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National report on the legal framework for ammonia regulation of livestock installations with a particular regard to Natura 2000 sites

Denmark

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Publication date:
2018

Document version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Anker, H. T., & Baaner, L. (2018). *National report on the legal framework for ammonia regulation of livestock installations with a particular regard to Natura 2000 sites: Denmark* . Department of Food and Resource Economics, University of Copenhagen. IFRO Report No. 275

Download date: 11. Oct. 2026

DEPARTMENT OF FOOD AND RESOURCE ECONOMICS
UNIVERSITY OF COPENHAGEN

IFRO Report

National report on the legal framework for ammonia regulation of livestock installations with a particular regard to Natura 2000 sites:

Denmark

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IFRO Report 275

National report on the legal framework for ammonia regulation of livestock installations with a particular regard to Natura 2000 sites: Denmark

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Published June 2018

ISBN: 978-87-92591-97-5

This report has been elaborated as part of a comparative project initiated by the Danish Environmental Protection Agency, the Ministry of Environment and Food. The project has the purpose to compare the ammonia regulation of livestock installations with a particular view to Natura 2000 sites and the EU Habitats Directive. The project as a whole consists of three parts analysing the situation in Denmark, Germany – with a particular focus on Schleswig-Holstein – and the Netherlands from a legal perspective, an economic perspective and a natural science perspective.

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1 Implementation of the EU Habitats Directive (HBD) – legal framework

1.a General overview of the legal framework

The Danish implementation of the EU Habitats Directive (HBD) and Birds Directive (BD) is scattered across a number of different pieces of legislation due to a rather sectoral implementation approach where responsibilities for implementing the directives have been allocated to different ministries. Furthermore, the implementation was originally rather narrow focusing primarily on the designation of Natura 2000 sites and the protection of Natura 2000 sites against new potentially harmful plans or projects, i.e. Article 6(3) of the HBD. Originally, the perception also appears to have been that the Habitats Directive did not affect existing activities such as farming or forestry. It was assumed that existing instruments for nature conservation, nature restoration etc. would be sufficient to protect Natura 2000 sites.

In 2003 a new Act on Environmental Objectives[1] was adopted laying down the framework for so-called Natura 2000 plans with the general aim to ensure a favourable conservation status within the Natura 2000 sites, i.e. to implement Article 6(1) of the HBD. The rules on the Natura 2000 plans were adopted in parallel to the river basin management plans based on the requirements of the Water Framework Directive (WFD). However, separate legislation has subsequently been adopted for the second generation river basin management plans. Following a formal letter of notice from the European Commission in 2003 (SG-Greffe (2003) D/220455), new legislation was introduced in 2004 – amending the Nature Protection Act and the Forest Act – with the particular purpose to address existing harmful farming and forestry activities, i.e. to implement Art. 6(2) of the HBD. Finally, in 2009 new rules were adopted in the Nature Protection Act and the Hunting and Wildlife Management Act to ensure implementation of in particular Art. 12 of the HBD and the direct prohibition as regards Annex IV species and their breeding and resting sites.

The current legal framework implementing the Habitats Directive thus consists of rules that are aimed primarily at:

- Designating Natura 2000 sites – Act on Environmental Objectives + Executive Order 926/2016
- Assessing and establishing conservation objectives for species and habitat types in Natura 2000 plans – Act on Environmental Objectives + Executive Order 945/2016

[1] Act no. 1150 of 17. December 2003 (lov om miljømål m.v. for vandforekomster og internationale naturbeskyttelsesområder) – most recently Consolidated Act no. 119 of 26. January 2017 (bekendtgørelse af lov om miljømål m.v. for internationale naturbeskyttelsesområder).

- Establishing programmes of measures and local Natura 2000 action plans – Act on Environmental Objectives, Executive Orders 944/2016 + 946/2016 (+ a guidance regarding follow-up on the 2016-2021 Natura 2000 plans) (Naturstyrelsen, 2016a)
- Restricting existing harmful land use with reference to the established Natura 2000- plans – Nature Protection Act and Forest Act
- Performing impact assessments of new or amended plans and projects that may affect Natura 2000 sites – executive orders within different ministries, e.g. Executive Order 926/2016
- Performing impact assessment of plans and projects that may affect Annex IV species - executive orders within different ministries, e.g. Executive Order 926/2016
- Direct prohibitions as regards Annex IV species – Nature Protection Act and Hunting and Wildlife Management Act
- Monitoring of Natura 2000 sites – Act on Environmental Objectives + Executive Order 1001/2016

In particular the impact assessment requirements for new projects and activities must be taken into account when granting permits for e.g. livestock installations according to the Livestock Installations Act, see below Section 1.d and Section 3.

The current legal framework implementing the Habitats Directive requirements can thus be sketched as below.

