# REA & WHA response to Defra Clean Air Strategy

The Renewable Energy Association (REA) and Wood Heat Association (WHA) are pleased to submit this response to the above consultation. The REA represents a wide variety of organisations, including generators, project developers, fuel and power suppliers, investors, equipment producers and service providers. Members range in size from major multinationals to sole traders. There are over 550 corporate members of the REA, making it the largest renewable energy trade association in the UK. The WHA is the UK trade association for the modern wood heating and related biomass heating industry including wood fuel suppliers, biomass boiler and stove installers and distributors, and anyone involved in the supply chain.

**Respondent name**: Frank Aaskov (Policy Analyst) for biomass, Kiara Zennaro (Head of Biogas) for farming / AD
**Organisation name**: Renewable Energy Association and Wood Heat Association
**E-mail address**: faaskov@r-e-a.net; Kiara@r-e-a.net
**Contact address**: 80 Strand, London WC2R 0DT
**Contact telephone**: 0207 925 3570

## Answers to Consultation Questions

### 4. Securing clean growth and innovation

**Q.7. What do you think of the package of actions put forward in the clean growth and innovation chapter? Please provide evidence in support of your answer if possible.**

The REA and WHA welcome and support the Government's aim to improve the air quality. When assessing the emissions related to combustion of biomass and wood fuels, it is vital to differentiate between the different types of bioenergy. Although biomass fuel is used in biomass boilers and in biomass power generation as in recreational open fires and old stoves, the emissions profile is very different. Furthermore, the fuel used in the vast majority of cases also differ significantly, as, for example, compressed wood pellets with low moisture content are more likely to be used in power generation and biomass boilers compared to the use of wood logs in open fires.

Biomass Heat

There is a need for distinguishing between the air quality issues in the UK's urban centres and the rural, off-gas-grid areas, where the air quality is much better. Biomass heat installations replace coal and oil installations in rural areas, where air quality is less of a concern. The highest levels of certain pollutants are found in dense, urban centres, as illustrated by the consultation document. In these areas, tighter emissions requirements may be required on all sources of key pollutants if further reductions from the already-low levels are to be achieved. Practically, very few urban households have the space required for biomass boilers and fuel storage, not considering the logistical issues of having wood fuel delivered.

Economics will largely dictate the location of biomass boilers. There is a very small uptake of non-domestic biomass boilers in conurbations, particularly those that currently suffer from poor air quality. These areas are invariably fuelled by the main gas grid offering convenient low-cost fuel. In addition, the costs and economics of deliveries of solid biomass fuel in built-up areas also mean few installations. It is, therefore, unnecessary to prohibit the installation of biomass boilers in areas which are on the main gas grid as this has already proven to be unnecessary based on past deployment data.

Within the Renewable Heat Incentive, only 8 non-domestic biomass boilers have been installed in Greater London out of 13,167 boilers in total, representing just 0.06% of all installations. Similarly, only a total of 179 domestic RHI installations (including solar thermal, air-source & ground-source heat pumps) have been installed in inner London out of 63,068 installations, representing just 0.28% of all domestic installations.

For urban areas, Fuller et al. (2014)[1] suggest that emissions related to wood burning mainly arise from "a decorative or secondary heating source", garden waste burning, and patio wood burners. This would indicate that the emissions from urban wood burning are not from biomass boilers, but instead from open fires and old stoves. Furthermore, the Government's Domestic Wood Survey[2] shows that 68% (2014) of wood burning appliances in London were open fires. Font & Fuller (2017) from King's College London makes several note-worthy points in their report for Defra's "Airborne particles from wood burning in UK cities"[3]:

- "In most cities wood burning PM concentrations were greater in evenings, indicating residential combustion, and greater at weekends. Coupled with the poor correlation with daily temperature ($R^2$=0.12-0.57) this suggested that current urban wood burning was in large part decorative and was not being used primary heating."
- Emissions from wood burning have actually decreased between 2009 and 2015, as high emission fireplaces have been replaced with newer and lower emission wood stoves.
- Particle emissions from open fireplaces have been shown to be ~3 times higher than from traditional woodstove, ~12 times higher than eco-labelled stoves, and ~15 times higher than those from pellet stoves[4].

Mitchell (2017)[5] from the University of Leeds compared the emissions from various types of stoves in their PhD thesis, as illustrated below:

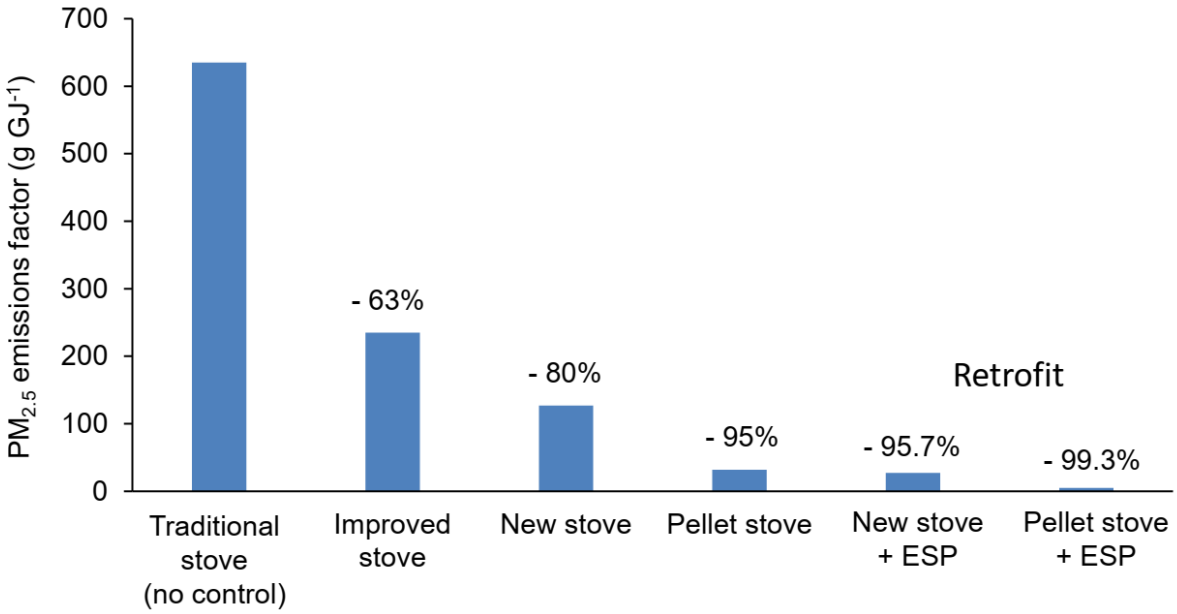
[1] Fuller, Gary W. (2014), Anja H. Tremper, Timothy D. Baker, Karl Espen Yttri, David Butterfield, Contribution of wood burning to PM10 in London, *Atmospheric Environment 87 (2014) 87-94*, Retrieved from https://doi.org/10.1016/j.atmosenv.2013.12.037

[2] DECC (2016), Summary results of the domestic wood use survey, *Renewables statistics*, 31 March 2016, Retrieved from https://www.gov.uk/government/publications/summary-results-of-the-domestic-wood-use-survey

[3] Font, Anna (2017), Gary Fuller, Airborne particles from wood burning in UK cities, Prepared for Defra, Retrieved from https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1801301017_KCL_WoodBurningReport_2017_FINAL.pdf

[4] AIRUSE, Action B4, 2015: Emission factors for biomass burning, AIRUS-LIFE11 ENV/ES/584, Retrieved from http://airuse.eu/wp-content/uploads/2013/11/R09_AIRUSE-Emission-factors-for-biomass-burning.pdf

[5] Mitchell, PhD Thesis, University of Leeds, 2017. Emissions factors from the EMEP (European Monitoring and Evaluation Programme) and GAINS (Greenhouse gas and Air Pollution Information and Simulation) databases. ESP is electrostatic precipitators.




