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Sent by email to: ClimateChange@agriculture.gov.ie

20th June 2019

Re: Code of Good Agricultural Practice for Reducing Ammonia Emissions from Agriculture

An Taisce welcome the opportunity to comment on the Code of Good Agricultural Practice for reducing Ammonia Emissions from Agriculture. We would like to raise the following points.

1. Voluntary Measures

The National Emission Ceilings Directive (NECD) establishes emission ceilings for 2020 and 2030, and requires Member States to put in place a Code of Good Agricultural Practice for reducing Ammonia Emissions from Agriculture. The purpose of the document is outlined as:

'This Code of Good Agricultural Practice for reducing ammonia emissions is a guidance document that outlines the best practice measures for removing or lowering ammonia emissions associated with agricultural activities. The measures outlined in the Code are voluntary measures to help farmers identify appropriate actions for their individual farm enterprise.'

Agriculture accounts for 99.1% of ammonia emissions in Ireland (EPA, 2019)[1], and Ireland have exceeded the emission ceiling for 2016 and 2017. As clearly outlined by the EPA (2019):

'Limiting and reducing NH3 emissions into the future ***could be problematic*** *given the strong performance of the agriculture sector in line with the ambitious targets of Food Wise 2025. A 26 per cent increase in dairy cow numbers and 24 per cent increase in nitrogen fertiliser use over the period 2012 to 2017 are the most significant drivers. There is now an immediate requirement for focused implementation of abatement measures at farm level.'* [An Taisce emphasis]

This is echoed by Teagasc (2018)[2]:

'Bringing emissions below the level of the crucial 2005 reference period in the years to 2030, however, ***would appear to be very challenging*** *for both emissions of GHGs and ammonia.'* [An Taisce emphasis]

and

'***Widespread and immediate adoption of mitigation action*** *is required or the agricultural sector may find itself constrained in its ability to grow over the medium to longer term.'* [An Taisce emphasis]

[1] EPA (2019) Ireland's Transboundary Gas Emissions 1990-2030
[2] Trevor Donnellan, Kevin Hanrahan and Gary Lanigan (2018). Future Scenarios for Irish Agriculture: Implications for Greenhouse Gas and Ammonia Emissions. Teagasc.

However, despite stark warnings from two different government bodies regarding the necessity for urgent action, this DAFM document only outlines voluntary measures, which are left up to the farmers to apply as they see appropriate. In the Code it states:

> `*the adoption and implementation of the good practice measures outlined in this Code will reduce the risk of Ireland exceeding its ammonia emission target"*

Given the above statements by both Teagasc and the EPA, it is clear that Ireland are almost certain to breach our emission targets, and while the implementation of the measures outlined would reduce our ammonia emissions, they will not stop us from breaching the NECD ceiling. Without drastic, compulsory measures, which this Code does not promote, there is no question that we will breach our targets, and to endeavour to 'reduce the risk' with voluntary measures is short sighted.

Failure to comply with the NECD reductions targets will leave Ireland open to penalties by the EU. In addition, it could undermine Ireland's marketing strategy, promoted via Origin Green, of Irish agriculture as sustainable and 'green'. This warning was given by Teagasc in 2018[3]:

> *'the clean green image of the sector highlighted in the Food Harvest 2020 and Food Wise 2025 agri-food sector development strategies could be vulnerable if customers internationally and at home form the impression that Ireland's agri-food sector is not contributing to national emission reduction obligations.'*

and again on April 4th in 2019 in a Farming Independent article[4] where Teagasc warned that greenwashing could backfire:

[3] Trevor Donnellan, Kevin Hanrahan and Gary Lanigan (2018). Future Scenarios for Irish Agriculture: Implications for Greenhouse Gas and Ammonia Emissions. Teagasc

[4] https://www.independent.ie/business/farming/agri-business/greenwashing-could-backfire-on-farming-37971831.html

'In (Bord Bia's) Origin Green we are making very strong claims about sustainable performance and environmental performance that is creating a need for credible demonstration of sustainability - the industry needs credible evidence rather than glamour stories.