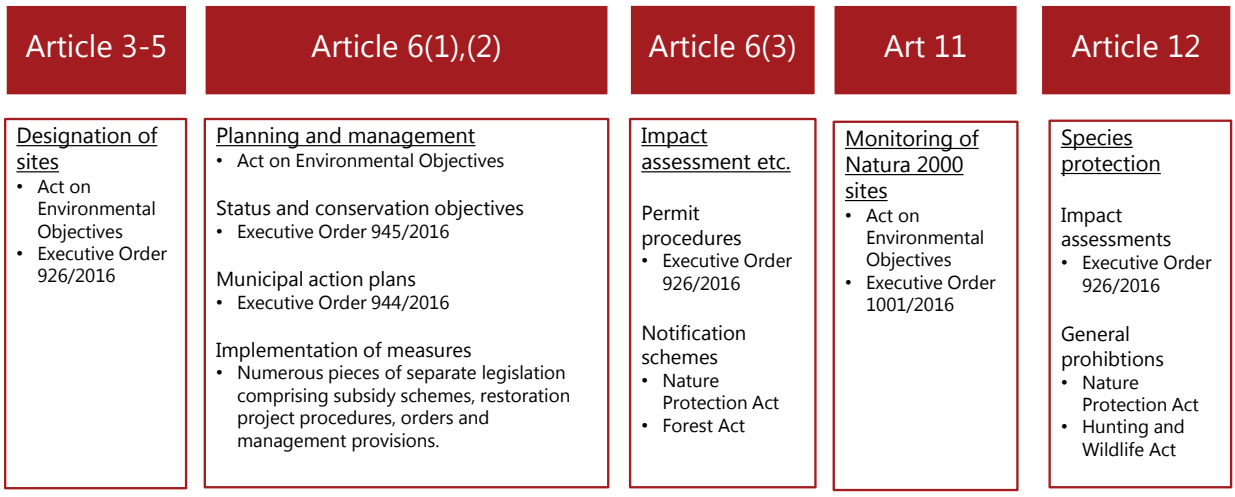

Figure 1. *Implementation of the Habitats Directive*

In addition to the specific Natura 2000 and Annex IV legislation, the general nature protection legislation also contributes to the protection of Natura 2000 sites and Annex IV species. This includes the general protection of certain habitats – known as § 3 habitats or protected nature types – according to the Nature Protection Act § 3. The § 3 habitats include lakes above 100 m^2 and designated water courses, as well as heaths, bogs, meadows etc. above 2.500 m^2. Approximately 10 per cent of the Danish land area was in 2016 registered as § 3 habitat types – including those within Natura 2000 sites.[2] It is prohibited to alter the natural state of § 3 habitat types, unless an exemption is granted.

Furthermore, areas subject to a nature conservation order (approximately 5 per cent of the Danish land area) are protected in accordance with that specific order – typically preventing alteration of the state of the area. Nature conservation orders should according to the Nature Protection Act contribute to the protection of Natura 2000 sites. Nature conservation orders are sometimes combined with nature restoration projects.

The lacunaes in the Danish implementation of the Habitats Directive have gradually been addressed through adjustments and amendments of the legislation. Yet, the legislation as indicated above has a fairly high level of complexity and some smaller lacunaes might still exist in particular as regards sectoral legislation, e.g. building legislation re. Annex IV species. The administration and enforcement of the rules has also improved gradually. The Nature and Environment Appeals Board (now the Environment & Food Appeals Board) has in its decisions emphasised the interpretation of the Court of Justice of European Union, in particular the strict interpretation as laid down in C-127/02 Waddenzee.

Infringement proceedings regarding the Habitats Directive have been initiated against Denmark by the European Commission, including the letter of formal notice in 2003 (SG-Greffe (2003) D/220455) and in 2006 (SG- Greffe(2006)D/203610) which was followed by a reasoned opinion (SG-Greffe (2010)D/881). Both cases have subsequently been closed. More site-specific cases have also been initiated, but later closed by the Commission, including *Lille Vildmose* (SG-Greffe (2009)D/508) and *Sønderborg-Kliplev* (SG-Greffe (2008)D/203610). Most recently, the European Commission initiated a so-called Pilot case regarding the adoption of an 'Agricultural Package' with reference to the Habitats Directive, the Water Framework Directive and the Nitrates Directive[3].

1.b Designation of Natura 2000 sites

The minister of Environment and Food is according to the Act on Environmental Objectives responsible for designation of Natura 2000 sites. The designation of Special Protected Areas

[2] http://mst.dk/natur-vand/natur/national-naturbeskyttelse/3-beskyttede-naturtyper/arealopgoerelse/

[3] European Commission, EU PILOT 8540/16/ENVI.

(SPA) for birds was provisionally delineated in 1983 and the final designation of the areas was implemented by Executive Order No. 408/1994. Special Areas for Conservation (SAC) according to the Habitats Directive were included in an Executive Order 782/1998. After a period of dialogue and negotiation with the Commission, the Commission's list of Sites of Community Interest (SCI) for the Atlantic biogeographical area, that included Denmark, was compiled and made available in December 2004. At present the designation is laid down in Executive Order 926/2016 that includes maps of the designated areas and reference to more detailed maps/data.

Denmark has now designated 113 Special Protected Areas (SPA) for birds and 261 Special Areas for Conservation (SAC) for other species and for habitat types, together forming 252 Natura 2000 sites. Around 6 per cent of the total terrestrial area and 11 per cent of the marine area (the exclusive economic zone - EEZ) is covered by SPA's whereas the SAC's comprise about 7 per cent of the terrestrial area and 15 per cent of the marine area. There is a considerable geographical overlap between the habitat and bird areas and together the Natura 2000 sites comprise about 8 and 17 per cent of terrestrial and marine area respectively.[4]

Table 1. *Natura 2000 coverage*

Coverage of SAC and SPA	***Km²***	***%***
Terrestrial SACs	*3,150*	*7.3*
Marine SACs	*16,150*	*14.7*
Terrestrial SPAs	*2,600*	*6.1*
Marine SPAs	*12,100*	*11.0*
Terrestrial Natura 2000 sites	*3,563*	*8.3*
Marine Natura 2000 sites	*18,722*	*17.0*