Together, this suggests that the main issue of emissions from wood burning in urban centres is related to open fires and in part old stoves that do not meet the new Ecodesign standards. It demonstrates that modern biomass boilers should be of much less concern in rural areas in relation to air quality, as any wood-burning emissions are more likely to originate from open fires. It, therefore, becomes much less relevant to exclude biomass installations from the RHI if installed on the gas grid, as modern biomass boilers are not the cause of the air quality problems in urban areas.

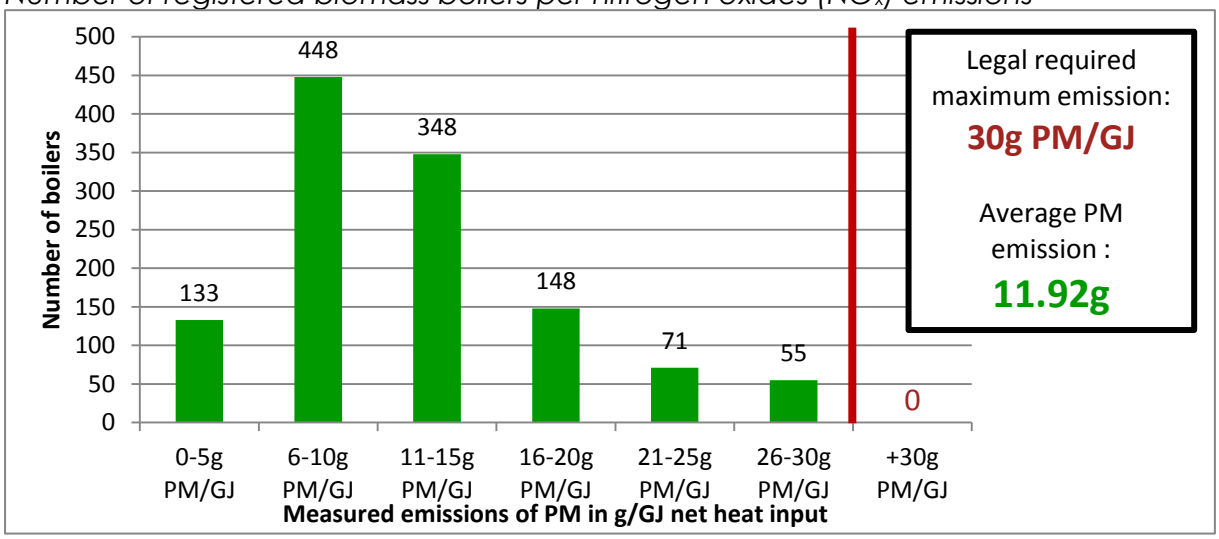
It would also exclude district heating using biomass, which is supposed to be a key part of the Government's strategy to decarbonise heat in urban centres. District heating needs a responsive heat source, preferably of a decent quality of heat for everything but the highest-quality modern buildings. Biomass would be an obvious option, but the boilers feeding the heat networks will need to be located in the urban areas.

It should be noted that electrostatic precipitators (ESP), as mentioned in the chart above, are a technical solution to a reduction in particulates, but these come at significant capital and on-going cost. These are currently being mandated in some areas of Austria and Germany, but mandatory fitting will preclude many potential renewable energy installations from being deployed as this increases the cost of installation and on-going operations. The medium combustion directive will make particulate abatement mandatory on large boilers from December 2018. However, no additional financial incentive is planned to be offered in order to offset the additional capital and running costs. Proportionality and flexibility are important factors to consider, as prescribing a particular technology removes the incentive for people to innovate new, more effective or cheaper ways of achieving low emissions.

Biomass boilers that are installed under the Renewable Heat Incentive and commissioned after 2013 are required to meet the RHI air quality requirements. The air quality requirements set limits on the emissions a product can produce. Products must operate within these limits to be eligible for the Domestic and Non-domestic

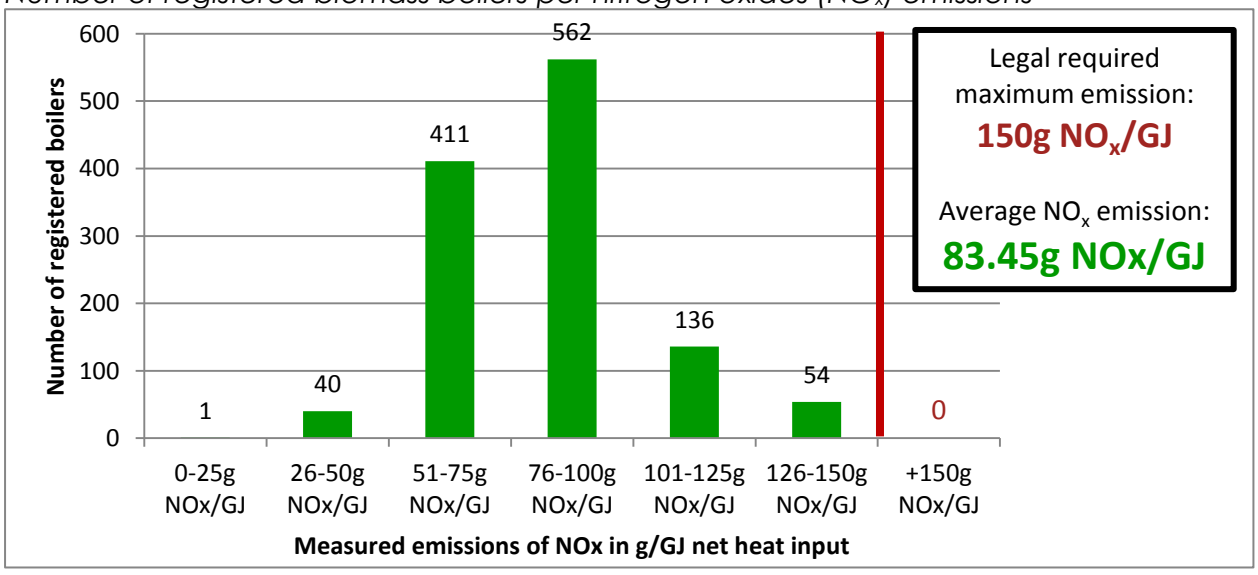
RHI scheme. Under the schemes, PM emissions must not exceed 30 grams per gigajoule net heat output, and $NO_x$ emissions must not exceed 150 grams per gigajoule net heat output. Products affected by these requirements will need to have an RHI Emission Certificate, which includes information about the product, the test laboratory, tested fuel types, and emissions. Analysis of these certificates suggests that biomass boilers, in general, have been tested at particulate matter emission levels that are considerably below the legal limit, as illustrated by the figure below. However, please note that these are data from lab tests rather than in situ testing, where emissions generally are expected to be somewhat higher.

