

Questions and Answers: Teagasc Research Insights webinar series
New Ammonia MACC – outlook to 2030 (7 October 2020)

#	1
Question	Summarise the problems caused by ammonia
Answer(s)	Ammonia causes negative impacts on animal and human health and ecosystems. Regarding health impacts, ammonia can lead to respiratory tract irritation. Ammonia can lead to eutrophication and acidification of terrestrial and aquatic ecosystems, potentially affecting N sensitive species and therefore leading to changes in habitat structure.

#	2
Question	How does the ROI inventory treat trailing hose, compared to trailing shoe slurry spreading. The UK emission factor states that trailing hose is half as effective as trailing shoe in achieving ammonia reduction. Is the same assumption made in the ROI?
Answer(s)	Currently, the Irish inventory does not include any LESS methods due to lack of activity data. Recent Teagasc report into manure management practices will help provide necessary activity data https://www.teagasc.ie/media/website/publications/2020/Manure-Management-Practices-Report.pdf for inclusion of LESS in the national inventory. However, similarly to the UK, emission factors for trailing shoe and trailing hose for ROI also assume that the efficacy of trailing hose is half of that of trailing shoe.

#	3
Question	From the graph showing the trend analysis of the cow numbers and fertilizer projections can we imply that the scenarios of hard and soft brexit increases cow numbers compared to BAU scenarios?
Answer(s)	Under the 3 scenarios (S1 to S3) dairy cow numbers are trending upward, a hard Brexit assumed under S2 leads to a slower rate of increase. The dairy sector is less exposed to the UK market so profitability of the sector still precipitates increased dairy cow numbers under the S2 scenario. The beef sector is heavily exposed to the UK market. Suckler cow numbers decline under all scenarios but a hard Brexit assumed under S2 leads to a bigger rate of decline in these numbers. The total cattle population declines by 2% and 9% under the S1 (BAU) and S2 (Hard Brexit – lower activity) scenarios respectively. Fertiliser is a function of animal numbers and the ratio of dairy to suckler cows. Dairy cows have greater energy demand and are associated with higher rates of chemical fertiliser per hectare to grow this forage.

#	4
Question	Under the European Green Deal there is a target to reduce nutrient losses by 50% with a reduction in fertiliser use by 20% - none of the scenarios show a decrease in fertiliser use so what is the likely scenario for Ireland to reduce fertiliser use?
Answer(s)	The activity scenarios used in this analysis were produced before the publishing of the EU Green Deal and therefore we had no view of possible targets to reduce fertiliser use. Where possible, mitigation measures and their adoption

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	pathways followed the DAFM's draft AgClimatise strategy. The aim of this analysis was to explore ammonia mitigation within the three projected activity scenarios.
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#	5
Question	How are the EA & DEFRA looking to address this in Northern Ireland post Brexit? Is there a roadmap for reduction to address the level 4 emissions we're seeing in the North? Are we looking to work with farmers in the North to address their risk?
Answer(s)	Unfortunately we are not currently aware of the exact plans for addressing ammonia concentration in Northern Ireland as our focus lies within the ROI.

#	6
Question	What quantity of the additional requirements are attributable to the expansion in dairy cow numbers?
Answer(s)	The analysis does not include a scenario that allows us to answer this question, but inevitably as animal numbers of any kind increase then increased mitigation is required.

#	7
Question	While a small portportion of overall mitigation, is the cost savings from using lime very low in the graphic?
Answer(s)	Area that is limed in year 1 of the study period (2021) has to be re-limed again in 4 years (2025) and 8 years (2029). The benefit of this liming is achieved at the start and maintained but the cost in repeated 3 times hence benefits in fertiliser saving are being offset somewhat by the cost of repeated liming.

#	8
Question	Hi, could you explain please, is the -31.13 KT reduction in NH3 from fertiliser take account if other measures been adopted resulting in increased N use efficiency. Hope this make sense!!
Answer(s)	The figure of -31.13 kT NH3 is for the protected urea measure on its own. When all measures are adopted, contribution of individual measures can change slightly due to interaction at different stages in the N flow model. Where nitrogen use efficiency improvements are achieved chemical N (protected urea form) is assumed to be reduced directly and proportionately on the back of this efficiency gain.