Mapping of the habitats in the Danish SAC's is done according to a guideline (Miljøstyrelsen, 2016) developed by the Ministry of Food and Environment with reference to the Interpretation Manual of European Union Habitats.[5] The guideline covers the 59 habitats of the Habitats Directive Annex 1 that are present in Denmark. As indicated in Annex I, of the 59 Annex 1 habitats present in Denmark 43 habitats are categorised as 'ammonia sensitive' regarding

[4] There are to some extent slightly different figures on the area of land and marine sites in different sources. This table is compiled by information provided at http://svana.dk/natur/natura-2000/natura-2000-omraaderne/fakta-om-omraaderne compared to the total land area of Denmark of 42.931 km² and exclusive economic zone of 110.000 km².

[5] European Commission DG Environment. Interpretation Manual of European Union Habitats EUR 28. April 2013.

deposition from livestock installations and manure spreading, see further below regarding the Livestock Installations Act. Furthermore, 19 of these 'ammonia sensitive' habitats are also categorised as 'nitrogen sensitive' in relation to pollution from nearby fertiliser use and run-off (Naturstyrelsen, 2016b).

As a part of the 2016 political agreement, 'The Nature Package' (Miljø- og Fødevareministeriet, 2016) [in Danish 'Naturpakken'], it has been agreed to review the Natura 2000 designation in order to reduce the share of intensively farmed areas within the Nature 2000 sites and, if necessary, expand the designated areas with more valuable nature, where it contributes to the fulfilment of the directives objectives. Once the review is completed, the new designation will be submitted to the Commission, which, according to the Danish Environmental Protection Agency, in general only accepts corrections of up to +/- 5 per cent of the individual areas.

1.c Instruments for proactive management of Natura sites – HBD art. 6(1-2)

In Denmark, the proactive management of Natura 2000 sites is mainly based on the drawing up of Natura 2000 plans, and to some extent also local action plans for each Natura 2000 site. The plans are developed in accordance with the framework laid down in the Act on Environmental Objectives. The process provides for public participation in the drawing up of the plans. The management objectives can be reached by the use of several measures and legal instruments. In addition to or in combination with the management plans, nature conservation orders as well as other nature management projects, including LIFE-projects, may be used to conserve, restore or rehabilitate Natura 2000 sites as well as other nature areas.

The *Natura 2000 plans* are issued by the Ministry of Environment and Food every 6th year – the first generation plans were supposed to have been adopted in 2009, but were not published until 2011. The second generation Natura 2000 plans were published in 2016 covering the period 2016-2021. Within 12 months after the publishing of a Natura 2000 plan the relevant municipalities must adopt a local *Natura 2000 action plan* – for forest areas a forest action plan must be adopted by the Nature Agency. In practice these action plans are developed for one or several Natura 2000 sites together, and in a mutual cooperation between the relevant municipalities and the Nature Agency. Thus, each Natura 2000 action plan typically covers one or a few similar Natura 2000 sites and specifies the measures to be taken by the involved municipalities and by the Nature Agency, who is responsible for the management of state forests. Other management plans may, however, replace the local action plans for publicly owned Natura 2000 sites, e.g. areas owned by the Ministry of Defence.

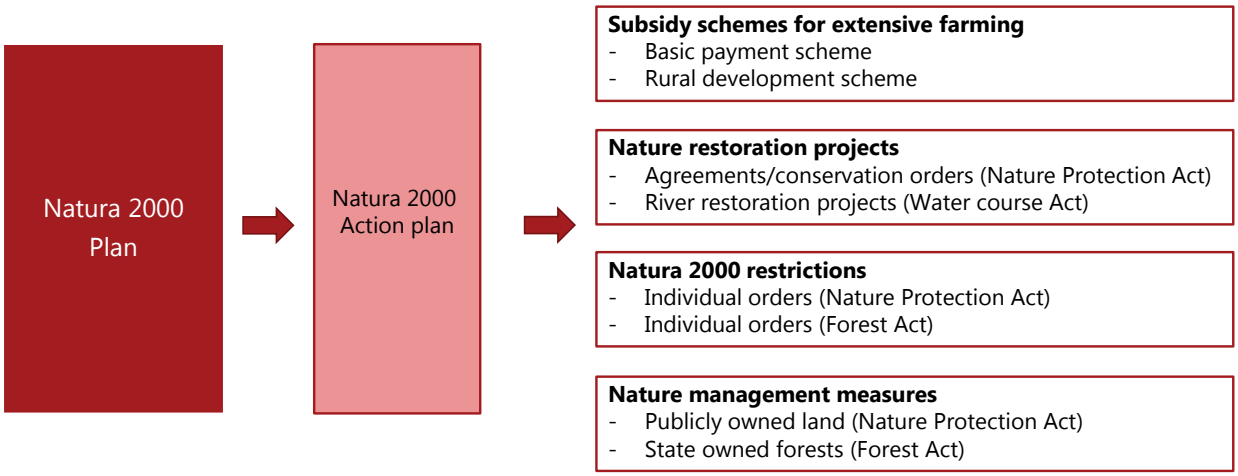

Figure 2. *Implementation of Natura 2000 plans*

The Natura 2000 action plans address and prioritise the actions that should be put in place by the municipality (or the Nature Agency). However, the action plans should also provide an overview of the distribution of initiatives between the municipalities, the Ministry of Environment and Food as well as private landowners.

