ATTACHMENT-7-1-3-2
Air Emissions Impact Report

Table of Contents

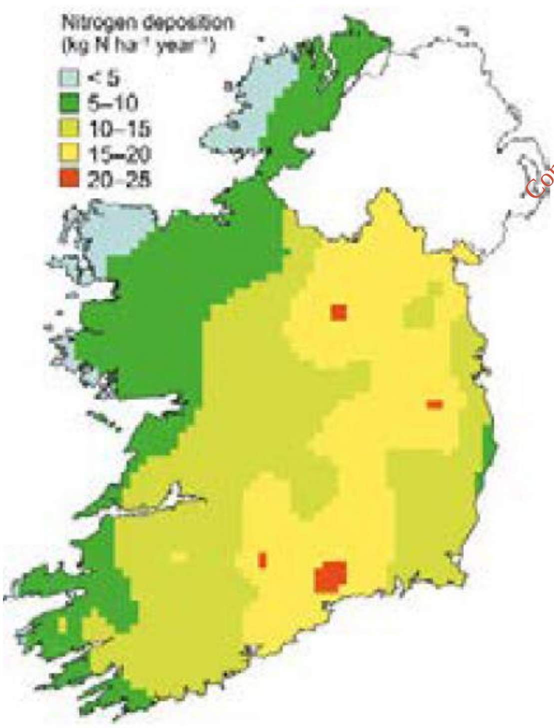
1.0 Air emissions

The main emissions are ammonia, methane, nitrous oxide, dust and odour emissions. Other fugitive emissions such as hydrogen sulphide, carbon monoxide and sulphur dioxide are also assessed.

2.0 Baseline Environment

The baseline ammonia (NH_3) deposition levels for the study area is approximately 17.5 kgs / ha / year[1] of NH_3-N or approx. 21[2] kgs NH_3 / ha. Agriculture in the study area is the source of 98%+ of these emissions (this assumes that the study area reflects the national situation).

Figure 1 : NH_3-N rates in Ireland



For fugitive emissions of methane (CH_4) and nitrous oxide (N_2O) the average national baseline is assumed to be relevant to the site. In the case of CH_4 this is approx. 560,000[3] tons over 8m hectares of land = 65-70 kgs / ha. In the case of N_2O this is approx. 23,300[4] tons over 8m hectares of land = 3 kgs / ha.

[1] Page 6 EPA Report; Ambient Atmospheric Ammonia in Ireland, 2013-2014 (Figure 2.3)
[2] NH_3 = atomic weight 14 for N and 3 for H_3, therefore N makes up 82% of NH_3 => 21 x 0.85 = 17.5kgs N.
[3] Table 4 2018 CSO Environmental Accounts
[4] Table 3 2018 CSO Environmental Accounts

Table 1: Pre-mitigation Gaseous Emissions

Category of pig	Number	NH_3 (kgs)	CH_4 (kgs)	N_2O (kgs)
<u>**(i) 600 sows (Licensed number)**</u>				
Suckling sows & litter	190	893	4370	6
Dry sows	410	1312	9430	13
Boars	10	34	230	0.3
Maiden gilts	150	390	1725	2
Weaners	3450	3450	30015	16
Fattening pigs	3750	9750	49875	54
Total =>		**15,829 (100%)**	**95,645 (100%)**	**92 (100%)**
<u>**(ii) 1000 sows (Revised numbers)**</u> Suckling sows & litter	167	785	3841	5
Dry sows	833	2666	19159	26
Boars	5	17	115	0.1
Maiden gilts	166	432	1909	2
Weaners	5357	5357	46607	25
Fattening pigs	3957	10289	52630	57
Total =>		**19,545 (123%)**	**124,261 (130%)**	**116 (127%)**

The development of the on-site mill with upgraded electricity supply will facilitate the operation of the mill and the formulation of low protein diets for the production pigs and therefore a conservative 2[5]% reduction in protein in these diets will result in a 20% reduction in NH_3 emissions (Table 4.17 of BAT 2017) from weaner and finisher pigs. While reductions in CH_4 and N_2O are also reported due to lower protein diets the information is less conclusive – so the reduction is only assumed for NH_3. The rural air quality for this area is rated as 'Good' by the EPA Air Quality Index for Health (http://www.epa.ie/air/quality/). The baseline deposition of ammonia which includes the existing pig farm is estimated to be average for the South West of Ireland i.e. 21 kgs / ha / year (see Figure 1). The additional post-mitigation loading due to the revised stock numbers is a fraction of one kilogram per hectare per year which is not significant. Within 1-2 kilometres of the pig unit the post-mitigation NH_3 deposition levels are elevated by less than 1 kgs / ha / year due to the revised stock numbers. The average value of NH_3 in the atmosphere for Ireland is 1.456 µg NH_3/m^3 and measurements from the UK at sites near pig and poultry farms were 8.68 µg NH_3/m^3. These levels are far less than exposure limits for NH_3 set by the Occupational Safety and Health Administration (OSHA) in the USA (ATSDR, 2004) – 87 hours exposure : 17000 µg NH_3/m^3. Without mitigation there are no known significant effects on rural dwellings at these acceptably low levels.