If we are to continue with the sustainability claims that we are a clean, green food producing nation, we need to prove it. Other organisations outside of Ireland will be very quick to pounce on claims that we make.'

In our considered opinion, given the serious challenge facing Ireland to reach our ammonia reduction targets, voluntary measures which are self-identified by farmers will not sufficiently reduce our ammonia emissions. Indeed, Teagasc have highlighted that even with the implementation of all abatement measures, including those which are likely to be economically unfeasible, we will still exceed our emission ceiling for ammonia for 2020 and 2030.

In a 2015 document[5], Teagasc examined abatement potential of various methods using a baseline projection. 12 kT NH_3 represented the maximum biophysical abatement potential, and it was highlighted that this would be extremely challenging to implement due to incentivising farmer uptake of abatement measures, and verifying that the abatement measures are implemented. Even with a 12 kT reduction in ammonia, or a 16 kT reduction, as outlined in a more recent Teagasc document[6], Ireland would still breach our ammonia ceiling by 8 kT or 4 kT respectively, depending on which figures you use (NEC ceiling for 2030=108 kT NH_3, EPA projection for ammonia emissions for 2030=128 kT NH_3, Ammonia emissions with maximum abatement of 16 kT NH_3 applied=112 kT NH_3). Teagasc are in the process of revising their ammonia abatement figures, with An Taisce given to understand that they will demonstrate increased abatement potential in a document to be released later this

[5] Gary J. Lanigan, Trevor Donnellan, Kevin Hanrahan, William Burchill, Patrick Forrestal, Gerard McCutcheon, Paul Crosson, Pat Murphy, Rogier Schulte, Karl Richards, Paddy Browne (2015). An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030. Teagasc.
[6] Krol, Dominika (2019). Updated Ammonia Abatement Potential in the Projected S1 Activity Scenario. Teagasc.

year. However, we would highlight that this abatement potential is based on data up to 2017, and the levels of ammonia emissions may well be greater than predicted. Indeed, this potential underestimation is clearly demonstrated in Figure 1 in relation to synthetic fertiliser import projections under the six different Teagasc scenarios. An Taisce would highlight that EPA data on fertiliser import indicates that we are already far in excess of any of the scenario projections, at 408,000 tonnes for 2018[7] . It would appear to An Taisce that if the projections for fertiliser import were underestimates, even for the most intensive scenario modelled, then it would follow that our ammonia emissions will likely also be similarly inflated relative to the projected scenarios. If the fertiliser import figures from the EPA are indicative of a trend over and above any of the modelled scenarios, as opposed to being an outlier, any increased abatement capacity demonstrated by Teagasc projections later this year is likely to be offset by an increase in ammonia emissions.