An important part of the ammonia load to Danish Natura 2000 sites originates from local ammonia emissions from agriculture – in particular from livestock installations and manure spreading. This is also recognised as a problem in several of the pressure analyses prior to the plans. However, the Natura 2000 plans do not address airborne ammonia pollution. Ammonia pollution is handled through the Livestock Installations Act,[6] and the Natura 2000 plans do not include further initiatives or restrictions to address the impacts from ammonia emissions on Natura 2000 sites.[7] Consequently, the Natura 2000 action plans do not address ammonia emissions either. The Natura 2000 plans may, however, address the spreading of manure close to 'nitrogen or ammonia sensitive' habitats, e.g. by promoting the use of subsidy schemes regarding cultivation practices. Furthermore, a guidance note recommends certain measures aimed to reduce surface runoff or runoff through drainage water or groundwater (Naturstyrelsen, 2016b).

[6] Consolidated Act no. 256 of 21. March 2017 on livestock installations and fertiliser use. The title of the Act was amended in 2017 replacing the former title: Act on Environmental Permits for Livestock Installations.

[7] http://www.naturstyrelsen.dk/media/191457/naturstyrelsens-generelle-hoeringsnotat-2016.pdf. p. 23.

Moreover, Natura 2000 plans and Natura 2000 action plans may stipulate restoration or creation of new or extended habitats in order to achieve a favourable conservation status of certain habitats sensitive to ammonia deposition or species dependent on such habitats. These kinds of measures are normally implemented on state (or municipal) owned areas or by individual agreements with private landowners. Such new or extended habitats, however, may affect nearby landowners, as the presence of 'ammonia sensitive' habitats can reduce the possibilities for granting new permits for livestock installations.[8]

The municipalities and the Nature Agency can make use of a range of (proactive) measures in order to implement the Natura 2000 plans and action plans. However, in practice the main measures are small-scale conservation measures like extensive grazing, clearing of scrub, closing of drainage systems, dredging of ponds etc. Most measures on private land are implemented by the use of subsidy schemes for extensive farming practices. Others are more of a 'project nature' being individually designed nature restoration projects or nature conservation orders.

The amendment of the Nature Protection Act in 2004 put in place specific Natura 2000 rules in order to stress the obligations of the (local) authorities to restrict existing harmful land use activities. According to these rules the local authorities are obliged to implement measures specified in a local Natura 2000 action plan. Furthermore, the local authorities must either make agreements with landowners or order restrictions on existing land use and other activities if it is necessary to implement the Natura 2000 plans. If an agreement cannot be made, an order must be imposed, e.g. to refrain from certain farming practices, accept certain conservation measures, change, or eventually close down a production.

In case of individual Natura 2000 orders, as with nature conservation orders, the landowner (or a user) will be compensated for the loss inflicted by the order. This applies to existing activities that are not subject to new permit requirements or otherwise can be restricted through the issuance of orders without compensation.

The rules on Natura 2000 orders have mainly been used to restrict existing cultivation practices or to prevent otherwise lawful (re-)cultivation of land with the purpose to protect habitats sensitive to ammonia or nitrogen. In a case from 2013 a farmer was granted a compensation of 50.000 DKK per ha for not being allowed to (re-)cultivate 5.1 ha.[9]

[8] In the decision NMK-402-00001 the Nature and Environment Appeals Board did not find, however, that a Natura 2000 action plan was sufficiently precise to establish a framework for future permits for livestock installations, published in *Miljøretlige afgørelser og domme* 2013.3236.

[9] The case is published in Karnov Group, Miljøretlige afgørelser og domme 2013.2976.

Livestock installations are subject to detailed legal permit procedures (see section 3). This means that in such cases restrictions regarding e.g. ammonia emissions can be regulated through the permit without compensation to the landowner. A similar situation exists as regards reconsideration of existing permits. In general, it is also possible to issue orders to reduce significant pollution, without compensation – considering, however, the principle of proportionality, see section 3.

Consequently there are no published cases related to livestock installations where an agreement or order has been used to reduce e.g. ammonia emissions from the installation. However, in an unpublished case from 2005, before the Natura 2000 plans were issued, an agreement was made between a county council and a farmer on closing down a fur farm close to habitats sensitive to ammonia in Natura 2000 site (Svanninge Bakker) with the purpose to protect rare orchids. The farmer was paid a compensation of 3,5 mio. DKK.

Regulating ammonia emissions from existing livestock installations through the permit system appears to be the path laid out in the legislation and in the practices for Natura 2000 planning established by the Ministry of Environment and Food as well as in the practice of the municipalities.

1.d Instruments for assessment/permits of new projects – HBD art. 6(3-4)

The requirements in art. 6(3) of the Habitats Directive regarding (new) projects (and plans) is implemented in Denmark by two different sets of rules depending on whether a permit is required for the project or not. Those *projects that require a permit* are regulated by a number of Executive Orders requiring an assessment of the potential effects on Natura 2000 sites prior to issuing of a permit. Those *projects that do not require a permit* are subject to a notification scheme primarily concerning changes in farming and forestry practices within Natura 2000 sites.

