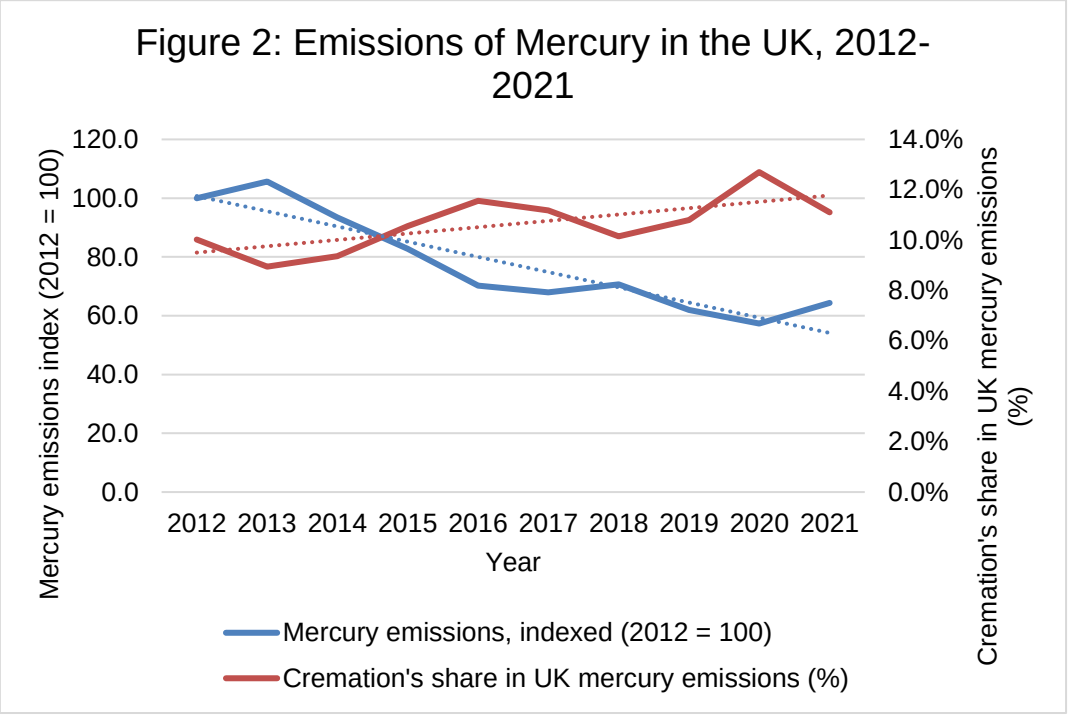
Senior Policy Sign-off:	✓	Date:	20/12/2022
Peer Review Sign-off:	✓	Date:	30/01/2023
Better Regulation Unit Sign-off:	✓	Date:	28/02/2023

[11] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/916918/better-regulation-guidance.pdf

1.0 Policy Rationale

Policy background

1. Mercury is of particular interest due to its health impact even at low levels. Some mercury compounds, including methylmercury, are extremely toxic. In humans there can be damage to the brain, kidneys, and lungs. Mercury is also a threat to the natural environment, where it occurs in various forms. Mercury is found in dental amalgam fillings and is emitted to air from those crematoria which have no abatement measures in place, and in much smaller quantities from abated crematoria. The work of the LAU-led TWG on crematoria revealed that, currently, approximately 70% of cremations in England take place in crematoria fitted with mercury abatement technology.
2. In the 25 Year Environment Plan we committed to reduce remaining land-based emissions of mercury to air and water in England by 50% from 2016 baseline by 2030. Mercury emissions have been aggravated by the pandemic. Therefore, it is important that we take steps to respond to the wider environmental impacts of the pandemic and ensure mercury targets are met.
3. UK emissions statistics indicate a large spike in emissions of mercury from crematoria in 2020. We are starting to see significant decreases in mercury emissions from larger industrial sites as a result of UK power generation moving to a cleaner fuel mix in the long term, including the cessation of coal burning, and the decommissioning of the UK's only mercury chlor-alkali facility[12]. As a result of these improvements, the proportion of mercury emissions coming from crematoria has increased. Figure 2 below demonstrates this, showing that crematoria's share in the UK's mercury emissions trended upwards between 2012-2021[13]relative to the decreased total amount, which trended downwards during the same period. This is likely to be addressed by expanding abatement technology across the sector.



Problem under consideration

[12] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1133967/environmental-improvement-plan-2023.pdf
[13] Data available at https://naei.beis.gov.uk/data/

4. Mercury is the main driver for the guidance review. The greatest risk to human health from mercury deposition is the potential accumulation of methylmercury, the toxic form of mercury, found in fish farmed for human consumption[14].
5. The emissions of the following pollutants are also considered key issues for the guidance review, which are released at different stages of the cremation process:
    - Total particulate matter (PM)
    - Hydrogen chloride (HCl)
    - Volatile organic compounds (VOCs)
    - Dioxins and furans
    - Nitrogen oxides (NOx)
    - Carbon dioxide (CO2)
6. NOx is one of the main pollutants emitted during the combustion process, and one of great concern for air quality as the UK has legally binding emission reduction targets associated with NOx for 2020 and 2030. The UK met its targets for 2020[15] but the latest projections, published in July 2022, show that we are forecast to exceed the 2030 target[16].

Rationale for intervention

7. Market failures occur when the market leads to an inefficient or inequitable allocation of resources. There are numerous examples of market failures, including externalities. Externalities are spill-over effects of economic activity which are not reflected in the market price. Air pollution is the classic example of a negative externality as the market price does not reflect the costs which air pollution imposes on human health and the environment. The market also does not incentivise crematoria to install abatement equipment, as it would require investment and ongoing costs and thereby lower the profits of crematoria.
8. The government is taking action to protect the public and the environment from the damage caused by exposure to emitted pollutants. Mandating the installation of abatement equipment at crematoria will bring benefits to both human health, and the environment. Abatement technology not only reduces mercury emissions during combustion, but also controls and reduces emissions to air of particulate matter, dioxins, and hydrogen chloride.
9. Without intervention, crematoria would continue to release harmful emissions to the air at current levels, negatively affecting human health and the environment.