#	9
Question	Where is Life Cycle Assessment fitting into ammonia abatement strategy?
Answer(s)	Life Cycle Assessment methodology calculates emissions per product and is usually used in the greenhouse gas footprints of different products. However, as the national emission reduction targets are based on absolute emissions, LCA would not be appropriate to adopt here. We have followed the national

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	inventory approach which reflects how emissions are calculated and reported nationally.
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#	10
Question	Hi guys, fantastic webinar, well done. For the LESS intervention, what spreading method was modelled, trailing shoe or trailing hose or a combination?
Answer(s)	The analysis assumed that half of the slurry spread by LESS is applied by trailing shoe and half by trailing hose.

#	11
Question	I have two questions - emission factors. these are the basis of your analysis - how much do these numbers depend on actual measurements? 2. Reduction of bovine population - how is this seen by the farming community? This will put a kind in their business
Answer(s)	Emission factors used in this analysis are based on published national and international research. They are specified for each individual measure in Chapter 4 of the document. Where possible, national data was used. In the absence of national data, data was used from peer reviewed international studies, UNECE guidance document and EMEP/EEA inventory guidebook. With regard to the projected changes to the bovine population, these are activity levels modelled by the FAPRI model based on assumptions with regard to issues such as CAP and Brexit, therefore there is a high level of uncertainty associated with such projections.

#	12
Question	What is the assumption in the MACC for timing of slurry application?
Answer(s)	The current assumptions of the EPA's national inventory with 52% of slurry spread in spring, 36% in summer and 12% in autumn are used for timing of slurry application. The option of adjusting timing of manure application has not been explored further in this analysis due to a) limited scope for further changes to timing of application and b) difficulties in recording timing of manure application for monitoring, reporting and verification purposes.

#	13
Question	Excellent presentations, thank you. A question on the health and ecosystem benefits. Accepting that there are legal limits on NH3 emissions, is it correct to assume that the health and ecosystem effects are more related to atmospheric concentration as sho...
Answer(s)	Concentrations are directly linked with emissions, if we have high or concentrated emissions typically we'd expect to see high concentrations. Health effects could occur from concentrations of ammonia, but would be more typically associated with PM2.5 which is formed when ammonia reacts with other pollutants. Ecosystem effects are primarily from the deposition of ammonia resulting in eutrophication and acidification of habitats. Dry deposition locally, causes the greatest biodiversity effects, and is directly linked with the

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	concentration.
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#	14
Question	Why are alternative land uses such as forestry or tillage not included in the options to reduce ammonia emissions?
Answer(s)	Such measures operate at scales different to that employed in the MACC analysis and the effects of such changes could not be readily captured in the national ammonia inventory. Rather, potential ammonia emission reduction would come from changes in land management associated with these land use alternatives.

#	15
Question	Thank you Cathal and Dominika. What are your thoughts on green ammonia?in terms of production of fertiliser
Answer(s)	Green ammonia uses renewable energy in the fertiliser production. While this will reduce GHG emissions associated with energy use of fertiliser production and make synthetic fertiliser products more sustainable, this process still captures a non-reactive nitrogen form and transforms it into a reactive form used in agriculture. Therefore the impact of green ammonia would not be seen from the national emission perspective explored in the MACC analysis.

#	16
Question	Was an overall reduction in chemical N usage considered in any scenario i.e. increase in NUE?
Answer(s)	The reduction in N usage was not considered in the three projected activity scenarios. Rather, adopting ammonia mitigation measures outlined in the MACC leads to a reduced need for synthetic N fertiliser.

#	17
Question	Anaerobic Digestion is known to significantly reduce emissions in both storage and spreading of slurry. Is there any reason it is not mentioned in this report?
Answer(s)	Digestate following anaerobic digestion is characterised by higher proportion of available N making it more susceptible to ammonia loss. This can be mitigated using LESS methods for landspreading of digestate, however more data is needed to quantify these emissions before this option can be considered in the MACC analysis.

#	18
Question	Are there plans to produce a broad/integrated farm sustainability MACC that allows us to look at the overall costs of implementation and to see where we can get double/triple... dividends?
Answer(s)	This is a significant undertaking. Initial research has started to look at this topic by way of a PhD Walsh Scholarship.

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#	19
Question	Will sourcing the proposed additional urea based fertilisers be an issue in the future?
Answer(s)	Globally, urea-based fertilisers are the main N source for agricultural use therefore they are widely available. Currently, all main fertiliser suppliers in Ireland carry protected urea products.