*Number of registered biomass boilers per nitrogen oxides ($NO_x$) emissions*




It shows that 77% of the boilers with an AQ certificate have tested measured PM emissions at less than half the legal limit, and 48% emitted less than a third of the legal threshold. This is also the case for $NO_x$, where 38% had measured $NO_x$ emissions at less than half of the legal limit, and 84% emitted less than two-thirds of the legal maximum (i.e. 100g $NO_x$/GJ or less).

*Number of registered biomass boilers per nitrogen oxides ($NO_x$) emissions*[6]




[6] Based on RHIEC data for the 1,205 biomass boilers which has an emission certificate. Please note that this is just an analysis of the certificates, and not the actual market. Out of the over 29,000 biomass

As noted above, it is important to recognise that in situ emissions differ from emissions in test centres. Emissions will depend on a number of factors such as boiler type, consumer patterns, boiler usage, fuel quality, the moisture content of the fuel, and whether the correct fuel is being used in the boiler. Consumers should be educated on what fuels are appropriate to use in their heating systems, how to use their boilers to avoid increased emissions (i.e. avoiding cold starting, compared to steady state running), and how to maintain the system. If regulated according to current standards and regulations, the deployment of modern biomass boilers would not have a significant impact on the air quality in off-gas-grid areas.

There exists robust legislation designed to prevent the current issues with air quality in so far that smoke control zones prohibit the combustion of wood in non-DEFRA exempted appliances, which include open fires. The emissions data suggests that the major contributors to the undesirable emissions are those which are illegal to operate in the first place. There is a significant lack of understanding within the general public as to what the smoke control act is, and what restrictions are in place under smoke control areas. Further education and enforcement of current legislation are required to make any disenable impact to these emissions sources. Local authorities have already highlighted, by the classification of smoke control zones, areas where potential emissions could lead to issues. In such areas, wood-burning appliances are required to be DEFRA "Exempt". The testing procedure requires the appliance to have detailed instructions on its use, the type of fuel approved, and it must meet specified maximum limits for emissions. The vast majority of biomass boilers sold in the UK have met the requirements of being DEFRA Exempt appliances.

Finally, it should also be noted that although the Clean Air Strategy states that domestic wood & coal burning contributes 38% of $PM_{2.5}$ emissions, the chart on p.25 (Annual mean PM2.5 north to south transect across the UK for 2016 from PCM model) clearly shows that it significantly less when taking all emission sources into account, rather than just focus on the non-background sources. If the bottom 4 or 5 bands of emission sources are discount as remote and therefore uncontrollable and measure the contribution of domestic sources relative to the rest of the bands, then domestic wood & coal burning will make up a higher proportion of $PM_{2.5}$ emissions. We do not believe it is helpful to discount the background emission sources as this distorts the full picture of how to reduce the overall level of pollution.

Rather than exclude biomass boilers from the RHI if installed in on-gas-grid areas, the Government could successfully tighten the air quality emission criteria under the RHI to exclude the systems that emit more emissions per heat input than average. This would likely make a much more significant difference than excluding the few systems that would be installed in on-gas-grid areas, as these are very few and far between. However, as stated above, biomass boilers are not the main contributor to air pollution in urban areas; instead open fires and old stoves are the main cause of air quality emissions.

installations, the majority of the installations could be boilers with very low emissions, with the high emission boilers only sold a few times, or vice versa. Data obtained from BEIS.

Quality management scheme for biomass heat

Finally, to further reduce emissions from biomass heat systems, we highly recommend adopting a Biomass Quality Management scheme for the UK to regulate system efficiency and emissions of non-domestic installations. There is a noteworthy difference between the emissions from high-quality installations operated correctly on the right fuel and low-quality installations operated incorrectly on the wrong fuel. But the UK lacks a well-established and recognised quality scheme to ensure that biomass heating systems are designed, installed and operated correctly. There has been demonstrable appetite from the industry for standards and improved regulation which is tied to the RHI since before the NDRHI was launched in November 2011. An example of a quality management system is the QM Holzheizwerke programme, a joint Swiss-Austrian-German initiative which was first implemented in Switzerland in 2000. The scheme was introduced to address critical issues with the Swiss biomass sector, which had seen dramatic growth in the preceding decade. Summarised briefly, these were:

- High investment, high thermal wear of wood boilers, high maintenance costs, poor efficiency, high thermal losses in district heating;
- Loss instead of profit of operating schemes;
- Complaints due to elevated smoke emission in the vicinity of biomass boilers.

QM Holz covers the entire process of designing, procuring, installing and setting to work a biomass heating system, from initial brief to end of life and disposal. QM Holz has been extremely successful in raising performance (and thereby reducing emissions) across the biomass sectors in Switzerland, Austria and Germany by providing clarity of responsibilities across the supply chain and measurable minimum standards.

Using and being measured against QM Holz is a requirement for the receipt of public investment in a biomass plant in most Swiss Cantons and in some regions of Austria and Germany. Its adoption is also being considered in Japan, Belgium, the Netherlands and Canada to support their growing biomass sectors. Most other technologies – oil, gas and coal – all have minimum installation standards that must be met, and, as the UK biomass industry matures, biomass boilers also need minimum installation standards.

The Wood Heat Association has been investigating the possibility of transferring the QM Holz system to the UK for some years but has lacked the resources required to translate and adapt the manuals and technical documents which constitute the scheme. The QM Holz scheme was originally supported by the Swiss Federal Office of Energy with around £1.6m of funding. Ongoing revenues to implement and improve the scheme are provided by fees charged to scheme developers/operators.

Conversations with the QM Holz project manager in Switzerland indicate that around £200,000 would be required to translate and adapt the scheme for the UK.

We believe that the costs of doing this could be shared between a number of English-speaking countries, particularly Canada, New Zealand and Ireland - all of which are at early stages of biomass market development. New Zealand and Canada have expressed an interest in partnering with the UK in this action.

Potential UK partners for a biomass Code of Practice include:

- CIBSE – Chartered Institution of Building Service Engineers

- WHA – Wood Heat Association
- HETAS - Heating Equipment Testing and Approval Scheme
- CEA – Combustion Engineering Association
- HSE – Health and Safety Executive

All of whom have indicated their willingness to be involved and expressed concern at the current state of standards in the industry.

QM Holz would take approximately 12-18 months to translate, update and implement in the UK.

The steps would broadly be:

- Raw translation of text, graphics, tables
- Proofreading by an expert in heat production and heat distribution
- Text editing and formatting
- Production of QM-documents
- Adaption of climatic conditions to the Excel-Tool 'Situationserfassung'
- Adaption of technical aspects to the local situation
- Key indicators of actual wood heating plants in the UK (best practice, bad practice)
- Legal regulations (fire protection/prevention, safety & protection devices, noise protection, etc.)