Policy objective

10. Mercury abatement technology (flue gas treatment) was originally introduced to reduce emissions to air of mercury, and it is the starting point for the guidance review to extend this Best Available Technique (BAT) to existing unabated cremators over an appropriate timescale, to make industry almost fully abated (~95%). It is not possible for the whole industry to become abated because of space issues in a small number of crematoria.
11. The principle of flue gas treatment is the injection of reagents into the flue gas the gas emanating from the plant owing to the combustion process – in the form of a mixture of sodium bicarbonate or lime and activated carbon. The sodium bicarbonate reacts with the acidic gases and the carbon absorbs mercury and dioxins.

[14] https://www.who.int/news-room/fact-sheets/detail/mercury-and-health
[15] https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-background#annual-emission-ceilings
[16] https://naei.beis.gov.uk/resources/Annex_I_UK_CLRTAP_2022Submission_v1.xls

12. Flue gas treatment has proved to be effective in absorbing not only mercury, but it is also successful in reducing emissions of dust (particulate matter), acid gases (HCI), and dioxins and furans.
13. Mass emissions data collected from crematoria during the review process, described in the "Options Considered" box above, indicate that flue gas treatment removes almost 96% of particulate and dioxin emissions and around 83% of mercury and HCl emissions.
14. Data collected during the same guidance review process demonstrate that, currently, around 71.8% of cremations in the UK are carried out in cremators fitted with a flue gas treatment system. If the level for flue gas treatment could be raised from 71.8% to 95%, emissions of particulates and dioxins will be reduced by 71%. Emissions of mercury and HCI will be reduced by 47% by raising abatement to the same level.
15. Given this level of performance, flue gas treatment is the best available technique (BAT); the same technology should be set across the sector to create a level playing field.
16. The 2012 crematoria guidance does not refer to emissions of NOx, so there is limited data available. The new guidance considers NOx a key pollutant and requires mandatory monitoring and the ambition for the introduction of future emission limit values (ELV) by 2027.
17. There are other elements associated with the cremation process that play a significant role in the combustion conditions (e.g., temperature in the second chamber), which also affect energy efficiency and fuel consumption. These have not been considered in their full potential in the current crematoria guidance, and how these lead to carbon emissions. Under the new guidance, there is scope for greater flexibility in specifying the combustion conditions in the second chamber, provided that ELVs are not exceeded, which leads to a major saving consumption and reduction in carbon emissions.
18. The revised draft guidance makes a substantial step forward in reducing the environmental impact of the cremation sector through its emissions to air. It will also ensure the UK is prepared for any future pandemics where we may see an increase in operating hours of crematoria, ensuring minimal impacts on human health and the environment.

Options considered

Option 0 – Do Nothing

19. Data provided by industry show that, at present, more than 70% of cremations in the UK are carried out in cremators fitted with abatement. The current guidance has proved to be fit for purpose in its original intention to go further than the minimum number of cremations (50%) taking place in abated cremators. Industry data show that this has led to a decrease of main pollutants associated with crematoria, such as mercury, particulate matter, acid gases, and dioxins, and furans. Industry has responded and progressed well.
20. Under the current guidance, there is also a burden sharing scheme in place called the Crematoria Abatement of Mercury Emissions Organisation (CAMEO) that enables the cost or burden of abating to be shared across the sector. The CAMEO scheme operates a trading pool where those operators who have exceeded the 50% abated cremations can benefit from their surplus by selling it to those who have abated less than the annual target.
21. While the scheme has contributed positively to abated operators, the sector seems to have become stagnant around current levels of abatement (70%). With the new guidance, the cremation industry will become almost fully abated by 1 January 2027, so it is expected that the CAMEO scheme will no longer be required after that date.
22. However, under the 25 Year Environment Plan and policies aimed to improve emissions at local level, we are committed to reduce mercury concentrations further and achieve targets for key pollutants. This will not be achievable if we keep standards within the current guidance, as the only way to further reduce emissions is for industry to become fully abated. There are also key

considerations that are out of scope in the 2012 guidance (e.g., lack of monitoring and ELVs for NOx, stack height design) that play an important role in helping to reduce national emissions, which have been included in the review.

23. Industry has fully engaged in the crematoria guidance review to date, and, alongside regulators, there has been consensus regarding the proposed guidance. If the guidance update does not progress, industry may see the decision as a lack of ambition and commitment, and a waste of their time engaging in the process to date. Standards would not move forwards, and we would not see a decrease in emissions of key pollutants as a result.

Option 1 - Publish an updated process guidance note for crematoria (preferred option)

24. Our preferred option is to proceed with the review of crematoria guidance, as agreed by the Technical Working Group (TWG), to achieve further reductions of mercury and emissions of other associated pollutants. This will also bring a level playing field across industry, where the crematoria sector will become almost fully abated. There is currently a CAMEO scheme in place where unabated cremators make financial contributions to compensate investments in abatement by abated cremators. It works on a voluntary basis and does not offset the cost of an abated system.
25. The review has also recommended an obligation to monitor NOx, with the ambition to set future ELVs. The new guidance also replaces an out-of-date calculation method of the chimney height and sets a requirement to assess the impact of emissions on local air quality, which must demonstrate an insignificant impact. This is especially important given NOx emissions are not part of the 2012 guidance and therefore not considered when the stack heights of many crematoria were designed.
26. There are requirements to report on carbon emissions arising from the use of fuel, electricity consumption, and the combustion of coffins including any fittings; and tighter obligations for all emissions monitoring, equipment, techniques, personnel, and organisations employed to be accredited to EN ISO/IEC 17025 or MCERTS. These are technical accreditations that provide an independent and authoritative declaration that the organisation carrying out the emissions monitoring undertakes the activity professionally and competently. This will raise emissions monitoring standards.
27. All the above will play an important role, not only by reducing emissions further but in monitoring other key pollutants, which will set the basis for future regulation. The new guidance will bring standards and technology within the sector to up to date levels.
28. The United Kingdom ratified the Minamata Convention into law in 2018[17]. This entails a number of measures designed to tackle mercury deposition, including phasing down the use of amalgam fillings[18]. However, the use of dental amalgam in the UK is an ongoing practice and so abatement at crematoria is necessary to mitigate emissions of mercury from the cremation process.