[7] pers comm

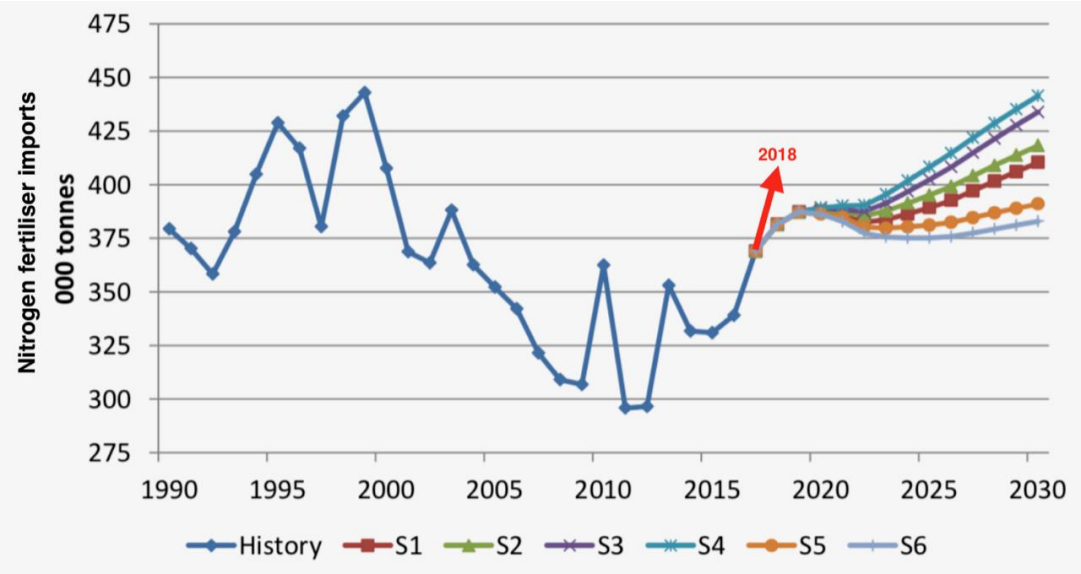


Figure 1: Teagasc projections[8] for the volume of nitrogen fertiliser imports to Ireland under 6 scenarios. Red arrow is superimposed by An Taisce, indicating actual figures provided by the EPA for 2018.

As An Taisce understand it, even with every possible abatement measure implemented, Ireland will breach our ammonia limits for both 2020 and 2030. As such, this Code of Good Agricultural practice, while required under the NECD, will do little to address Ireland's lack of compliance with this Directive, and could be interpreted as being more of a 'tick-box' exercise. As recognised by Teagasc (2015) significant policy measures would be necessary to implement uptake of ammonia abatement measures, and many could only be implemented at huge cost. This Code is essentially meaningless without mandatory implementation combined with rigorous policy changes, and substantial funding for specific measures.

[8] Lanigan et al (2018) An Analysis of Abatement Potential of Greenhouse Gas Emissions in Irish Agriculture 2021-2030. Teagasc.

2. Ammonia impacts on Natura 2000 Sites

Nitrogen pollution in the form of ammonia (NH_3) poses a serious risk to global biodiversity, leading to species decline via eutrophication, acidification and direct toxicity to a range of habitat types (Kelleghan et al (2019[9]) and references therein). Numerous studies have highlighted the link between nitrogen pollution and species decline (Kelleghan et al (2019[10]) and references therein). As ammonia levels increase, fast growing generalist species begin to dominate, and out-compete the more specialised species which are predominantly slow growing and nutrient sensitive[11].

The European Union's Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EC) require EU Member States to identify and maintain the Natura 2000 network of designated sites in "*favourable conservation status*". The NPWS 6 yearly Article 17 Report from 2013, on the status of habitats and species, shows the scale of the challenge facing Ireland. Of the 59 overall habitat assessments, only 5 stood at "Favourable" status, 30 at "Inadequate" and 24 at "Bad". The habitats identified as having bad status include peatlands, including raised and blanket bogs, and heaths; and biodiversity rich grassland areas, including orchid-rich and species-rich grasslands. These are the very habitats which are most susceptible to ammonia pollution. Bog and peatland habitats are home to sensitive lichens and mosses, which are impacted by even low levels of ammonia pollution (5-10 kg/ha/yr[12]). Grasslands, heathlands and forests are also susceptible (10-25kg/ha/yr). An Irish study estimated that the average

[9] David B. Kelleghan, Enda T. Hayes, Mark Everard, Thomas P. Curran (2019) Mapping ammonia risk on sensitive habitats in Ireland. Science of The Total Environment, Volume 649, 1580-1589.
[10] David B. Kelleghan, Enda T. Hayes, Mark Everard, Thomas P. Curran (2019) Mapping ammonia risk on sensitive habitats in Ireland. Science of The Total Environment, Volume 649, 1580-1589.
[11] Susan Guthrie, Sarah Giles, Fay Dunkerley, Hadeel Tabaqchali, Amelia Harshfield, Becky Ioppolo, and Catriona Manville (2018). The impact of ammonia emissions from agriculture on biodiversity An evidence synthesis. The Royal Society.
[12] Bobbink, R., Hicks, K., Galloway, J., Spranger, T., Alkemade, R., Ashmore, M., Bustamante, M., Cinderby, S., Davidson, E., Dentener, F., Emmett, B., Erisman, J.W., Fenn, M., Gilliam, F., Nordin, A., Pardo, L., De Vries, W., 2010. Global assessment of nitrogen deposition effects on terrestrial plant diversity: a synthesis. Ecol. Appl. 20, 30–59