Table 2: Post-mitigation NH_3 Emissions

Category of pig	NH_3 (kgs)
(i) 600 sows (Licensed number)	15,829 (100%)

[5] A 3% reduction would lead to a 6% reduction in NH_3 emissions
[6] Section 2.1 EPA Report No 193 *Ambient Atmospheric Ammonia in Ireland,* 2013-2014

[7] Table 2.1 EPA Report No 193 *Ambient Atmospheric Ammonia in Ireland,* 2013-2014

Category of pig	NH_3 (kgs)
(ii) 1000 sows (with mitigation)	16,415[8] (104%)

A 3% reduction in protein in the growing pig diet is achievable with proper supplementation of amino acids – this would reduce NH_3 emissions further. The post mitigation impact means that proposed ammonia emissions can be maintained at similar levels to the existing licensed emissions. The lower nitrogen content in the slurry will also reduce N_2O emissions.

From 2020 Ireland will have an ammonia ceiling of 112.2 kilotons representing a 1% ammonia reduction relative to the 2005 level. A further reduction target of 5% relative to the 2005[9] level is to be achieved by 2030 – i.e. a ceiling of 107.6 kilotons - this is a 7.24% reduction on the 116 kt ceiling and a 9.2% reduction on the latest 2018 levels. Under the NEC Directive Ireland has to adopt and implement a '*Code of Good Agricultural Practise for reducing Ammonia Emissions from Agriculture*' – DAFM November 2019. This pig farm will commit to adopt and abide with measures specified in this COP. Measures within the code of practice (COP) which will be adopted a move towards low emission spreading (e.g. trailing shoe), applying early in the year in cool conditions and storage in covered manure stores.

Table 3: Post-mitigation Odour Emissions

Category of pig	Number	Odour emissions / animal (o.u.)	Total Odour emissions (o.u.)
<u>600 sows</u> Suckling sow & litter	190	18	3420
Dry sow	410	19	7790
Boars	10	20	200
Maiden gilts	150	20	3000
Weaners	3450	6	20700
Fattening pigs	3750	22.5	84375
Total =>			**119,485 (100%)**
<u>1000 sows</u> Suckling sow & litter	167	18	3006
Dry sow	833	19	15827
Boars	5	20	100
Maiden gilts	166	20	3320
Weaners	5357	4.8	25714
Fattening pigs	3957	18	71226
Total =>			**119,193 (100%)**

Odour emissions will not increase post mitigation.

8 Assumes weaner and finisher NH3 emissions reduced to 4286kgs and 8230kgs respectively
9 116 kt NH_3

3.0 Dust, Particulate Matter and other gases

Dust particles emitted from pig houses are made airborne by mechanical disintegration of solid particles, ranging in size from less than 1 µm to greater than 100 µm. The dust generated within indoor pig buildings may contain many types of particles including: animal dander, faecal material and urine of both pigs and rodents, feed components, bedding materials, absorbed gases, chemicals, viruses, bacteria, yeasts, moulds and their by-products. Dust can contribute to malodour emissions.

Along with dust particulate matter (PM10 and PM2.5) is also found in emissions from pig buildings – but at very low levels which are readily dissipated in the atmosphere to harmless levels. At a national level NH_3/NH_4 emissions (particularly from land-spreading) are linked with national particulate matter emissions. Agriculture accounts for 36% and 14% of national PM10 and PM2.5 emissions (Tables 10 and 11 of CSO, 2016, Environmental Accounts for Air Emissions).

Sulphur dioxide (SO_2) is a harmful gas produced mainly by the combustion of fuel and particularly associated with the power generating industry. Very small quantities will be produced from the combustion of fuels at the proposed development (e.g. heating, diesel engines). Hydrogen sulphide (H_2S) is a gas associated with slurry storage and may be vented from the site during slurry agitation and pumping. Agriculture accounts for less than 2% of the national carbon monoxide production, which again is produced from the decomposition of slurry. Non-methane volatile organic compounds area produced from slurry storage. The concentration of these latter compounds may be negligible in a measurable sense but combined they create odour (and contribute to particulate matter) and are emitted via the ventilation in very small quantities.