Other Options

29. Non-regulatory options were considered. For instance, we discussed an accreditation scheme, similar to the Red Tractor scheme for food and drink[19], whereby crematoria compliant with the guidance could signal themselves as being less environmentally damaging than those without accreditation. The idea of accreditations is that consumers can discern between products based on their environmental impact and make more sustainable purchases. We deemed this unlikely to be effective given that crematoria are sparsely located across the UK and so customers are likely use their local crematorium and not 'shop around' based on environmental impact.

[17] https://www.mercuryconvention.org/en/parties

[18] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/731998/TS_9.2018_Minamata_Convention.pdf

[19] https://redtractor.org.uk/about-red-tractor/

30. We also considered a code of good practice – in effect, making the guidance optional rather than statutory. However, there is no reason to believe that an optional approach would succeed in increasing abatement uptake as the 2012 guidance has led to uptake plateauing at slightly over 70%. Uptake has been stagnant at this level for some time.
31. With the issues associated with the above two non-regulatory options in mind, we identified proceeding with the guidance review as our preferred option.

2.0Costs and Benefits

Option 0 – Do Nothing

32. If no policy were implemented, the existing stock of crematoria would largely remain as is, though some may install abatement equipment as their existing technology expires. The current stock is summarised in Table 1 below, where the number of crematoria has come from the Cremation Society[20]. Data from industry indicates that 35% of all crematoria are single unit (have one cremator/can perform one cremation at a time), 55% are double unit, and 10% are triple unit.

Table 1: Existing Stock of Crematoria			
Number of units per crematorium	**Number of crematoria**	**With abatement technology**	**Without abatement technology**
1	110	74	36
2	173	135	38
3	33	26	7
Total	*316*	*235*	*81*
% Of Total	*100%*	*74%*	*26%*

33. There would be no change in emissions of PM2.5, mercury, dioxins, or HCl, relative to the baseline. Figures 3-4 below show the potential path of these pollutants over 2024-33, the would-be first 10 years of the policy's lifetime.
34. These graphs cover modelling of emissions from both abated and unabated crematoria. They have been generated by combining emission factors given by a provider of crematoria abatement equipment, shown in Table 2 below, with a forecast in the number of cremations in the UK. This approach is also used by the National Atmospheric Emissions Inventory (NAEI) to forecast emissions from crematoria[21].

Table 2: Emission Factors for Unabated and Abated Crematoria, with Benefit of Abatement			
Pollutant	**Unabated (g/cremation) (A)**	**Abated (g/cremation) (B)**	**Benefit g/cremation (A)-(B)**
PM2.5	114.7	4.8	109.9
Mercury	0.5	0.03	0.5
Dioxins	6.25E-07	2.62E-08	5.99E-07
HCl	62.7	10.7	52.0

35. The charts show that emissions from crematoria are highest for PM2.5 and slightly lower for hydrogen chloride. Emissions of mercury and dioxins[22] are far lower but not trivial, as even low levels of emissions can have damaging impacts on human health and the environment.

[20] https://www.cremation.org.uk/progress-of-cremation-united-kingdom
[21] Please refer to https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2203151456_GB_IIR_2022_Submission_v1.pdf and https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2207211449_GB_IIR_2022_Projections_Addendum.pdf for more information.
[22] Any reference to masses of dioxins is expressed as masses of International Toxic Equivalent (I-TEQ). This combines the mass of all species of dioxins emitted in terms of how toxic they are compared to the most toxic species of dioxin, 2,3,7,8TCDD. More information can be found at https://doi.org/10.1093/toxsci/kfl055.