nitrogen deposition on Irish grasslands may be as high as 22kg/ha/yr[13]. Guthrie *et al.* (2018[14]) highlight that if ammonia pollution is extensive enough, the change of species composition and rate of extinction may alter the nature of the habitat entirely, and certain sensitive habitats may be lost. This would have serious ramifications for Ireland's obligations under the Habitats Directive.

Under the NECD, ammonia must be monitored on biodiversity rich sites such as Natura 2000 sites[15], and it should be predicated on a risk based approach. Recently published work on ammonia impacts on SACs by Kelleghan et al. (2019)[16], highlights the lack of monitoring of ammonia in Ireland. The authors outline that without detailed mapping of ammonia emissions, it will be extremely difficult to identify which Natura sites are most at risk of impacts caused by elevated ammonia emissions. As outlined by the authors, in order to accurately create a deposition model, a concentration model is first required. To date, Ireland has carried out only 2 atmospheric ammonia assessments, the latest, from 2013-2014, based on just 25 locations, and these sites were purposely chosen to avoid areas of high ammonia concentration, such as pig and poultry farms. Using interpolated data, the Kelleghan et al (2019) model predicts that 81, 34 and 6% of Natura 2000 sites in Ireland may exceed ammonia concentrations of 1, 2, and 3 µg/ m3, respectively, with critical levels identified internationally as being 1 and 3 ± 1 ug/m3.

Given the paucity in the data, and the requirement under the NECD to have a risk based approach which incorporates sensitive sites, An Taisce submit that in order to assess any positive impact of the suggested abatement measures for sensitive sites, a robust monitoring network should be in place, particularly in sensitive Natura 2000 sites. Although Ireland needs

[13] Stevens, C.J., Dise, N.B., Mountford, O. et al., 2004. Impact of nitrogen deposition on the species richness of grasslands. Science 303: 1876–1879.
[14] Susan Guthrie, Sarah Giles, Fay Dunkerley, Hadeel Tabaqchali, Amelia Harshfield, Becky Ioppolo, and Catriona Manville (2018). The impact of ammonia emissions from agriculture on biodiversity An evidence synthesis. The Royal Society.
[15] European Commission, 2018. Ecosystem monitoring under Article 9 and Annex V of Directive 2016/2284 (NECD) http://ec.europa.eu/environment/air/reduction/ecosysmonitoring.htm
[16] David B. Kelleghan, Enda T. Hayes, Mark Everard, Thomas P. Curran (2019) Mapping ammonia risk on sensitive habitats in Ireland. Science of The Total Environment, Volume 649, 1580-1589.

to reduce ammonia emissions at a national level, particular attention should be paid to emissions in high risk areas, such as those identified by Kelleghan et al (2019[17]). To fail to adequately reduce NH3 emissions in these areas in particular will potentially put Ireland in contravention of the Habitats Directives, and leave us liable to ECJ levied fines.

3. Health Impacts

In addition to the environmental impacts, ammonia also poses a serious health risk. Fine particulate matter with a diameter less than 2.5 micrometres ($PM_{2.5}$) is well known to be harmful to health, with the capacity to penetrate deep into the lungs. Ammonia is wind borne and can mix with industrial and car fumes, forming $PM_{2.5}$, which is linked to higher death rates, respiratory problems, cardiovascular diseases, cognitive decline and low birth weights. Research by the Max Plank institute[18] found that the concentration of fine particulates in the atmosphere could be halved by preventing the release of ammonia due to agricultural activities. The same authors found that a 50% reduction in ammonia would decrease mortality from $PM_{2.5}$ by 20%, and 50,000 European deaths per year could be prevented. The lead author then further analysed the data for the UK[19], outlining that at least 3000 premature deaths could be prevented annually by cutting ammonia emissions. He outlined that ammonia is one of the key elements of $PM_{2.5}$ formation.