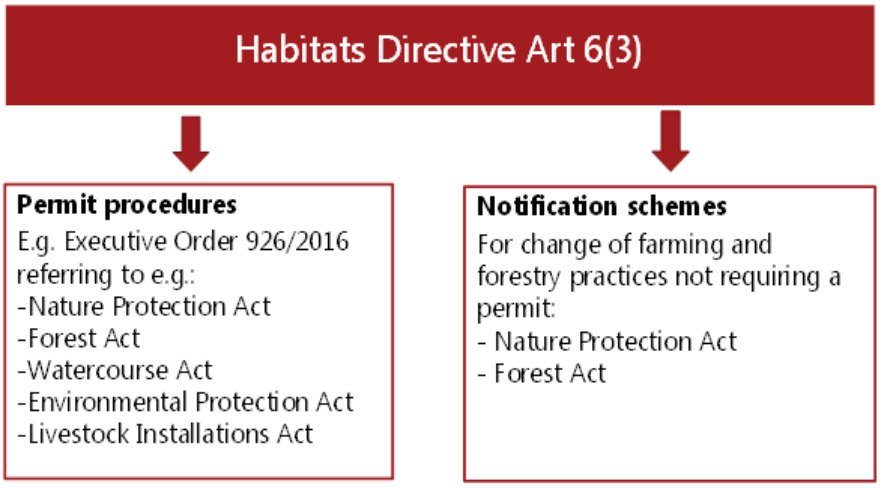

Figure 3. Implementation of HBD Art. 6(3)

Permit procedures. Executive Order 926/2016 lays down assessment requirements for projects that are subject to permit requirements according to environmental legislation, including the Livestock Installations Act, while other Executive Orders lay down assessment requirements regarding projects subject to other permit requirements, including also building permits. According to Executive Order 926/2016 projects that may significantly affect a Natura 2000 must be subject to an assessment of the potential effects on the relevant habitats and species. A permit cannot be granted if the project will negatively affect the integrity of the site.

While the Executive Order applies to permit requirements e.g. for the establishment, amendment or expansion of a livestock installation, it does not apply when an existing permit is (only) being reconsidered, see further below as regards the permit requirements for livestock installations.

Notification schemes. The Natura 2000 notification schemes are specifically established to implement article 6(3) for activities that do not require a permit. 'Projects' in this context are according to the Nature Protection Act and the Forest Act primarily changes in farming or forestry practices, including significant changes in the application of manure or in grazing intensity. The notification scheme only applies to projects within a Natura 2000 site. If the authorities find that the change might compromise the conservation status of the habitats in the Natura 2000 site, an agreement shall be made with the land owner – or alternatively an order prohibiting the project must be imposed. The owner will in such cases be compensated for the loss of property value.

2 Ammonia regulation in general – short overview

2.a Policy objectives/reduction targets, action plans etc.

Denmark is subject to ammonia emission ceilings as well as reduction targets in accordance with the UNECE Protocols on emission ceilings under the UNECE Air Pollution Convention[10] as well as the EU National Emissions Ceilings Directive.[11] Denmark is committed to a 2020 ammonia reduction target of 24 per cent compared to 2005 levels. There is no additional target for 2030.[12] The 2010 reduction target was 43 per cent compared to 1990 levels equivalent to

[10] United Nations Economic Commission for Europe Convention on Long Range Transboundary Air Pollution Convention.

[11] Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (NEC Directive) will be repealed by 1st July 2018 by Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, OJ L 344, 17.12.2016, p. 1–31 (NERC Directive).

[12] NERC Directive, Annex II.

an emission ceiling of 69,000 tonnes in 2010. It is estimated that 96 per cent of ammonia pollution is related to agriculture (Nielsen et al., 2013).

In 2001 an Ammonia Action Plan was adopted with the purpose to achieve the 2010 reduction target as well as to protect Natura 2000 sites (Ministeriet for Fødevarer, Landbrug og Fiskeri & Miljø- og Energiministeriet, 2001). The Ammonia Action Plan identified a number of measures related to livestock installations, manure storage, spreading of manure as well as injecting anhydrous ammonia into straw [in Danish halmludning]. The Ammonia Action Plan was followed by subsequent legislation that has gradually been strengthened during the years.

In 2007 a new Act on Environmental Permits for Livestock Installations introduced two different sets of buffer zone requirements: 1) a 300 m buffer zone around specific habitat types prohibiting additional ammonia pollution from new or amended livestock installations (above 15 AU); and 2) a 300-1000 m buffer zone with a general ammonia emission reduction requirement for new or amended livestock installations as well as specific additional ammonia thresholds. The ammonia regulation in the Act on Environmental Permits for Livestock Installations was in 2011 replaced by a set of new rules combining the general ammonia emission reduction requirement with more specific total ammonia thresholds to be applied in the permit procedures for establishment or amendment of livestock installations, see further below.

2.b Main regulatory instruments

In Denmark 95 per cent of the ammonia emissions originates from agriculture, whereof 50 per cent originates from livestock installations (including storage of manure) and around 28 per cent from spreading of manure (Mikkelsen & Albrektsen, 2017). Thus, regulatory measures concerning ammonia are mainly directed towards livestock installations, including storage of manure, and towards the application of manure.

Other industrial installations emitting e.g. ammonia or NO_x may, however, be subject to emission limits established in environmental permits in accordance with the Environmental Protection Act. Non-permit activities may also be subject to individual orders restricting e.g. emissions.