Figure 3: Baseline Emissions of PM2.5 and HCl without Policy, 2024-33

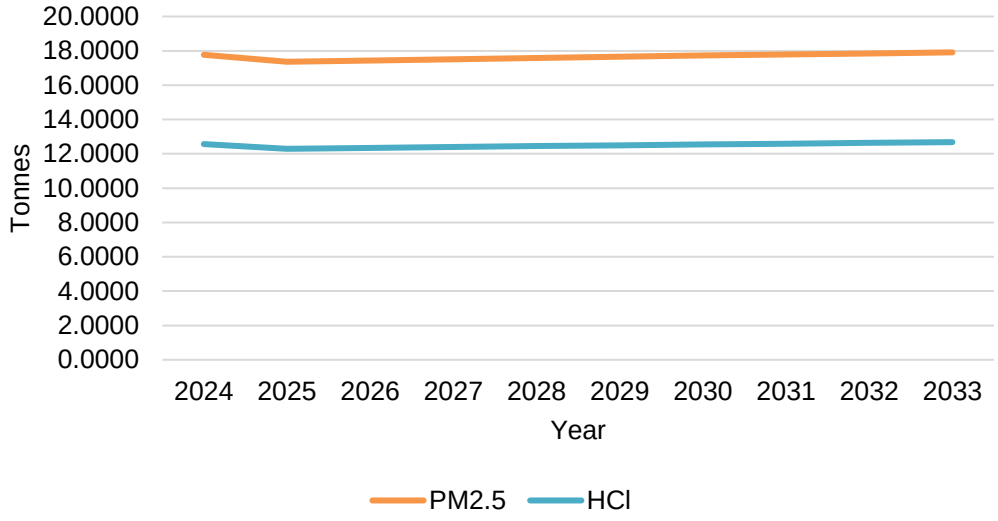
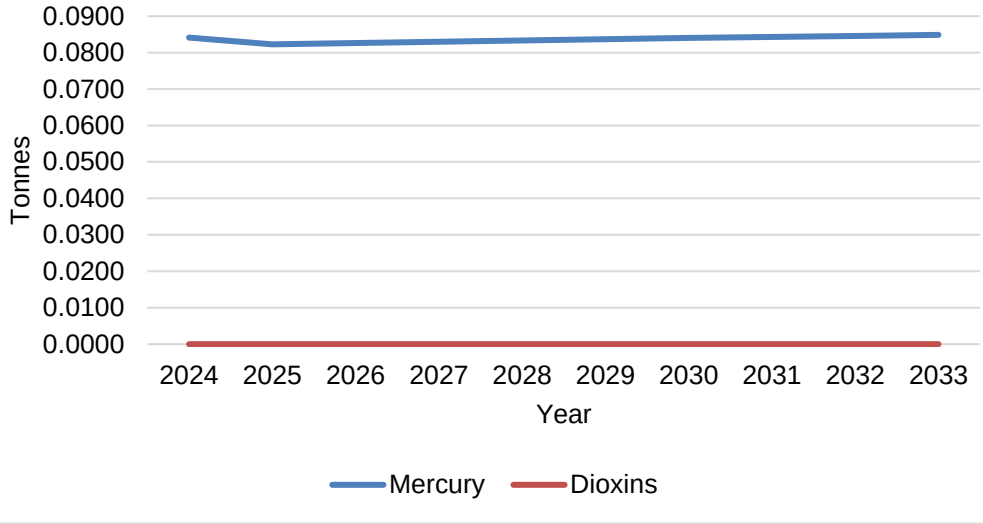


Figure 4: Baseline Emissions of Mercury and Dioxins without Policy, 2024-33



Option 1 – Retrofitting Unabated Crematoria with Abatement Equipment

36. This policy would lead to the following abatement path for PM2.5, mercury, dioxins, and HCl. The emission factors detailed in Table 2 above are also used to generate these charts, along with an assumption on the number of newly abated cremations per year. In 2024, we assume that 0% of all cremations are newly abated, rising to 11.6% in 2025, and 23.2% from 2026 onwards. This brings the overall level of abatement assumed to 95%, which is the intention of the policy. The charts below therefore only refer to lower emissions at those crematoria that will be retrofitting with abatement equipment.

Figure 5: Changes in Emissions of PM2.5 and HCl Under New Guidance, 2024-2033

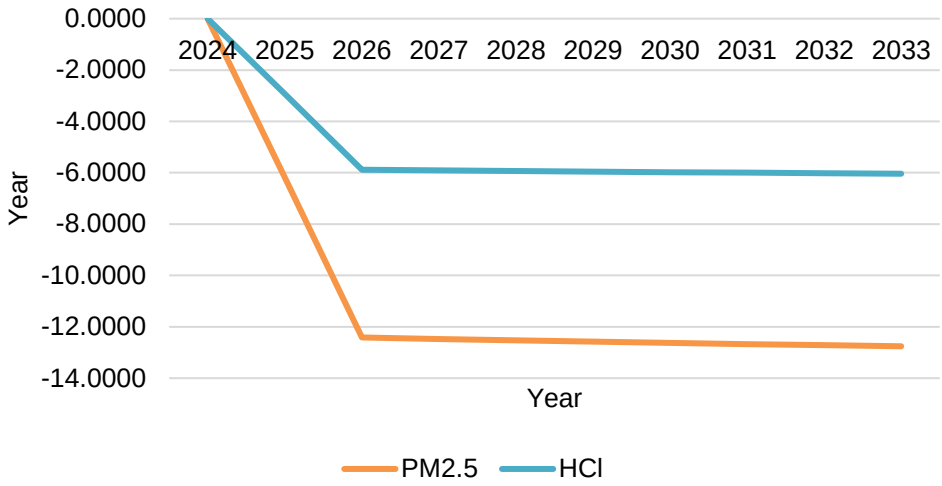
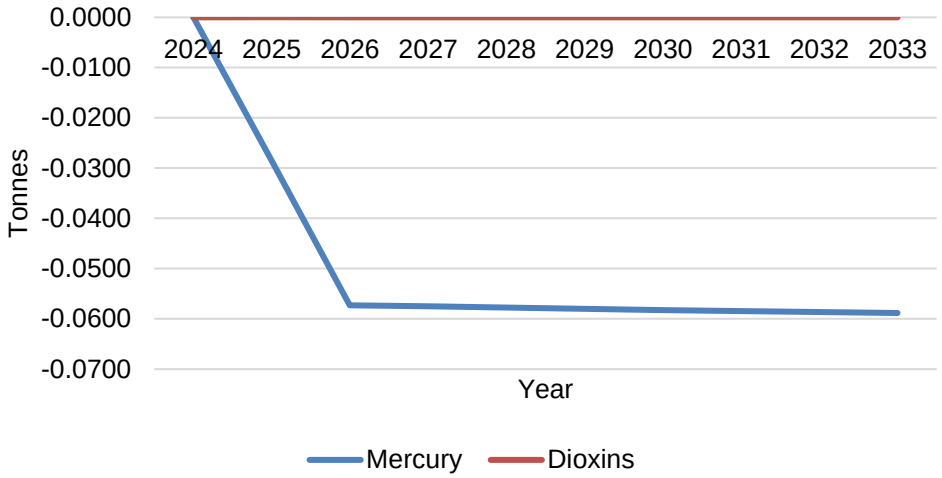


Figure 6: Changes in Emissions of Mercury and Dioxins Under New Guidance, 2024-2033