In high concentrations, exposure to ammonia causes immediate burning of the nose, throat and respiratory tract. Generally speaking, ammonia is a reactive gas and much of it is deposited close to where it is emitted, however, some may reach higher levels in the atmosphere and be wind dispersed for long distances, potentially hundreds of kilometres once

[17]David B. Kelleghan, Enda T. Hayes, Mark Everard, Thomas P. Curran (2019) Mapping ammonia risk on sensitive habitats in Ireland. Science of The Total Environment, Volume 649, 1580-1589.
[18] Pozzer, A. and Tsimpidi, A. P. and Karydis, V. A. and de Meij, A. and Lelieveld, J. (2017). Impact of agricultural emission reductions on fine-particulate matter and public health. Atmospheric Chemistry and Physics. 17 (20) 12813-12826

[19] https://www.thebureauinvestigates.com/stories/2019-06-13/deadly-gas-ammonia-cutting-farm-emissions-could-save-3000-lives-a-year

it binds to sulphur and nitrogen oxides[20]. As such, the ever increasing ammonia emissions have serious health implications for those living within the zone of impact of the more intensive farms where ammonia concentrations will be highest, in addition to the communities further away whom will also be impacted by the $PM_{2.5}$ which is wind borne. This also poses a direct and serious risk for personnel working on intensive animal farms, with studies demonstrating that the levels of particulate matter in these facilities is over the safe limits of exposure[21]. This may give rise to future legal action by such workers whose health may be seriously impacted by the working conditions.

Thus, DAFM has an obligation to reduce the national emissions of ammonia for public health reasons, in addition to environmental reasons. Elevated ammonia has been proven to be detrimental across the board, and abatement measures must be rigorously enforced and effective.

4. Specific measures

The Code is essentially a list of different measures which farmers can voluntarily implement, with the choice of what they feel is most appropriate left up to them. However, An Taisce would highlight that the whole ammonia lifecycle needs to be taken into account. If emissions are reduced at the manure storage stage, by covering the storage area, one of the measures promoted in the Code, then it leads to the retention of this nitrogen in the manure, which is then available for volatilisation upon slurry spreading[22]. It would effectively postpone the

20 https://webarchive.nationalarchives.gov.uk/20130402200536/http://archive.defra.gov.uk/environment/quality/air/airquality/publications/ammonia/documents/ammonia-in-uk.pdf

21 Van Ransbeeck N, Van Langenhove H, Michiels A, Sonck B, Demeyer P. Exposure levels of farmers and veterinarians to particulate matter and gases during operational tasks in pig-fattening houses. Annals of Agricultural and Environmental Medicine. 2014;21(3):472-478. doi:10.5604/12321966.1120586.

22 Gary J. Lanigan, Trevor Donnellan, Kevin Hanrahan, William Burchill, Patrick Forrestal, Gerard McCutcheon, Paul Crosson, Pat Murphy, Rogier Schulte, Karl Richards, Paddy Browne (2015). An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030. Teagasc.

release of ammonia, but not prevent it. As such, abatement measures need to be used in tandem, spanning the whole life cycle of manure, including storage and application[23]. To apply the measures outlined in the Code using a piecemeal approach may fail to achieve the aim of reducing ammonia emissions. There is the argument that there should be more focus on the feedstuff abatement measures, which would reduce the amount of ammonia produced in the first place[24].