The impacts of dust, particulate matter and the other gases discussed above are not significant from the pig farm. Normal mitigation measures such as cleanliness, good housekeeping and adequate ventilation can control the gases within the pig houses and they are rapidly dispersed outside the pig buildings to harmless levels.

4.0 Climate change

The 2019 National *Climate Action Plan to Tackle Climate Breakdown* sets out specific targets and dates by which these actions should be implemented. While recognising there are no zero emission options for agriculture and that agriculture presents challenges that are not fully amenable to technological solutions for emission abatement, as may exist or evolve in other sectors, the plan expects agriculture to contribute to the 2030 goals by effectively reducing CO_2 emissions by 10 – 15% from current levels (page 101 of the plan).

The most recent EPA Report (July 2020): *Ireland's Greenhouse Gas Emissions Projections; 2019 – 2040* predicts that Ireland can and will meet its 2030 commitments by early adoption of a '*with additional measures scenario*' and a reduction of 12% in agricultural GHGs. The targets mentioned in relation to agriculture in Section 3.3 of that report focus mainly on the primary GHG emitting sectors (dairy, beef and sheep) but specifically mentions; *some of the key measures include nitrogen use efficiency, use of protected urea products, improved animal health, extended grazing, reducing crude protein in pigs, low emission slurry spreading, inclusion of clover in pasture swards.* The proposed reconfiguration of the P0915-01 herd will include *reducing crude protein in pigs* and *low emission slurry spreading* and will also help reduce nitrogen usage on farms leading to improved *nitrogen use efficiency.* Improved genetics will improve overall efficiency and reduce the carbon footprint.

When compared with beef or sheep meat products pork has a lower CO_2 footprint than. Page 30, Figure ES10 of the EC JRC 2010 report on the Evaluation of the livestock sector's contribution to EU GHG emissions illustrates that Irish beef and sheep meat have a footprint of approx. 20kgs CO_2 eq. / kg product. Pork has a footprint of approx. 5 kgs CO_2 eq. / kg product and thus is four times more efficient from a carbon emissions / climate point of view in satisfying increasing demand for meat protein at home and abroad. This fact has to be considered as an underlying cumulative effect and advantage that pork has from a climate change perspective where displacing 1kg of beef or pork can reduce the CO_2 emissions associated with that kg of product by 75%.

4.1 Future Potential Climate Mitigation

Technologies such as Anaerobic Digestion (AD) and renewable solar energy needs to be incentivised with government financial supports to make it commercially viable. This technology has the potential to further off-set CO_2 and NH_3.

- AD has reported benefits of up to 40%[10] reduction in NH_3 emissions, 80% CH_4 reductions and odour reductions, improved availability of Nitrogen in the residue manure and a potential 3.2kg CO_2 equivalent reduction in Greenhouse gases for every m^3 of biogas produced (page 604 of BAT). Typical yields of biogas from pig manure are approx. 2211 m^3 per ton of manure. Thus the AD of 15,000m^3 could mitigate approx. 1,000 tons of CO_2 each year – in addition to the other benefits. This is equivalent to approx. 32% of the methane produced[12].
- Installation of solar panels on roofs. According to SEAI[13] each m^2 of roof panel can generate 130 kWh. The roof area is approximately 14,000 m^2. If solar panels were installed on 70% of this area the mitigation would be equivalent to approx. 596[14] tons per annum. This is equivalent to approx. 19% of the post mitigation methane production.
- Use of Slurry Amendments. These are is currently being researched by Teagasc (for residues and effectiveness) and offer opportunities to reduce the emissions from manure management.

5.0 Conclusions

- Dust, particulate matter and emissions such as hydrogen sulphide, carbon monoxide and sulphur dioxide will not have a significant impact;
- The revised livestock numbers will not result in a significant increase in NH_3 emissions compared with the licensed numbers – with mitigation;
- Post mitigation odour emissions will not change significantly; and
- Future mitigation will be dependent on government supports for renewable energy option which can mitigate methane emissions.

[10] Page 600 – 604 of BAT for Intensive Rearing of Pigs and Poultry, 2017
[11] BAT P.603 say 22t / m3 @6%.
[12] 124t CH_4 produced. 1,000t CO_2 is equivalent 40t of methane
[13] https://www.seai.ie/publications/FAQs_on_Solar_PV.pdf
[14] 9,800m^2 of roof area @ 130 kWh / m^2 = 1,274,000 kWh @ 468 gCO_2/kWh = 596 tons CO_2. 468 gCO_2/kWh is the average CO_2 intensity per kWh in Ireland: https://www.seai.ie/publications/Energy-Related-Emissions-in-Ireland-2016-report.pdf