37. From these graphs, we can see that the largest reduction of emissions is of PM2.5. Reductions of hydrogen chloride are also significant. The policy achieves relatively lower levels of abatement of mercury and dioxins, though the impacts of these pollutants on human health and the environment mean that these reductions are still significant.
38. A cost-benefit analysis has been conducted for this intervention and the results are presented in Table 3 below:

Table 3: Results of Cost-Benefit Analysis, 2024-2033[23]

Category	Total (Discounted, £m)
Benefits	
PM2.5	£14.77
Mercury	£7.20
Dioxins	£0.03
Gas (£)	£7.19
Gas (GhG)	£14.93

[23] Note: these results do not include a monetised value for the benefits associated with reductions of hydrogen chloride, or the costs of familiarisation, monitoring and enforcement by local authorities, or additional monitoring and reporting by crematoria

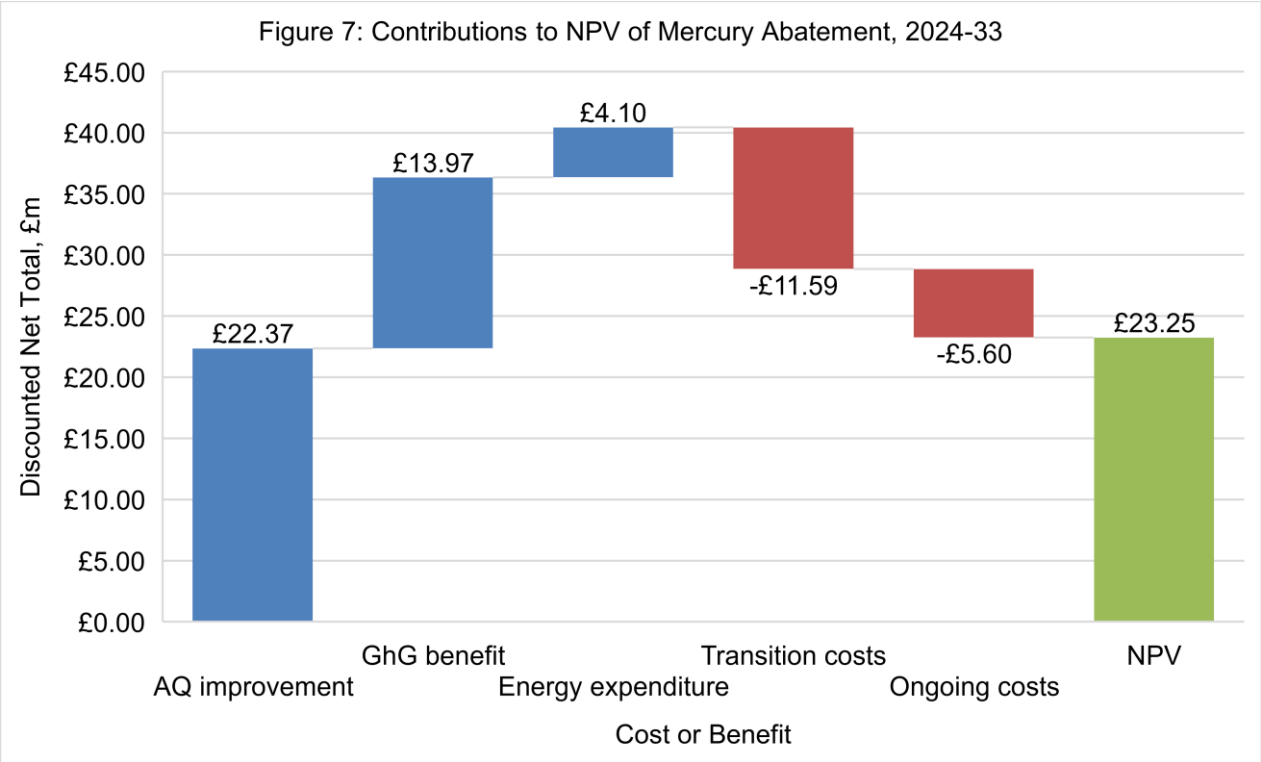
Gas (AQ)	£0.44
Total	£44.56
Costs	
Equipment	£11.59
Reagent	£4.69
Servicing	£0.91
Electricity (£)	£3.09
Electricity (GhG)	£0.96
Electricity (AQ)	£0.07
Total	£21.31
NPV	*£23.25*
BCR	*2.09*

39. The net present value associated with this policy is £23.25m and the benefit-cost ratio is 2.09, indicating that this intervention would clearly deliver more benefits to society than it would impose costs. Table 4 below aggregates the costs and benefits into different categories and Figure 5 beneath shows these values graphically. In Figure 7, the heights of the bars represent the values of the costs and benefits:

Table 4: Aggregated Costs and Benefits, 2024-2033[24]

Category	Total (Discounted, £m)
AQ improvement	£22.37
GhG benefit	£13.97
Energy expenditure	£4.10
Transition costs	-£11.59
Ongoing costs	-£5.60
NPV	*£23.25*
BCR	*2.09*

[24] Note: these results do not include a monetised value for the benefits associated with reductions of hydrogen chloride, or the costs of familiarisation, monitoring and enforcement by local authorities, or additional monitoring and reporting by crematoria



40. The net air quality improvement is worth £22.37m and is comprised of the reductions in emissions of PM2.5, mercury, and dioxins, as well as the reductions in pollutant emissions from gas use, less the increase in emissions from electricity generation. It does not include the reductions of emissions of hydrogen chloride. The net greenhouse gas, or climate, benefit, is slightly lower than the net air quality benefit, at £13.97m. This is the difference between the reduction in greenhouse gas emissions from lower gas use, and the increase in greenhouse gas emissions from extra electricity consumption. Over 2024-33, there will be a 59.9 ktCO2e reduction in emissions of greenhouse gases, equating to 5.99 ktCO2e/year, which will be of value as the UK pursues its Net Zero greenhouse gas ambition. Crematoria will also spend less on energy overall as a result of this policy – spending more on electricity but far less on gas – which is worth £4.10m to society.
41. The £11.59mtransition cost is a result of crematoria purchasing and installing the abatement equipment, whilst the £5.60m ongoing cost figure represents expenditure by crematoria on reagent (chemicals required for abatement) and annual servicing. The extra electricity requirement is also an ongoing cost, but this is netted off against the gas savings in the above table and chart.