In combinations, we believe these measures would minimise the emissions related to biomass boilers (which again differ from emissions related to open fires and old stoves).

Biomass Power

Reducing airborne emission relating to power generation is important to minimise the overall impact on human health. However, it is vital to recognise that emissions related to the biomass power generation are much less significant than other sources.

Research shows that large-scale biomass power generation emits significantly fewer SO, $NO_x$, PM, and VOC emissions than smaller scale applications[7]. Gasification can furthermore facilitate a reduction in emissions. Some emissions could be released upstream, but emissions are only "additional where previously uncultivated land is devoted to energy crops"[8]. The emissions from biomass are lower than coal, significantly so in terms of nitrous oxides and sulphur dioxide. The Drax biomass power stations, for example, reduced $NO_x$ emissions by over 60% over the period 2012-2017, and $SO_2$ emissions by over 70% over the period 2012-2017, when converting to biomass.

BREF (Best Available Techniques, a European environmental permitting regulations) is coming into effect in 2021 for large power stations, and introduces stricter emissions limits, such as ~ 66% tightening of NOx limits, ~ 60% tightening of SO2 limits, and ~ 60% tightening of PM limits.

[7] Thornley, P., Upham, P., Huang, Y., Rezvani, S., Brammer, J. and Rogers, J., 2009. Integrated assessment of bioelectricity technology options. Energy Policy, 37(3), pp.890-903.
[8] Thornley, P., 2008. Airborne emissions from biomass based power generation systems. Environmental Research Letters, 3(1), p.014004. Accessible here: https://www.researchgate.net/profile/Patricia_Thornley/publication/230982435_Airborne_emissions_from_biomass_based_power_generation_systems/links/546230650cf2837efdaff1c1.pdf

We appreciate that the government wants to reduce the emissions related to combustion of wood in urban areas. But if this is the aim, then excluding biomass power from future allocation rounds of the contracts for difference scheme will not help. Biomass power generation emits significantly fewer emissions than open fires and stoves per kWh generated and are typically not located in urban areas.

The value of biomass should be recognised in meeting the climate change policies affordably. Biomass power is the UK's second largest source of renewable power generation. It makes a major contribution to decarbonisation at an affordable level, helping to keep bills lower. It has played a direct, central role in removing coal from the UK's power grid and in supporting the wide deployment of other renewable technologies. It is coupling with future CCUS technologies will add to its importance in the future. The difference between biomass power and recreational wood heating should also be recognised. Different feedstocks, emissions-limiting technologies and regulatory regimes all mean that biomass for power has a very different emissions profile to recreational wood burning in open fires and old stoves. Emissions of NOx, SO2 and particulates are all demonstrably far lower for biomass power than for open fires and old stoves as the chart above illustrated. Biomass power is strictly and effectively regulated on air quality.

The UK's fleet of biomass-fired power generators is overseen by world-leading regulations, known as the Sustainability Criteria, which ensure their low-carbon credentials. Through the use of low-grade wood rejected by high-grade wood users (industries such as construction and furniture), biomass power makes use of a forestry waste material. The Sustainability Criteria require that wood sourced for UK energy use must not be the result of land use change, thus protecting forest lands. This protection, combined with local laws and economic forces that incentivise long-term stock management in forests, is helping to ensure the net growth of forests. The Southern USA, which supplies the largest amount of UK biomass pellets, has seen its working forests inventories more than double since 1953 when records began.

Greenhouse gas emissions throughout the supply chain are also independently audited and reported to Ofgem, with a requirement to ensure 60% lower GHG emissions compared to the EU Fossil Fuel Grid average. This system ensures that biomass supports the UK's commitments to combatting climate change, as set out in the Paris Accord.

Biomass has thus far helped the UK to cut its dependence on coal significantly. This is not only through direct conversions of power plants from coal to biomass feedstocks, as in the case of Drax. It is also through broader support of renewables deployment, which is only possible with 'dispatchable' backup supply.

**Q8. In what areas of the air quality industry is there potential for UK leadership?**

The UK could show leadership by adopting a new quality management scheme for non-domestic biomass installations and further tighten the air quality emission criteria under the RHI. This would drastically reduce any emissions from the biomass heat sector.

**Q9. In your view, what are the barriers to the take-up of existing technologies which can help tackle air pollution? How can these barriers be overcome?**

There are currently no required standards for non-domestic biomass installations. This reduces the likelihood that systems will be well-designed, installed and operated.

Once a boiler has achieved an RHI compliant emissions certificate and is being operated using compliant fuel, no further checks on quality are conducted despite the fact that poor quality installation and operation can result in much higher than necessary emissions. On-site checking of emissions, along with quality management of installations, could improve the situation, although, as already pointed out, the real problem is emissions from unregulated burning in open fires and old stoves rather than the already regulated biomass boiler market.

**Q10. In your view, are the priorities identified for innovation funding the right ones?**

If the Government wants to reduce emissions related to biomass boilers, the Government could successfully tighten the air quality emission criteria under the RHI and introduce a quality management scheme for biomass heat which would improve efficiency and reduce emissions. However, this would probably not impact significantly on overall air quality as biomass boilers, as opposed to old stoves and open fires, not to mention transport, contribute to only a fraction of air pollution levels.

## 5. Action to reduce emissions from transport

**Q11. What do you think of the package of actions put forward in the transport chapter? Please provide evidence in support of your answer if possible.**

Although the Strategy does not cover reducing exhaust emissions from road vehicles, (as this would be covered in The Road to Zero) we are making comments on road transport here, as The Road to Zero has shortcomings in that respect.

We, therefore, want to highlight the following air quality benefits of these biofuels:

- Hydrotreated Vegetable Oil / Gas to Liquid Fuels (sometimes known as paraffinic diesel). These are clean, high-quality diesel fuels made from a wide variety of feedstocks, and are associated with $NO_x$ emissions reductions of 3% - 18 %, and particulate matter reductions in the range of 12% - 48%[9].
- E10 (petrol containing 10% bioethanol). The Road to Zero makes no direct mention of E10 in relation to air quality, and the subsequently published consultation "*E10 petrol, consumer protection and fuel pump labelling*" states "E10 is generally acknowledged to make a negligible difference in tailpipe emissions compared to the current E5 grade". We disagree. We believe there are improvements in air quality on a vehicle by vehicle basis from E10. These are detailed in this presentation made to the LowCVP[10] and summarised in this factsheet[11]. The headline figures are $NO_x$ reduced by up to 34%, Particulate matter reduced by up to 95% and Nanoparticles reduced by up to 96%. Secondly, even if there were no improvements in air quality from using E10 in any individual vehicle, the overall impact of the introduction of E10 would be likely to have the effect of encouraging the replacement of older vehicles, which are inherently more polluting than newer vehicles, which will thereby improve over time. As it has been recognised by the recent joint select committee, carbon emissions and air pollution needs to be dealt with

[9] For more information, see http://synthetic-fuels.eu/images/Paraffinic_Fuels_-_Environmental_Benefits.pdf
[10] Environmental impacts of E10. Dr Michael Goldsworthy. LowCVP FWG; 14th June 2018 http://www.r-e-a.net/upload/nnfcc_e10_slides_for_lowcvp.pdf
[11] https://docs.wixstatic.com/ugd/3fb734_c264f6bcb39f430ab829d6e93c3809ca.pdf

together, rather than separately. Under this approach, E10 has a big impact on carbon reductions and improvement of air quality. It is also worth noting that E10 is one of the only immediately available solution at-scale which can deliver major impact, if the Government chose to implement E10.