3 Livestock regulation and 'ammonia sensitive' areas

Livestock installations have since 2007 been subject to a comprehensive environmental permit scheme as laid down in the Livestock Installations Act.[13] The Act applies to small as well as large

[13] Consolidated Act no. 256 of 21. March 2017 (bekendtgørelse af lov om husdyrbrug og anvendelse af gødning m.v.).

livestock installations and includes all types of livestock. It combines implementation of the Industrial Emissions Directive (IED or IE Directive)[14] as well as the EIA Directive.[15]

The Act was amended in February 2017[16] and a new permit scheme entered into force by 1 August 2017. The permit thresholds are summarised in table 3 below. The new permit scheme introduces new permit thresholds based on the size of the production area as opposed to the number of animals based on so-called animal units (AU) in the 2007 legislation.[17] According to the new rules a livestock installation with more than 100 m^2 of production area (e.g. stables etc.) will be subject to a permit requirement (§ 16b). If the livestock installation has an ammonia emission above 3,500 kg nitrogen per year or is above the permit thresholds of the IE Directive[18] a more comprehensive permit is required (§ 16a).

The new permit thresholds replace the previous scheme that had three kinds of permits depending on the number of animal units (AU): 1) 15-75 AU, 2)75-250 AU (approx.) and 3) above 250 AU with some variations corresponding to the IE Directive permit thresholds as well as those of the EIA Directive.[19] However, fur farms with more than 3 AU have – due to often high ammonia emissions - also been subject to a permit requirement, cf. Executive Order 211/2017. While the small farms (15-75 AU) mainly have been subject to a simplified permit (§ 10), a more comprehensive permit (§ 11) has applied to medium farms (75-250 AU) and a full permit (§ 12) in accordance with the IE Directive to the large farms (250 AU-). If, however, a small farm could have significant effects on the environment, a § 11 permit would be required.

The permit scheme applies to the establishment, expansion or other alterations of a livestock installation.[20] Furthermore, the rules of the Livestock Installations Act also apply to reconsideration/updating of existing permits – including permits granted under the legislation prior to 2007. While the scheme for updating of existing permits – within 8 years - so far has

[14] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), OJ L 334, 17.12.2010, p. 17–119.

[15] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, OJ L 26, 28.1.2012, p. 1–21

[16] Act no. 204 of 28 February 2017.

[17] One animal unit (AU) was as a main rule equivalent to 100 kg N "ex stock" (ab lager), but a detailed list of number of animals of different types per AU was provided in Executive Order 1324/2016.

[18] According to the IE Directive, Annex I intensive rearing of poultry or pigs: a) with more than 40 000 places for poultry; (b) with more than 2 000 places for production pigs (over 30 kg), or (c) with more than 750 places for sows should be subject to an environmental permit.

[19] The variations are: 270 AU if minimum 90 per cent are sows with piglets up to 30 kg, or 750 places for sows, 210 AU if production pigs (over 30 kg), or 2.000 places for production pig (over 30 kg) or 100 AU for broilers, or 230 AU for hens or 40.000 places for poultry.

[20] Certain minor adjustments that will not negatively affect the environment are subject to a notification scheme cf. Executive Order 916/2017 §§ 10-19.

applied to permits for livestock installations above 75 animal units (and sometimes fewer animal units if having potential significant effects on the environment), the new legislation with effect from August 2017 request updating of permits for livestock installations above the IED thresholds. According to Executive Order 916/2017 § 39 existing (§§ 11 or 12) permits for non-IED installations have to be reconsidered/updated if they do not comply with the total ammonia emission thresholds, see below b.3.

Ammonia emissions play an important role in the permit decisions through different assessment and permit requirements. This includes general assessment/permit requirements reflected in BAT and in the general ammonia emission reduction requirement, as well as specific assessment/permit requirements that are related to the presence of habitats considered sensitive to ammonia deposition.

Table 3a. *Overview of the 2007 rules*

Rules until August 1st 2017			
Permit thresholds and categories	**§ 10 Farms of 15-75 AU (Fur farms of 3-25 AU)**	**§ 11 Farms of 75-250 AU (Fur farms 25-250 AU)**	**§ 12 Farms of more than 250 AU**
Technology / emission limits	BAT[21]	BAT *and* 30 % emission reduction compared to 2005/2006 level	BAT *and* 30 % emission reduction compared to 2005/2006 level
Maximum total deposition on category 1 habitats	0.2-0.7 kg N/ha/year depending on number of farms in proximity	0.2-0.7 kg N/ha/year depending on number of farms in proximity	0.2-0.7 kg N/ha/year depending on number of farms in proximity
Maximum total deposition on category 2 habitats	1.0 kg N/ha/year	1.0 kg N/ha/year	1.0 kg N/ha/year
Maximum additional deposition on category 3 habitats	Individual assessment above 1.0 kg N/ha/year	Individual assessment above 1.0 kg N/ha/year	Individual assessment above 1.0 kg N/ha/year
Maximum deposition on other nutrient sensitive habitats, e.g. ponds and meadows	Individual assessment	Individual assessment	Individual assessment
Impact on Annex IV species and habitats	Individual assessment	Individual assessment	Individual assessment

[21] BAT for small farms refer to the general requirement of best available technique in the Livestock Installations Act § 19. However, the small farms were not subject to the BAT-standards and emission levels issued by the Environmental Protection Agency.