Summary

42. The following costs and benefits have been considered in this de minimis assessment:

Monetised Costs

Transition Costs

- Installing abatement equipment (direct)

Ongoing Costs

- Use of reagents for abatement (direct)
- Maintenance of abatement equipment (direct)
- Increases in electricity consumption/expenditure (direct)
- Increases in emissions of greenhouse gases from electricity consumption (indirect)
- Increases in emissions of air pollutants from electricity consumption (indirect)

Unmonetised Costs

- Familiarisation costs (direct)
- Increases in monitoring and enforcement costs for local authorities (direct)
- Increases in monitoring and reporting costs (direct)

Monetised Benefits

- Reductions in emissions of PM2.5 (direct)
- Reductions in emissions of mercury (direct)
- Reductions in emissions of dioxins (direct)
- Reductions in gas consumption/expenditure (direct)
- Reductions in emissions of greenhouse gases from gas consumption (indirect)
- Reductions in emissions of air pollutants from gas consumption (indirect)

Unmonetised Benefits

- Reduction in emissions of hydrogen chloride (direct)

Costs

Transition Costs

43. The single transition cost associated with this intervention is the abatement equipment itself. This varies by size of crematoria (number of units) as set out in Table 5 below, provided to the Environment Agency by industry:

Table 5: Costs of Abatement Equipment	
No. units	**Cost**
1	£300,000
2	£400,000
3	£500,000

44. A compliance rate of 95% across the industry is expected by the end of the intended implementation phase, the end of 2026. This is a provisional date as delays may occur with the delivery of this new guidance, such as deferral towards consultation and/or publication of government response. To achieve this, it is assumed that all unabated double- and triple-unit crematoria, and 19 of the unabated single-unit crematoria, install the equipment. This is a reasonable assumption given that the larger crematoria are likely to have greater financial resources available to them than smaller crematoria do. The stock of crematoria under the new guidance, once the deadline has been reached, is shown in Table 6 below:

Table 6: Stock of Crematoria Under New Guidance			
Number of units per crematorium	**Number of crematoria**	**With abatement technology**	**Without abatement technology**
1	110	93	17
2	173	173	0
3	33	33	0
Total	*316*	*299*	*17*
% Of Total	*100%*	*95%*	*5%*

45. The total cost of this would be £24.4m. The operational lifetime of the abatement equipment is 15 years, giving an average annual equipment cost of £1.63m.
46. It is also assumed that no crematoria install the equipment in 2024, given that crematoria are likely to have short-term financial plans, so that compliance only begins in 2025. It is assumed that any crematorium that will comply will have done so by the deadline (i.e., by the last day of 2026). This is summarised in Table 7 below:

Table 7: Number of Newly Abated Crematoria per Year (versus Counterfactual)			
Number of units per crematorium	**2024**	**2025**	**2026 onwards**
1	0	10	19
2	0	19	38
3	0	4	7
Total	*0*	*33*	*64*

47. Our assumptions around implementation will be tested at consultation.
48. There are not expected to be any significant familiarisation costs associated with operating the abatement equipment, as it simply requires installation and is then always operational.

On-going Costs

49. There will be ongoing direct costs associated with chemicals required (reagents), servicing the equipment, and additional electricity usage. There will also be ongoing indirect costs: increases in emissions of greenhouse gases and air pollutants, owing to additional electricity consumption.
50. Where a cost or benefit is on a per cremation basis, the forecast activity data (number of cremations per year) from the NAEI is used. This is based on data from the Cremation Society, scaled to reflect likely population changes[25]. The assumed level of abatement across cremations, and the number of newly abated cremations in each year, is shown in Table 8 below:

Table 8: Level of Abatement Across Cremations		
Year	**% Of All Cremations Abated**	**% Of Newly Abated Cremations**
2024	71.8%	0.0%
2025	83.4%	11.6%
2026 onwards	95.0%	23.2%

51. Where a cost or benefit is on a per crematorium basis, the number of crematoria assumed to have installed abatement equipment at a given point in time is determined by the uptake assumed in the Table 6 above.
52. Industry has estimated costs of reagent at between £2.50 and £9.00 per cremation. For this analysis, the midpoint of £5.75 per cremation has been used.
53. Industry has also provided an annual figure of £2,000 per crematorium for servicing.
54. According to data from a provider of abatement equipment, an additional 90-130 MJ (25.00-36.11 kWh) of electricity will be required per cremation, to operate the abatement equipment. For this analysis, the midpoint, 30.56 kWh/cremation, has been used.
55. This has been monetised using the Green Book's supplementary guidance on valuing energy use[26], which provides forecasts of electricity prices. This was last updated in 2020 and energy prices have significantly increased since then, so the monetised electricity costs are likely to represent a conservative estimate. This is given consideration in the Sensitivity Analysis section of this de minimis assessment.
56. The extra electricity requirement will lead to emissions of greenhouse gases on the National Grid. The Green Book's supplementary guidance[27] provides emission factors (mass of carbon dioxide equivalent emitted per kWh generated), which are used in tandem with carbon prices to monetise this indirect cost.

[25] Please refer to https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2203151456_GB_IIR_2022_Submission_v1.pdf and https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2207211449_GB_IIR_2022_Projections_Addendum.pdf for more information.
[26] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[27] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

57. The additional electricity consumption will also lead to emissions of air pollutants associated with power generation on the National Grid. Activity costs, i.e., a cost of air pollution per kWh electricity generated, are also included in the Green Book guidance[28] and these have been used.