- Biomethane**:** The main benefits of fuelling vehicles on renewable gas are GHG reductions and noise. However, there is a modest improvement in particulate matter and $NO_x$ "testing indicates that the transition to Euro VI has, for diesel heavy goods vehicles, been effective in cutting overall $NO_x$ emissions by over 98% when compared to Euro V vehicles. A further move from Euro VI diesel vehicles to Euro VI dedicated gas increases that reduction in $NO_x$ emissions to at least 99%"[12].
- Waste/wood derived fuels: Fuels produced from waste or woody biomass using the Fischer-Tropsch process[13] not only offer $CO_2$ emission reductions of 70% or more, but also have significant air quality benefits for heavy goods vehicles and aviation; they are hydrocarbon fuels which contain very low levels of aromatics and sulphur, thus contributing to significant reductions in emissions of particulates (>90% reduction), sulphur (>90% reduction), $NO_x$ (up to 10% reduction), carbon monoxide and unburnt hydrocarbons.

We note the references to hydrogen in relation to measures for rail and maritime transport. We would like to point out that the potential supply of hydrogen will be more limited than it could be due to the unnecessarily restrictive nature of qualifying renewable electricity that could be used for the production of renewable hydrogen under the DfT's Renewable Transport Fuels Obligation.

**Q12. Do you feel that the approaches proposed for reducing emissions from Non-Road Mobile Machinery are appropriate or not? Why?**

We have not addressed NRMM in this response, but support the NFU's comments on this theme.

## 6. Action to reduce emissions at home

**Q13. What do you think of the package of actions put forward to reduce the impact of domestic combustion? Please provide evidence in support of your answer if possible.**

We welcome the actions outlined in this chapter and look forward to working with the Government on these initiatives.

However, we are concerned that by limiting new stoves to the highest standards without implementing some policy to encourage the replacement of open fires and old stoves risks paralyzing the market, as consumers are likely to keep their old appliances rather purchase the newer expensive systems. To reduce emissions from old stoves and open fires, some incentive for their replacement is needed, alongside

[12] Emissions Testing of Gas-Powered Commercial Vehicles. LowCVP, January 2017. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/581859/emissions-testing-of-gas-powered-commercial-vehicles.pdf

[13] Anderson, B. E. and e. al. (February 2011). Alternative Aviation Fuel Experiment (AAFEX), NASA Langley Research Center; and Elgowainy, A., et al. (2012). Life-cycle analysis of alternative aviation fuels in GREET, Argonne National Laboratory (ANL)

consumer information and education of the benefits of increased efficiency and reduced emissions.

**Q14. Which of the following measures to provide information on a product's non-methane volatile organic compound content would you find most helpful for informing your choice of household and personal care products, and please would you briefly explain your answer?**

a) "A B C" label on product packaging (a categorised product rating for relevant domestic products, similar to other labels such as food traffic light labels)

b) information on manufacturer website

c) leaflet at the point of sale

d) inclusion in advertising campaigns

e) other option

**Q15. What further actions do you think can be taken to reduce human exposure from indoor air pollution?**

## 7. Action to reduce emissions from farming

**Q.16. what do you think of the package of actions put forward in the farming chapter? Please provide evidence in support of your answer if possible.**

Air quality has negative impacts on human health and the environment and can be life-threatening, so we agree it needs to be tackled by Defra. Therefore, on the whole, we welcome proposals from Defra to reduce ammonia emissions from the farming sector.

With regard to anaerobic digestion (AD), there is now widespread recognition of the benefits of this technology not only through the generation of a renewable fuel (biogas or biomethane) that can be used for power, heat and transport, but also the production of a sustainable fertiliser and/or soil improver in the form of digestate (either as whole digestate, separated liquor and/or separated fibre). AD is also critical to abate GHG emissions from agriculture associated with slurries and manures, and those from biodegradable waste disposal to landfill. It can play a strategic role in enhancing the UK soils and supporting sustainable and profitable farming.

It is accepted that agriculture is responsible collectively for 88% of ammonia emissions, and we understand that only 3% of these emissions currently come from the spreading of digestate to land (0.6kt from the process and storage, 9.8kt from digestate spreading) [14] and these are projected to increase over the next few years to reflect the AD sector's growth: AD is projected to account for 6.4% of UK ammonia emissions by 2020 and these projections are mostly based on the market data provided by the NNFCC and the rate at which AD has been growing in previous years.

From previous discussions with Defra, we understand that an assumption has been made that all or most digestate is spread with a low trajectory splash plate. This is not the case in reality.

[14] The evidence for the 3% is published in the annual Informative Inventory Report.

There has been significant investment in the sector within the last five years in equipment which assists in mitigating emissions during spreading such as direct injection. Many farmers now have a much better understanding of the benefits of digestate and its correct application and have invested accordingly.

It is understood that there is limited data currently available on the extent to which precision application methods are used on farm and believe that this information might change the betrayal of air quality impact from the livestock and AD sectors.

The REA and ADBA (the Anaerobic Digestion and Biogas Association) have recently conducted a joint survey of members to find out what percentage of the digestate that they spread is carried out using low emission spreading techniques[15] and the results (shown below) suggest that there is a move away from the use of splash plates or nozzles to lower emission strategies such as the use of band spreaders which distribute the digestate directly to the soil in close proximity to the growing crop, or the use of shallow or deep injection techniques which prevent any ammonia volatilisation taking place. There is a much better understanding by the farming and landspreading community of the benefits of correct application of digestate to land, as this not only reduces the environmental risks associated with its deployment to land but also improves its efficacy as a fertiliser replacement.

We believe it is important that the sector's improvement in the uptake of low emissions techniques is recognised by Defra and that more accurate assumptions are used to inform Defra's data inventory and conclusions on the potential impact from the AD sector on ammonia emissions.

In addition, it is important to acknowledge that the AD industry is no longer growing as rapidly as it has in recent years. Incentives have been scaled back significantly: the Feed-in Tariffs scheme closes in March 2019, there has been no growth in 2017 due to delays to the RHI reforms and there is uncertainty about support for biogas heat and biomethane production after the Renewable Heat Incentive scheme ends in 2021. This must be carefully considered and reflected in any projections made on the potential growth of this sector in future years.

Finally, it is useful to note that, although the DC-Agri project funded by the Waste and Resources Action Programme found that the spreading of food-based digestates generates greater ammonia emissions than livestock slurries, the project did not look at the separated fractions from the whole digestates (e.g. separated fibre and liquid fractions) and no scientific work has been carried out on digestates that are not based on food wastes.

Results from REA/ADBA survey on digestate spreading:

We had 43 responses to the survey. The total volume of liquid digestate applied by the respondents was 2,424,400 $m^3$ per year.