#	20
Question	My question is, how far does ammonia travel from where it is emitted? Is it very local - or can it travel significantly? Does this have implications for how well coordinated ammonia reduction in the North and South of Ireland needs to be?
Answer(s)	Ammonia on its own does not travel far. However, it is highly reactive and can be transformed to ammonium as PM2.5 which can be transported in longer ranges and subsequently deposited through rainfall. This transport is affected by the environmental conditions and local topography. Due to predominant south westerly wind conditions in Ireland, it is likely that ammonium, created from ammonia emissions will cross the border. It is vital that both the North and South maximise efforts to reduce ammonia emissions, if these efforts are not co-ordinated emission reduction efforts in one country may be shadowed by emissions from the other.

#	21
Question	Why would there be a savings with Covering Pig slurry tanks versus a cost with Covering bovine tanks
Answer(s)	This is a function of the different emission factors used for bovine covered (5%) and uncovered (10%) stores versus pig covered (13%) and uncovered (52%) stores applied in the inventory accounting system. More nitrogen is hence retained by covering pig stores and this is reflected in greater chemical N savings in monetary terms.

#	22
Question	Covering pig slurry stores was shown to be a cost benefit for the farmer, which is a positive. Was the cost of covering stores, retrofitting existing stores taken into the analysis? Also, was the BAT conclusion requirement for permitted farms to cover sto...
Answer(s)	A cost of €4 per m ³ was assumed for the installation cost of switching from uncovered to covered pig slurry stores by deploying rigid covers in line with Reis et al., (2015).

#	23
Question	Q to Cathal on caveat no 3. Is it likely that efficiency gains would not lead to a decrease in chemical N use?
Answer(s)	By improving nitrogen use efficiency (NUE) there is a reduced requirement for chemical N fertiliser. Farmers will need advice as to how much to reduce for their given circumstance. Risk averse farmer may choose to apply the same

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	level of fertiliser as a hedge against lower yields. Farmers need to be encouraged/advised to reduce chemical fertiliser on the back of improved NUE.
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#	24
Question	Do we need a more heavy handed approach from policy makers? ie. Banning splashplate in a quicker time frame or mandatory protected N?
Answer(s)	LESS is already mandated on all derogation farms. These farms represent 26% of slurry spread in Ireland. Following the draft AgClimatise strategy, only 10% of slurry will not spread by LESS by 2030.

#	25
Question	Given that nitrogen types are all readily transformed in the soil, will the switch to protected urea not eventually lead to higher future losses unless the overall N loading to the soil is reduced?
Answer(s)	Throughout the MACC analysis it is assumed that improved NUE leads to reduction in the use of synthetic N fertiliser. It is correct to assume that the overall N loading to the soils should be reduced and with the improvement in the NUE it comes as a financial saving to the farmer.

#	26
Question	Are there any practical treatments that can be applied to slurry stored in slatted tanks to reduce ammonia losses? If so how effective are they?
Answer(s)	Chemical acidifiers are commonly known slurry amendments to reduce ammonia emissions. Amendments such as aluminium sulphate (commonly referred to as alum) can be used in the slatted tanks during slurry storage without the need for additional infrastructure necessary for liquid acid dosing. Due to this ease and safety of use and the efficacy of ammonia mitigation this particular amendment was chosen for the MACC analysis.

#	27
Question	Has the extra cost from using LESS been taken into account in your analysis?
Answer(s)	Contractor market rates for slurry spreading are employed as a proxy for the cost of slurry application in the case of both the splashplate and LESS methods of application.

#	28
Question	Can you clarify the extent of the ammonia monitoring network in ROI - how many alpha, delta and continuous monitoring systems are operated?
Answer(s)	Monitoring of atmospheric concentrations of ammonia in the ROI is the domain of the EPA. Currently, ammonia is monitored at 5 EMEP stations (EPA), and two sites in Slieve Beagh by the Ulster Wildlife Trust, all using ALPHA samplers in triplicate. The EPA are currently developing the National Ecosystem Monitoring Network to monitor the effects of air pollution across a range of sensitive habitats. The NEMN will likely use a combination of ALPHA and DELTA samplers

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	across multiple sites. Previous monitoring has been done in 1999-2000 and 2013-2014 using Willems Badges across 40 and 24 sites respectively, and monitoring on 12 Natura 2000 sites in 2017 using ALPHA samplers.
#	29
Question	Would the N loading issue benefit from incorporating the cost of soil testing in the MACC to help reduce use?
Answer(s)	Currently, there is no available N soil test reliable on Irish soils therefore no soil testing is incorporated into the recommendations in the Teagasc Major and Micro Nutrient Advice for Productive Agricultural Crops. For the same reason, soil testing for N content cannot be incorporated into the MACC.