Unmonetised Costs

58. Whilst we do not anticipate familiarisation costs associated with operating the new abatement equipment, there are likely to be some owing to crematoria having to correctly interpret the updated guidance. These have not been monetised due to a lack of data. They are not expected to be significant however, as the changes to the guidance are fairly unambiguous. Moreover, industry has been involved with updating the guidance through the Technical Working Group, and so the changes will be anticipated by many.
59. Local authorities across the United Kingdom will face an additional monitoring and enforcement burden in order to check compliance amongst crematoria with the updated, statutory guidance. We did not collect data on the potential cost of this, though the additional burden on local authorities is not expected to be significant as this policy does not extend to a high number of polluters.
60. The updated guidance requires crematoria to monitor and report on a greater number of emitted substances. We would therefore expect to see an increase in monitoring and reporting costs through this channel. Industry did not provide data on monitoring and reporting costs and so we have been unable to monetise this increase in costs, though an expert at the Environment Agency has confirmed that the additional monitoring burden is not significant.
61. If we had been able to monetise the additional costs associated with familiarisation, monitoring and enforcement by local authorities, and the additional monitoring and reporting burden, we would see a slightly lower net present value and benefit-cost ratio.
62. The extent to which crematoria and local authorities expect to face these unmonetised costs will be tested at consultation.

Benefits

Monetised benefits

63. Monetised benefits related to this policy are derived from the reductions of three pollutants from crematoria: PM2.5, mercury, and dioxins. Table 8 below shows emissions from unabated and abated crematoria, as well as the benefit per cremation, provided by abatement equipment firms[29]:

Table 8: Emission Factors for Unabated and Abated Crematoria, with Benefit of Abatement

Pollutant	Unabated (g/cremation) (A)	Abated (g/cremation) (B)	Benefit (g/cremation) (A)-(B)
PM2.5	114.7	4.8	109.9
Mercury	0.5	0.03	0.5
Dioxins	6.25×10^{-7}	2.62×10^{-8}	4.49×10^{-7}
HCl	62.7	10.7	52.0

64. These have been monetised using Defra's damage costing guidance[30] in tandem with Green Book methodology. The damage cost for PM2.5 was obtained from the damage cost guidance[31],

[28] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[29] Note that this is identical to Table 2 above and repeated for ease of access.
[30] https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance
[31] https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance

whilst the damage costs for mercury and dioxins are from Schucht et al. (2021)[32], which appears to be the best available evidence. The damage costs for mercury and dioxins have been converted from euros to British pounds using a recent exchange rate[33]. There exists no published damage cost for HCl, nor a reasonable proxy, so it is assumed at £0/tonne by default. The damage costs for PM2.5, mercury, and dioxins are provided in Table 9 below:

Table 9: Damage Costs for PM2.5, Mercury, and Dioxins

Pollutant	Damage Cost (2020 prices, £/tonne)
PM2.5	£149,219
Mercury	£15,775,696
Dioxins[34]	£56,931,755,218

65. It is assumed that crematoria retrofitting with abatement equipment will abate all of their cremations. This is the case for plants that already have flue gas treatment installed.
66. The updated guidance allows for both retrofitting and already abated crematoria to reduce their gas consumption. Retrofitting crematoria can lower the temperature and reduce the residence time in their second chamber, and already abated crematoria can take advantage of this second source of gas saving. The lower temperature leads to a reduction of 400 MJ (111.11 kWh) gas per cremation and the shorter residence time leads to a reduction of 150 MJ (41.67 kWh) gas per cremation. Given the high gas prices at present, it is assumed that all crematoria take advantage of this opportunity as soon as it is available to them – at the onset of the new guidance for already abated crematoria, and upon abatement for newly abated crematoria.
67. These gas savings are monetised using Green Book guidance[35], which provides forecasts of gas prices. This was last updated in 2020 and energy prices have significantly increased since then, so the monetised gas savings are likely to represent a conservative estimate. This is given consideration in the Sensitivity Analysis section of this De Minimis Assessment.
68. Lower gas consumption will lead to lower emissions of greenhouse gases. To model the emissions savings, emission factors for carbon dioxide, methane, and nitrous oxide were used for the combustion of natural gas and liquefied petroleum gas (LPG) at crematoria were obtained from the NAEI database[36]. These were aggregated into a single emission factor associated with gas consumption at crematoria. This was combined with carbon prices from the Green Book supplementary guidance[37].
69. Air quality will also benefit from lower gas consumption at crematoria. As in the case with electricity consumption and air pollution, the benefits of this have been monetised using the activity costs in the Green Book guidance[38].

Unmonetised Benefits

70. The mandatory installation of abatement equipment at crematoria will also lead to reductions in emissions of hydrogen chloride. We estimate that this policy would lead to 50.6 tonnes of HCl emissions being avoided over 2024-33. This would bring benefits for human health and the environment and increase the net present value figure presented as part of this assessment. There is no published damage cost for hydrogen chloride, nor is there a reasonable proxy among

[32] DOI: http://dx.doi.org/10.1016/j.envsci.2015.03.001
[33] 1 EUR = 0.8791324 GBP. Exchange rate obtained from xe.com at 10:01 on 18/01/2023.
[34] £/tonne I-TEQ
[35] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[36] https://naei.beis.gov.uk/data/ef-all?q=153809
[37] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[38] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

existing damage costs. An industry expert on damage costs expects that the damage cost for hydrogen chloride is low.

Business Impact Target Calculations

71. The Equivalent Annual Net Direct Cost to Business (EANDCB) of this measure is £1.59m/year. As is standard in EANDCB calculations, this includes all direct costs and direct benefits to businesses. For costs, these are: the equipment, reagent, servicing costs, and electricity consumption. The sole direct benefit to businesses is the reduction in gas consumption. The effects of changes in emissions of greenhouse gases and air pollutants associated with changes in energy use are not included, as they are indirect costs and benefits.