Further, Teagasc have outlined which measures are most cost effective (use of urease inhibitors, trailing hose for bovine slurry, reducing poultry pH and the reduction of crude protein in pig diets). The use of these measures could provide 60% of ammonia mitigation for 40% of the cost[25]. As such, An Taisce would question why the Code does not prioritise particular measures, or indeed provide a cost analysis, as carried out by Teagasc. Farmers should be fully informed as to the benefits and costs involved in implementation of particular measures. For instance, a switch to using urea inhibitors would economically benefit any farmers currently using CAN synthetic fertiliser, which is currently the main fertiliser used in Ireland, at €0.95 per kg/N for protected urea, versus €1.05 kg/N for CAN. The replacement of CAN by protected urea would not reduce ammonia emissions, but would significantly reduce GHG emissions. As such, if protected urea were the main fertiliser used it would be a win win in terms of reducing ammonia emissions relative to unprotected urea, and for reducing GHG emissions relative to CAN. Despite remaining doubts in certain bodies regarding the safety of protected urea, An Taisce would highlight that it has been approved for use within the EU, and several studies have indicated that there is no risk of residue, unlike DHD, a nitrification inhibitor which is not in use in Ireland.

[23] Susan Guthrie, Sarah Giles, Fay Dunkerley, Hadeel Tabaqchali, Amelia Harshfield, Becky Ioppolo, and Catriona Manville (2018). The impact of ammonia emissions from agriculture on biodiversity An evidence synthesis. The Royal Society.

[24] Susan Guthrie, Sarah Giles, Fay Dunkerley, Hadeel Tabaqchali, Amelia Harshfield, Becky Ioppolo, and Catriona Manville (2018). The impact of ammonia emissions from agriculture on biodiversity An evidence synthesis. The Royal Society.

[25] Gary J. Lanigan, Trevor Donnellan, Kevin Hanrahan, William Burchill, Patrick Forrestal, Gerard McCutcheon, Paul Crosson, Pat Murphy, Rogier Schulte, Karl Richards, Paddy Browne (2015). An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030. Teagasc.

If this were clearly highlighted to farmers in this Code, it would facilitate further uptake of this measure, one which Teagasc have outlined would be both cost-effective and beneficial in terms of the percentage of mitigation it represents.

It must be noted that Teagasc highlight that three of the four most effective methods for ammonia abatement are also the most expensive, the use of trailing shoe for dairy and non-dairy, and covering slurry pits. It is unclear how the DAFM intend to facilitate sufficient uptake of these expensive methods given the widely recognised indebtedness of many farmers in Ireland. While the grant aided TAM scheme will facilitate a certain level of uptake of LESS machinery, An Taisce understand that approximately 2,500 applications have been made for this machinery[26], which represents roughly 10% of all farmers. However, Teagasc abatement calculations are based on 25% uptake of this method[27]. It would appear to An Taisce that a 25% uptake of this method would be very challenging to achieve given the financial contstraints.

Furthermore, this code lacks any analysis of trade-offs. For instance, the use of trailing shoe is highlighted as one of the most effective measures for reducing ammonia emissions, but given that this covers a much smaller area than a splash plate, it requires farmers to repeatedly drive up and down their fields, with a roughly 20 tonne machine, including the slurry tank, which would lead to serious soil compaction, with obvious negative impacts on soil health, and ultimately increasing runoff. These trade-offs need to be highlighted and properly considered in a holistic way. The abatement of one environmental stressor should not exacerbate other agricultural pressures.

Further to that, the problem of transboundary ammonia pollution must be considered, as even with abatement by Ireland, emissions from Northern Ireland will further elevate ammonia levels in the ROI. The ammonia emissions in Northern Ireland are also highly elevated, representing 12% of UK ammonia emissions, due primarily to a high prevalence of intensive

[26] DAFM, pers comm.
[27] Krol, Dominika (2019). Updated Ammonia Abatement Potential in the Projected S1 Activity Scenario. Teagasc.

pig and poultry farms, many of which occur along the north-south border. Transboundary consultation will be a necessary step in the reduction of our ammonia emissions, and should be a major consideration in the licencing of further intensive agricultural facilities.

Overall, An Taisce submit that the Code contains no timetable for implementation of the measures, no mandatory measures, no obvious incentives and no real guidance on which measures would be most cost effective to implement, while being effective at reducing emissions. What is needed is a drastic reduction in emissions, and this Code, as stands, will undoubtedly fail to achieve that.