Table 3b. *Overview of the 2017 rules*

Rules from August 1st 2017		
Permit thresholds categories	**Above 100 m^2 production area**	**IED-thresholds or above 3.500 kg NH_3-N/year**
Technology / emission limits	BAT if emission exceeds 750 kg NH_3-N/year	BAT
Maximum total deposition on category 1 habitats	0.2-0.7 kg N/ha/year depending on number of farms in proximity	0.2-0.7 kg N/ha/year depending on number of farms in proximity
Maximum total deposition on category 2 habitats	1.0 kg N/ha/year	1.0 kg N/ha/year
Maximum additional deposition on category 3 habitats	Individual assessment above 1.0 kg N/ha/year	Individual assessment above 1.0 kg N/ha/year
Maximum deposition on other sensitive habitats, e.g. ponds and meadows	Individual assessment	Individual assessment
Impact on Annex IV species and habitats	Individual assessment	Individual assessment

Furthermore, impacts on other sensitive habitats within Natura 2000 sites should also be assessed as part of the permit process in accordance with Executive Order 926/2016. This also applies to breeding and resting places for Annex IV species – both within and outside Natura 2000 areas. In addition, impacts on other protected areas, e.g. § 3 habitats that do not fall within category 1-3, are in accordance with practice also considered as part of the permit procedure.

For the purpose of addressing ammonia emissions in permit decisions the Livestock Installations Act in § 7 distinguishes between 'ammonia sensitive habitats' within Natura 2000 sites (category 1) and 'ammonia sensitive habitats' outside Natura 2000 sites (category 2). In addition, the municipalities may identify other habitats sensitive to ammonia deposition

(category 3), see further below. Most of these habitats are also protected according to the Nature Protection Act as § 3 habitat types.

3.a General ammonia standards/regulations for all livestock installations

General ammonia standards for all livestock installations are primarily related to storage facilities for manure etc. Storage facilities for liquid manure shall be equipped with a solid *or* dense cover unless an approved alternative technology can replace the cover. If the storage facility is located less than 300 m from an area with one of the 43 habitats considered 'ammonia sensitive' (category 1 and 2 habitats) the cover must be solid, unless a similar approved technology can replace the solid cover, cf. Executive Order 865/2017. The farmer must keep a log in order to document compliance with the rules. If the cover is inadequate the supervisory authority must issue an order.

It is not allowed to establish, expand or otherwise amend a livestock installation or manure storage facilities within 10 m from an area with 'ammonia sensitive' habitats as identified in § 7 of the Livestock Installations Act. Small livestock installations that are not subject to a permit requirement as a main rule cannot be established, expanded or amended within 50 m from category 1 and 2 habitats, cf. Executive Order 865/2017 § 8.

In addition to these general restrictions more detailed criteria apply for livestock permits, including BAT requirements as indicated below.

3.b Permit and assessment requirements for livestock installations

Livestock installations that require a permit are subject to specific assessment and permit criteria as laid down in the Act and in Executive Order 916/2017. Furthermore, an online guidance published by the Environmental Protection Agency[22] elaborates on the criteria, e.g. in accordance with several decisions made by the Nature and Environmental Appeals Board.[23]

3.b.1 BAT requirements

According to the new 2017 rules in the Livestock Installations Act a permit shall include BAT requirements if the installation will lead to an ammonia emission above 750 kg NH_3-N per year, cf. Sec. 27(2). The BAT requirements will be established on the basis of BAT standards for different types of livestock productions. These standards will be aligned with the recently adopted EU BAT conclusions under the IE Directive.[24] Livestock installations with an ammonia

[22] www.husdyrvejledning.mst.dk

[23] With effect from February 2017 the Environment and Food Appeals Board (Miljø- og Fødevareklagenævnet).

[24] Commission Implementing Decision (EU) 2017/302 of 15 February 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the intensive rearing of poultry or pigs (notified under document C(2017) 688), C/2017/0688, OJ L 43, 21.2.2017, p. 231–279.

emission below 750 kg NH_3-N per year are not subject to specific BAT standards or emission levels. They are, however, subject to different general requirements regarding stables and storage facilities according to Executive Order 865/2017, including technology requirements for specific types of livestock installations such as fur farms.

According to the 2007 rules all livestock installations subject to a permit should comply with a general BAT requirement. For livestock installations above 75 AU or having a potentially significant effect on the environment (§§ 11 and 12) BAT requirements were specified in BAT documents for different types of livestock installations[25] as well as in the decisions of the Appeals Board. The Appeals Board has confirmed that the BAT standard emission limits should be applied when deciding on the permit.[26] However, in some cases individual emission limits and technology conditions can be established due to specific circumstances.

With regard to ammonia the BAT documents specify emission levels as well as different types of pre-examined technologies.[27] The emission levels may differ depending on whether the permit includes new buildings/stables or existing ones. The standard emission levels apply to new buildings or existing buildings that are significantly renovated as part of the project. For existing buildings that are not renovated an individual assessment shall be made as regards BAT emission levels. According to the BAT documents issued under the previous legislation the setting of emission levels has been based on an assessment of available technologies and a principle of maximum costs. If a technology would lead to costs higher than 100 DKK/kg reduced nitrogen emission, the technology should not be included in the assessment. Furthermore, it has been assessed that additional costs for the farmer should not exceed 8 DKK/kg pig produced for slaughter or 1 per cent of the total production costs for dairy farmers.[28] In 2011, standard ammonia emission levels for slaughter pigs have been set between 0.21 and 0.30 kg NH_3-N per produced pig between 32-107 kg (Miljøstyrelsen, 2011a). Standard ammonia emission levels for dairy cattle have in 2011 been set between 6.30 and 7.31 kg NH_3-N per cow depending on the number of cows in the stable. The lowest emission levels apply to large farms with more than 750 AU (Miljøstyrelsen, 2011b). According to the new rules maximum emission levels are calculated on the basis of emission factors per m^2.