Sensitivity Analysis

72. Sensitivity analysis has been conducted for the gas and electricity prices used, as those provided in the Green Book guidance[39] are substantially different from current prices. Tipping point analysis has been used, which is where key parameters are changed such that the value at which the NPV switches from positive to negative is found.
73. For gas prices, a 323-324% reduction in prices, i.e., negative gas prices, would be required in order for the NPV to flip to negative. For electricity prices, a 751-752% increase in prices would change the NPV from positive to negative. This analysis is therefore not considered highly sensitive to the chosen values for gas and electricity prices.
74. As a further check, the energy prices under the current Energy Price Guarantee (EPG)[40] were compared to the 2022 values in the Green Book (GB)[41], shown in Table 10 below:

Table 10: Comparison of Energy Price Guarantee with Green Book Energy Prices

Source	Energy Price Guarantee (p/kWh)	2022 Green Book (p/kWh)	Increase (EPG vs. GB)
Gas	10.3	2.4	330.8%
Electricity	34.0	13.0	161.2%

75. Compared to the 2022 Green Book prices, the Energy Price Guarantee prices represent a 330.8% on the gas price and a 161.2% increase on the electricity price. Given that a 751-752% increase in electricity prices would be required to switch the NPV to negative, this is not an issue – electricity prices could further increase by over 100% on the Green Book values before changing the sign of the NPV. For gas, adopting the Energy Price Guarantee values would increase the NPV, so it is not an issue that the Green Book values have been used instead.

Risks and unintended consequences

76. The benefits of this policy rely on the currently unabated crematoria complying with the new guidance and retrofitting with abatement equipment. Compliance is therefore the key issue, and

[39] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[40] https://www.gov.uk/government/publications/energy-bills-support/energy-bills-support-factsheet-8-september-2022
[41] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

there are not expected to be problems with this as industry has responded positively under the existing guidance.

77. No issues with enforcement are expected. Industry has responded well to the implementation of standards under the existing guidance since 2012. The purpose of the new guidance is to expand abatement to the rest of industry, providing a reasonable implementation phase to do so. Industry has been part of the TWG during the review process and the new measures have been agreed by participants in consensus-based decision making.
78. In general, legal challenges are not expected.
79. A potential unintended consequence of this policy is crematoria charging higher prices for their services. Given the limited state of competition between crematoria – a recent CMA report has shown that most do not face much, or any, local competition[42] – it is expected that firms will be able to pass on much of the increase in their costs to their customers. It is estimated that the new guidance would lead to an increase in cost of approximately £20.51 per cremation.
80. Data collated for the UK for 2021 by SunLife[43], a Canadian financial services company, give an average price of £3,765 for a cremation and £1,647 for a direct cremation. The increases in cost detailed above equate to approximately 1% of the price of each type of cremation. Firms should be mindful of any price increase given current cost of living pressures and the sensitivities surrounding funerals in general.
81. As there exists no evidence on the extent to which retrofitting crematoria will pass on the increase in costs they face, we have not attempted to conduct any distributional analysis. This does not affect the outcome of the cost-benefit analysis, as it simply amounts to transfers between economic agents, but will impact upon the burden of the policy (i.e., who the costs are borne by).
82. As discussed, already abated crematoria also stand to benefit from the new guidance, as they can lower the residence time in the second cremation chamber. This will save 150 MJ (41.67 kWh) of gas per cremation, which equates to a saving of approximately £5.18 per cremation. This would give already abated crematoria a slight cost advantage (of around £25 per cremation) over the retrofitting plants. However, any price changes would be unlikely to lead to any effects on competition in reality as crematoria are typically not located close enough to one another in order to compete, as discussed in the CMA report[44].

Wider impacts

83. This policy will primarily affect small and micro businesses, respectively defined by the Regulatory Policy Committee as firms with between 10-49 employees and 1-9 employees. It is therefore not the case that the intervention will disproportionately affect small and micro businesses, which is why a Small and Micro Business Assessment (SaMBA) has not been conducted.

Equalities Impact Assessment

84. As explored in the Risks and unintended consequences section, this policy may lead to higher prices for consumers. This would lead to more expenditure on cremations for those in religious groups where cremation is permitted, including Christians, Sikhs, Hindus, and Buddhists, versus other groups in society.

Justice Impact Test

85. It is not expected that this policy will have any impacts on the justice system.

Trade Impact

86. It is our view that there will not be any trade impacts owing to this policy change.

[42] https://assets.publishing.service.gov.uk/media/5e32d2e1e5274a08e81217e1/Crematoria-_competition.pdf
[43] https://www.sunlife.co.uk/funeral-costs/
[44] https://assets.publishing.service.gov.uk/media/5e32d2e1e5274a08e81217e1/Crematoria-_competition.pdf

3.0 Post implementation review

1. **Review status:** Please classify with an 'x' and provide any explanations below.

	Sunset clause		Other review clause		Political commitment		Other reason	X	No plan to review

Regulations to be reviewed every five years to ensure continued suitability.

2. **Expected review date** (month and year, xx/xx):

		/			Five years from when the Regulations come into force

3. **Rationale for PIR approach:**

We have no plans to conduct a post-implementation review. Evidence collected during the data-gathering phase of the guidance review indicates that the abatement technology significantly reduces emissions to air of mercury. We are confident that this is the most effective technique of reducing mercury emissions from crematoria and the industry will be almost fully abated by the beginning of 2027. Nevertheless, we anticipate this guidance will be kept under review with time. Technological changes may expand the definition of Best Available Techniques for the sector in the future, and there are other key pollutants that require monitoring that may affect future ELVs setting.

In terms of monitoring and evaluation, the updated guidance mandates that crematoria monitor the emissions of key pollutants at least once a year, or more frequently if required due to impact on local air quality receptors. The operator will keep records of all inspections, tests, monitoring, and visual assessments; and will report the monitoring data within the timescale, frequency, and format agreed with the regulator. These data will make it clear to regulators whether a given crematorium is compliant, enabling appropriate action to be taken.