5. Intensive Agricultural Model

Ireland's agricultural intensification programme is increasing the volumes of animal manure produced, and is also increasing the volumes of synthetic fertiliser required for the production of grass to feed this increasing herd. Both of these are going to further increase our ammonia emissions, in contravention of the National Emissions Ceilings (NEC) Directive (2016/2284/EU). This will expose the State to legal action both at national and EU level. Further, on the 13 March 2019 the European Parliament called for future CAP payments to EU farms to be linked to progress on cutting harmful air pollution including ammonia in a motion backed by an overwhelming majority of MEPs. The motion also highlighted how the agriculture sector was falling behind as other industries make efforts to tackle emissions:

> "*the costs of air pollution control in Europe are significantly lower in the agricultural sector than in other sectors where more stringent emission controls have already been implemented*".

As such, the sustainability of Ireland's intensive agricultural system must be seriously called into question in the face of increasing ammonia emissions. An Taisce submit that in order to comply with the NEC in a meaningful way, and indeed the Water Framework Directive and Habitats Directive, the sheer numbers of animals, bovine, poultry and pig will have to be reduced, in addition to fertiliser use. To continue with our current system will undoubtedly

lead to EU fines for failing to abide by a multitude of Directives, potentially negating any financial benefit gained by this intensification under Foodwise 2025. An Taisce submit that our current agricultural model is unsustainable on multiple fronts, with rising ammonia emissions being just another indication of this. As outlined by Teagasc[28], there is a:

> *'continuing dilemma between policy driven and industry motivated ambitions to increase agricultural activity levels and commitments to reduce emissions. The resolution of this dilemma is perhaps the most important challenge currently facing the Irish agri-food sector'*

The DAFM silo type approach to the issues surrounding Ireland's intensification of our agricultural system will not be effective, particularly by means of non-binding documents such as this Code. A transformation change is clearly necessary. What is needed is a holistic assessment of the entire agricultural system, with consideration of all the environmental and economic angles. Only then can we chart a new way forward, one which benefits all stakeholders.

6. Recommendations

1. The Code should include a cost analysis of the measures, with a clear indication for farmers of roughly how much each measure will cost to implement, and how effective they would be.
2. Measures should be ranked in preferential order, so farmers can clearly identify which measures would be more effective.
3. A full life cycle analysis of ammonia emissions is necessary, which link back to the effectiveness of the ammonia abatement potential. For example covering of slurry pits, which may prove very expensive to implement, will do little for ammonia abatement if used in isolation, as the ammonia will just then be available for release upon landspreading. Certain measures should be clearly linked to each other, and not presented as standalone measures.

[28] Lanigan et al (2018) An Analysis of Abatement Potential of Greenhouse Gas Emissions in Irish Agriculture 2021-2030. Teagasc.

4. The use of protected urea should be a clear recommendation, to replace both unprotected urea and CAN, as this is one of the easiest measures to implement, and will also have benefits in terms of reducing GHG emissions from CAN, and ammonia emissions from unprotected urea.
5. There should be an outright ban on splash plate slurry spreading, as proposed by DEFRA in the UK from 2025 onwards. If 100% of slurry was spread using LESS technology, between 4.1 and 6.2 kT NH_3 could be abated[29].
6. Measures should be clearly timetabled, and enforced. Most importantly, a clear funding mechanism should be identified, as without additional funding many of these measures will be unfeasible for farmers already under significant financial pressure. The cost of ammonia abatement will rarely prove cost negative to farmers, and as such sufficient financing is imperative.
7. Knowledge sharing for farmers is essential to the success of any abatement programme, the cost of which must also be factored in to any cost-benefit analysis.
8. The trade-offs of using certain methodologies should be clearly highlighted, e.g. soil compaction associated with certain LESS methods.
9. Consideration should be given for herd reduction, and the ammonia abatement which that would provide

[29] Gary J. Lanigan, Trevor Donnellan, Kevin Hanrahan, William Burchill, Patrick Forrestal, Gerard McCutcheon, Paul Crosson, Pat Murphy, Rogier Schulte, Karl Richards, Paddy Browne (2015). An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030. Teagasc.

An Taisce would request that you take these comments into account

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