As can be seen from the table below, nearly all liquid digestate applied by the respondents (93%) was spread using low emission techniques.

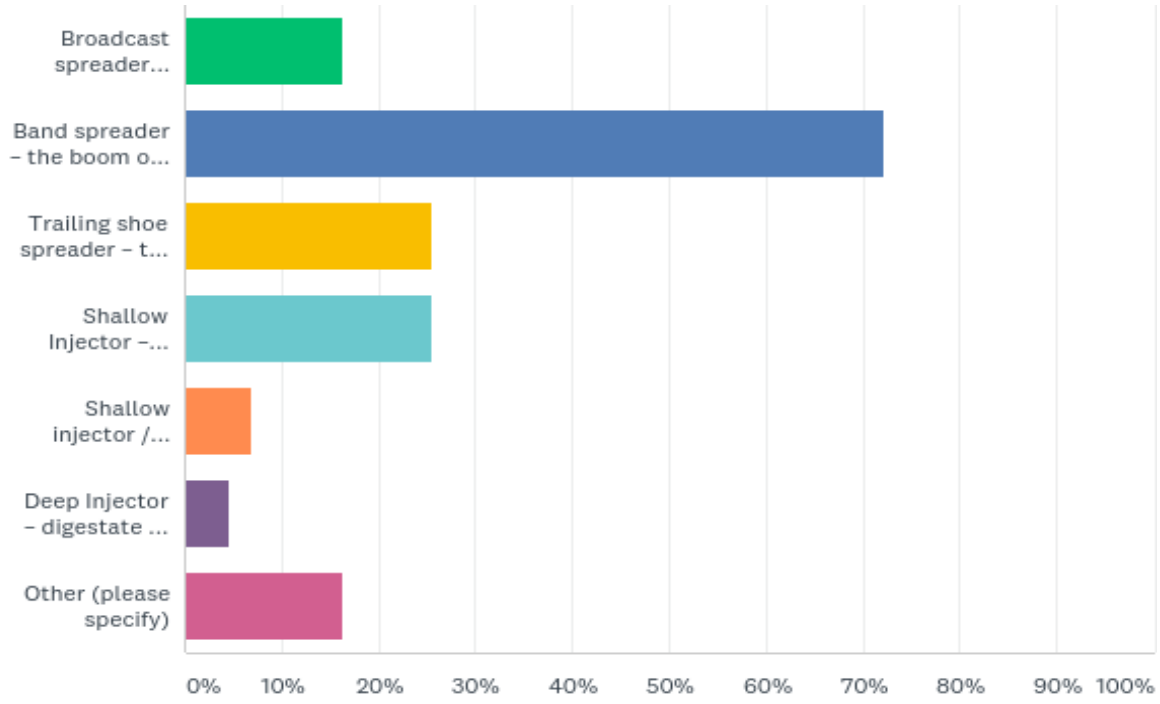
| *Emission technique that has been used to apply liquid digestate* | *Volume ($m^3$)* | *% of total volume* |
|---|---|---|

[15] Although Defra's consultation is not clear on whether the term 'low emission techniques' refers to liquid digestates only, our interpretation, in line with the CoGAP, is that this term only refer to this form of digestate (i.e. whole digestate and separated liquor and not solid fibre or other solid manures).

| | | |
|---|---|---|
| Low emission techniques (bandspreading, trailing shoe or hose spreaders, shallow injector, shallow injector/aerator, deep injector) | 2,251,600 | **93 %** |
| Broadcast spreader (splash plate or nozzles) | 172,600 | 7 % |

As illustrated by the table and associated chart below, most of the respondents have said they are using band spreaders (around 71% of responses), with a significant number of responses also stating that trailing shoe (approximately 26%) and shallow injectors (another 26%) are used. Please note that the percentages are not cumulative as respondents may be using more than one technique to spread the digestate.

| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Broadcast spreader (splash plate or nozzles) – the digestate is forced under pressure through a nozzle, often onto an inclined plate to increase the sideways spread. | 16.28% | 7 |
| Band spreader – the boom of the spreader has a number of hoses connected to it, distributing the digestate close to the ground in strips or bands. It is fed with digestate from a single pipe, thus relying on the pressure at each of the hose outlets to provide even distribution. | 72.09% | 31 |
| Trailing shoe spreader – this is a similar configuration to the band spreader with a shoe added to each hose allowing the digestate to be deposited under the crop canopy onto the soil. | 25.58% | 11 |
| Shallow Injector – digestate is injected under the soil surface by open slot shallow injection, up to 50 mm deep. | 25.58% | 11 |
| Shallow injector / aerator - digestate is injected under the soil surface in conjunction with aeration of the soil. | 6.98% | 3 |
| Deep Injector – digestate is injected under the soil surface by deep injection over 150 mm deep. | 4.65% | 2 |
| Other (please specify) | 16.28% | 7 |
| Total Respondents: 43 | | |




Our questions on the storage of digestate have also returned an interesting result. Nearly 70% of respondents have said that the digestate storage is already covered. In some cases where the digestate is not covered, this is not liquid digestate but rather the separated fibre fraction which is stockpiled on the farm.

Some comments on the storage included:

- "Recently constructed lagoon stores are now all covered. Earlier designs are not. We have had to stop using clay balls as they sink and block the tankers and spreaders."
- "Most of our off-site, field-based digestate stores are covered. Some are not this is due to cost to cover existing stores. Cost to cover stores should be covered by the production location but is not".

**Q17. What are your preferences in relation to the 3 regulatory approaches outlined and the timeframe for their implementation: (1) introduction of nitrogen (or fertiliser) limits; (2) extension of permitting to large dairy farms; (3) rules on specific emissions-reducing practices? Please provide evidence in support of your views if possible.**

There are three proposals within the consultation document which relate to reducing ammonia emissions.

1. The introduction of nitrogen (or fertiliser) limits.

In general, *for composts and digestates we do not agree with the proposal to introduce nitrogen or fertiliser limits* and provide our reasons below.

The benefits of using composts and digestates within the farming sector are now well recognised (see DC-Agri project) and it is important that industry is not handcuffed to rules that are too restrictive or prevent future innovation. The use of digestate, in particular, is still relatively young and the market is still maturing. Any proposals

regarding the use of these materials must allow continued growth and development. Too many constraints will disincentivise digestate use in the future.

Many AD operators, farmers that apply digestates and composts, and the agronomists approving these materials' applications to land have already a very good understanding of the benefits of digestate and its correct application. They can make bespoke decisions based on what is best for the specific crops to which digestates and composts are applied, given the specific type of soil on which these crops are grown. Introduction of nitrogen or fertiliser limits could jeopardise this approach. For example, capping nitrogen levels may also restrict the addition of organic matter and other important nutrients (phosphate, potash and trace elements) contained within organic resources like composts and digestates to soils where organic matter is low or other nutrients are deficient.

RB209 (a Nutrient Management Guide) is widely used by farmers and the regulator to determine optimal application rates and timings of application and this seems to have widespread recognition within the farming community.

Although not all agricultural land in the UK is captured within Nitrate Vulnerable Zones (NVZs), the new water protection rules introduced this year by Defra for all farmers in England require them to have a nutrient management plan, i.e. plan how much fertiliser or manure to use to match the crop requirement. We understand from members that there is still little awareness of these new rules within the farming community, so more need to be done to increase awareness.

It is important that, when considering nitrogen for fertiliser limits, environmental and economic benefits are taken into account. A holistic approach needs to be taken when making these decisions rather than just focussing on ammonia emissions.

The consultation specifically mentions the example of the integrated approach adopted in Denmark to reduce ammonia emissions. However, we understand from some members that this system is very bureaucratic and burdensome for farmers and limits very challenging to meet and can only be met through the application of techniques such as acidification (which in the UK is still being trialled and its impact on the soil is still largely unknown) or the provision of significant extra storage so that spreading can be done to match crop demand for nitrogen.

We welcome Defra's proposal to task a group of independent specialists to recommend, by November 2019, whether nitrogen or fertiliser limits should be set and at what level(s). However, we urge Defra to include AD and composting site operators as well as academics and agronomists within this working group.

2. Extension of environmental permitting to large dairy farms by 2025

It is important that all sectors of the farming community are treated equally and it would appear that this is not currently the case with the pig and poultry community being more heavily regulated than the dairy sector.

It should be noted that the dairy sector is and has been for some time under considerable financial duress with milk prices falling, so any suggestions need to be delivered in this context and be achievable and timed to allow 'soft' implementation in an already stressed sector.

The cost of environmental permitting has also significantly increased recently, so some sort of financial support must be provided to dairy farmers if this becomes a requirement, to help them in the transition period.

It is also important to consider what level of additional resourcing the environmental regulator would need if a significant number of sites are required to be permitted.

3. Rules on specific emissions-reducing practices

Overall this approach is our preferred one, although we highlight below some important issues for each of the suggested measures.

*a. A requirement for all solid manure and solid digestate spread to bare land to be incorporated rapidly (within 24 hours) by 2022*

It is important to clarify what 'bare land' means in this sentence. There are some applications made to land during seedbed establishment and in most instances, it is already the norm to incorporate these materials directly after application. We assume that this proposal does not include grassland applications (as manure will be spread on the surface and not incorporated), but we seek clarification from Defra on this point.

Farming is a dynamic process which is influenced by many factors including the weather, so it is important that some flexibility allowed in order that this does not inhibit the operation of farms and their contractors. More spreading of organic materials to land is being carried out by specialists in the field, as the requirement for bespoke machinery becomes more common. These machines are very expensive to purchase and as with all contractor related work can be subject to delays and breakdowns as they are by nature operating in a fluid market environment.

*b. A requirement to spread slurries and digestates using low emission spreading equipment (trailing hose or trailing shoe or injection) by 2027*

The DC-Agri project has highlighted that, provided digestates are spread when there is a crop nitrogen requirement and using precision application methods such as bandspreading or shallow injection (which are more likely to ensure efficient nitrogen uptake by the crop), ammonia emissions are significantly reduced. In principle, we agree with Defra's proposals that all slurry and digestate should be spread using low emission spreading equipment. We believe that the 2027 deadline for implementing this change should be achievable.

There will be some instances when this is not feasible on account of crop conditions so it should still be allowed in exceptional and clearly defined circumstances.

As explained above, it is important to acknowledge that, according to our survey, much of the AD industry is now using low emission spreading techniques to spread digestate to land.

The recent survey carried out by the REA and ADBA of its AD operators, asked members what application method they used to apply digestate. Of the 43 respondents to the survey who collectively spread in excess of 2.4 million $m^3$ of digestate 93% was spread using low emission techniques.

The data inventory and projections utilised by Defra to inform these proposals and future changes in regulatory requirements must be updated to reflect more accurate assumptions in terms of spreading techniques used by the farming sector to spread digestate to land.

In addition to ensuring that digestates are applied using low emission techniques, it is absolutely paramount to ensure digestates and slurries are only applied at the right time, i.e. when there is a crop nutrient requirement. For this to happen, it is important sufficient storage is provided to enable digestate to be stored for as long as needed.

Therefore, any funding from the Government to tackle ammonia emissions from AD should be targeted at high precision spreading equipment as well as provision of storage capacity.

This can be done through:

- Funding to enable farmers and anaerobic digestion operators to build sufficient new stores for liquid digestates and slurries on farms and AD sites for these materials, so they can be stored for as long as needed and spread when there is a crop nitrogen requirement. The Farming Ammonia Reduction Grant Scheme[16] has been providing practical help to farmers by funding slurry store covers which can reduce emissions during storage by up to 80%, however, the Scheme closed to new applicants in January 2017.
- Funding or low- or no-interest loans to support the purchase of low emission spreading equipment so that nitrogen uptake from crops can be maximised and emissions from this activity can be minimised. We are pleased that the Government, through its Countryside Productivity Scheme, has provided grants that can support digestate processing and spreading. This includes equipment for the processing of digestate, for example, to improve its fertiliser value, or advanced equipment for spreading digestate.

Landspreading contractors should be made eligible for any funding provided in the form of grants or loans for both storage and low emission spreading equipment. We understand from the NAAC that contractors spread most of the digestate produced in the UK; few small AD plants on farm can afford the equipment and the bigger ones tend to contract the work out to spread (however, please note that most of these contractors are not currently assured under NAAC Assured Land-Based Contractor Scheme).

In respect to landspreading and storage of liquids/slurries/digestates, it is essential that a separate piece of work/consultation is undertaken by Government to understand the cost and time that it will take to move the industry (farmers and others involved in landspreading) from the current situation to a position where these materials are only applied when the crops require them. An independent piece of research commissioned by Regen last autumn estimated that 1.4 million cubic meters of additional storage would be required if spreading to stubbles in the autumn was to be stopped. That figure may be conservative – but under current planning regulations, it would take many years, and many millions of pounds to construct that infrastructure. This spring (12 inches of rain between February and July) has highlighted the risk of attempting to spread liquids to land in the spring, and

[16] https://www.gov.uk/government/publications/farming-ammonia-reduction-grant-scheme-claim-form-and-offer-terms

targeting more materials to be spread to land in this window is not without significant potential environmental risk.

c. *The requirement for all slurry and digestate stores and manure heaps to be covered by 2027*

Liquid digestate storage

Firstly, coverage of stores is important to a certain extent, but ensuring the AD and farming sectors have enough storage capacity in place to be able to store digestate until this can be applied is even more crucial.

New permits being issued to the AD sector place a requirement on ensuring that storage lagoons for digestate are covered. For existing facilities there is a move to retrofit covers where this is feasible to do so; however, it can be uneconomic and very impractical in some instances to do this so the REA would like the regulator to take a pragmatic view in these cases.

A member of the REA commented that covering lagoons and farm slurry tanks is expensive, impractical and creates ATEX hazards where waste gases (including methane) are not properly captured and managed or harnessed, so the health and safety issues associated with coverage must be carefully considered, as well as the impracticalities. In the view of this member, larger scale, centralised processing of these wastes and residues should be encouraged and incentivised pro-actively, via AD facilities moving towards the bio-refineries of the future.

Members commented that Government support or incentives could be targeted at the capture of nutrients and $CO_{2e}$ offset, which both affect local emissions reductions (and could be quantified via mass and energy balance monitoring). The resultant data recording should be part of the payment or Government support mechanism.

It is also crucial that challenges faced within the planning landscape are considered in conjunction with any proposals to introduce a requirement for covering stores. Retrofitting stores normally requires significant engineering works, which in turns means planning permission must be obtained. According to our members, in many cases, it has proven to be very challenging to obtain planning permission for lagoons that need retrofitting. This needs to be looked in conjunction with any requirement for covering stores.

The recent REA survey of members showed that just under 70% of respondents have covered storage and a number of the others not currently covered have plans to cover them in the near future.

One of the benefits of covering stores is that this prevents the ingress of rainwater which not only dilutes the digestate and its relative nutrient benefits but also means that there is a need to provide greater storage capacity.

The industry has to take steps to provide greater 'contingency' for storage not only because of less predictable weather patterns and subsequent spreading opportunities but also on account of a change in the EA's stance on autumn applications of digestate to combinable land.

Soil digestate / manure heaps

We do not support Defra's proposal to require coverage of all solid digestate and manure heaps. This would be completely impractical and could cause serious health and safety issues (it would require someone to manually cover and uncover a heap every time it is used or moved, with potential serious risk associated with uncontrolled release of gases.

One member of the REA has noted that if the heaps are covered with old plastic silage sheets, it is possible that pieces of plastics could contaminate the solid digestate/manure and the soil.

Another member of the REA commented that there should be a time limit to how long heaps of livestock manures are left for. This would enable maximising the carbon and nutrient value which would otherwise be lost through poor storage and prolonged degradation when these materials are left in fields for many months. Such resources would be better managed through AD, which can mineralise the ammonia into ammonium nitrate and reduce odour release, plus enable controlled storage and utilisation when the soil and crops most need it.

**Q18. Should future anaerobic digestion (AD) supported by government schemes be required to use best practice low emissions spreading techniques through certification? If not, what other short-term strategies to reduce ammonia emissions from AD should be implemented? Please provide any evidence you have to support your suggestions.**

Firstly, it is important to recognise that in many cases the producer of the digestate (AD plant which is the recipient of the Government support) is not responsible for the spreading of the digestate and should therefore not be liable if this is not applied correctly. The producer, however, should have an obligation to provide the digestate recipient with all the relevant information on the digestate that enables its user to make an informed decision on how the digestate should be applied to minimise any impact on the environment and maximise nutrient efficiency.

Where digestate spreading falls within existing regulatory controls (e.g. environmental permitting), the regulator already has a good insight into the sector and has opportunities through the existing permitting regime to make the necessary changes or enforce current requirements without additional constraints being implemented.

However, given the significant differences in the regulatory regimes that apply to digestate with different status (waste digestates, digestates from agricultural AD plants and EoW digestates), currently spreading of significant volumes of digestates takes place outside the environmental permitting system. For clarity, we summarise below the differences between different regimes applying to digestates with different status.

<u>Digestates with 'waste status' (e.g. food waste based digestates that are not certified to PAS 110 and the AD Quality Protocol):</u>

These digestates are spread under environmental permitting controls, so such digestates are already required to be spread in a way that minimises any environmental impact and digestate should be spread in line with CoGAP (which includes recommendations on how to minimise ammonia emissions) and with any other relevant regulations.

Digestates with End of Waste status (e.g. certified by a REAL appointed certification body to PAS 110 and the AD Quality Protocol)

Digestate certified to PAS 110 and the AD Quality Protocol under the Biofertiliser Certification Scheme owned by REAL must be dispatched with Supply Documentation which includes guidelines and conditions for the use of digestate. The conditions in the documentation must state that digestate 'must be used, stored and handled in accordance with good practice guidelines, including those specified in Appendix H'. Appendix H of the ADQP states that 'Spreading techniques and subsequent soil management that will minimise ammonia emissions should be adopted'. Supply documentation must be provided for each sale or supply of quality digestate and a copy of this documentation must be kept by the supplier. The certification body that audits the AD operator will check the correct Supply Documentation has been provided to the digestate buyer. So, appropriate controls are already in place to ensure appropriate information on the appropriate use of digestate is supplied to whoever buys the digestate. However, there is no auditing of the spreading of the digestate, given that the producer is no longer liable for the use of the digestate once this has been dispatched to the recipient.

'Agricultural' digestates

Currently, if the only input to an AD plant is agricultural manure and slurry or if agricultural manure and slurry is mixed with a non-waste feedstock (e.g. crops grown specifically for AD or crop residues that are not regarded as wastes), and the digestate is spread as a fertiliser on agricultural land, then the EA's view is that the digestate is not waste so it is not subject to environmental permitting controls.

These digestates must still be spread under NVZ regulations (if the land is within an NVZ) and water protection rules, however, there are currently no other mechanisms to ensure digestates are applied in an appropriate way.

Most AD plants operational and in development in the UK are of this kind, so a significant proportion of digestate would not be captured by the above control mechanisms. However, as already highlighted earlier in this response, feedback from our members shows that most digestates are already applied with low emission spreading techniques, so we do not consider that there is a justification for introducing any additional auditing or certification scheme specifically for digestates. The issue needs to be looked at across the whole farming sector, not just in the context of AD and digestates.

If Defra needs reassurance that all livestock slurries and digestates are applied in a way that minimises ammonia emissions, then we would advise that the best and simplest way forward is to ensure a baseline standard for the operation of spreading equipment by farmers, contractors and operators. For example, the scope of the NRoSO Scheme (National Register of Sprayer Operators) for spraying pesticides could be easily extended to include a qualification to cover the application of livestock slurries, manures, and all organic materials including digestates. We understand from our member agronomists that most farmers are farm assured (e.g. under a dairy or a cropping farm assurance scheme) and these schemes normally require the farmer to keep a record that pesticides are only spread by an NRoSO certified spreader operator. This record is provided by the spraying operator to the farmer. If the scope of this scheme were to be extended to include a further qualification to cover the application of livestock slurries, manures, and all organic

materials including digestates, a record could be provided by a qualified spreader operator to the farmer in the same way and this would be checked under the relevant farm assurance scheme.

The information supplied by the producer of digestate when this is supplied should include a statement to the effect that digestate needs to be spread using an NRoSO Scheme qualified spreading operator.

The possibility of introducing a requirement to use a contractor certified by the NAAC Assured Land-Based Contractor (Agricultural Operations) Scheme has also been discussed. This is already available and, having spoken to the NAAC, we understand the cost would not be prohibitive. According to NAAC, it is likely that contractors wouldn't pass on their cost of obtaining certification to farmers because of price competition amongst the contractors. However, members of the REA have highlighted that this could place an unnecessary burden on farmers or operators who have invested in high precision equipment and are spreading the material themselves, in the best possible way and in a timely fashion to optimise the nutrients that digestates supply.

Also, it is unclear who would be responsible for enforcing this scheme, especially where digestates are not regulated. Finally, most of the spreading contractors are currently not assured under the NAAC Scheme.