As mentioned above the BAT requirements will apply not only in case of a new permit application, but also in case of reconsideration or updating of an existing permit.[29] In practice,

[25] http://www2.mst.dk/wiki/Husdyrvejledning.BAT-standardvilk%C3%A5r.ashx.

[26] E.g. Natur- og Miljøklagenævnet Orienterer nr. 11, NMK-132-00042, 3. May 2011.

[27] The Environmental Protection Agency has published a number of technology sheets (teknologiblade) for different types of livestock productions as well as a list of technologies with documented effect (teknologilisten), http://mst.dk/erhverv/landbrug/miljoeteknologi-og-bat/teknologilisten/gaa-til-teknologilisten/

[28] On such calculations, see e.g. Jacobsen (2009).

[29] See the case published in Karnov Group: Miljøretlige afgørelser og domme 2013.3129

the allowable emission limit is calculated on the basis of the BAT standards and compared to the calculated emission from the installation as laid out in the application. It is possible to take into consideration a number of different measures that will reduce the emission from the installation. If the calculated ammonia emission exceeds the allowable emission limit a permit cannot be granted. In an appeals board decision from December 2016, the calculated excession of the allowable emission limit by 4 kg out of a calculated annual total of 3,724.65 kg nitrogen per year was, however, considered inferior.[30]

The legislation and permit system identifies the maximum allowable emission limit on the basis of calculations. It is up to the farmer how this limit shall be complied with by choosing relevant (and approved) technologies or other measures.

3.b.2 The general ammonia reduction requirement

The general ammonia reduction requirement which applied to livestock installations above 75 AU (and installations potentially having a significant effect on the environment) has been abandoned with effect from 1st August 2017 as it overlaps significantly with the BAT requirement. The general ammonia reduction requirement implied a 30 per cent ammonia reduction target compared to the 'best reference' level for new installations (stables) as well as existing installations (stables) that are renovated in a way that equals a new establishment.[31] There was some discretion left to the local authorities when determining whether a project involves 'renovation' of an existing stable or only smaller modifications. Furthermore, some variations as regards the 30 per cent reduction requirement applied depending on e.g. the type of animals. The 'best reference' level was based on 2005/06 standard figures for stable and storage systems with a few exemptions.

3.b.3 The specific ammonia thresholds

For livestock installations requiring a permit specific ammonia thresholds apply in the permit procedure. The thresholds apply to all permits granted under the Livestock Installations Act. The specific ammonia thresholds were amended in 2011[32] making it more clear whether to consider the *total* deposition from the whole installation or only the *additional* deposition resulting from an expansion or alteration of the production or installations. The specific ammonia thresholds depend upon the habitat type as well as on the potential cumulative effects considering other nearby livestock installations.

[30] Natur- og Miljøklagenævnet, NMK-132-00747, 19. December 2016.

[31] See e.g. Natur- og Miljøklagenævnet, NMK-132-000747, 19. December 2016.

[32] Act no. 122 of 23 February 2011 entered into force 15 March 2011.

As regards habitat types the legislation distinguishes between 3 categories of which only the first is related to Natura 2000 sites.

Table 4. *Definitions of category 1, 2 and 3 habitats*

Category 1 habitats	Category 2 habitats	Category 3 habitats
The following habitats if located within a Natura 2000 site: 1. Areas with one of the 43 Annex I habitats considered sensitive to ammonia deposition – no size threshold applied 2. Heaths and dry grasslands protected by the Nature Protection Act § 3.	The following habitats located outside Natura 2000 sites: 1. Raised bogs 2. Lobelia-lakes 3. Heaths above 10 ha 4. Dry grasslands above 2.5 ha	The following habitats located outside Natura 2000 sites: 1. Other areas with heath, bog/moor or dry grassland protected by the Nature Protection Act § 3. 2. Old grown forests fulfilling the criteria for being sensitive for ammonia deposition

As regards category 1 and 2 habitat types, the total deposition from the livestock installation is decisive, whereas only the additional deposition resulting from the new project (expanded or altered production) is taken into account as regards category 3 habitats.[33] When the total deposition is taken into account the result might be that a permit for an expansion of a livestock installation cannot be granted even though the result due to technological measures could be a lower ammonia emission than the one resulting from the existing installation.[34]

For *category 1 habitats* the maximum total deposition threshold is 0.7 kg N/ha/year if there are no other livestock installations in the proximity, 0.4 kg N/ha/year if there is one other livestock installation in the proximity, or 0.2 kg N/ha/year if there is more than one other livestock installation in the proximity.

An 'accumulation model' has been laid down to establish the number of other livestock installations within the proximity of the ammonia sensitive habitat depending upon their ammonia emission and the distance to what is named as 'the most critical habitat point', which is typically the distance between the edge of the habitat and the center of the installation. The calculations can be rather complicated as illustrated by figure 4 below from the ministerial guidance.

[33] All previous alterations (within the previous 8 years) should, however, be taken into consideration, cf. Executive Order 211/2017 Annex 3, see also Natur- og Miljøklagenævnet, NMK-131-00223,21. December 2016.

[34] See the case published in Miljøretlige afgørelser og domme 2012.2428

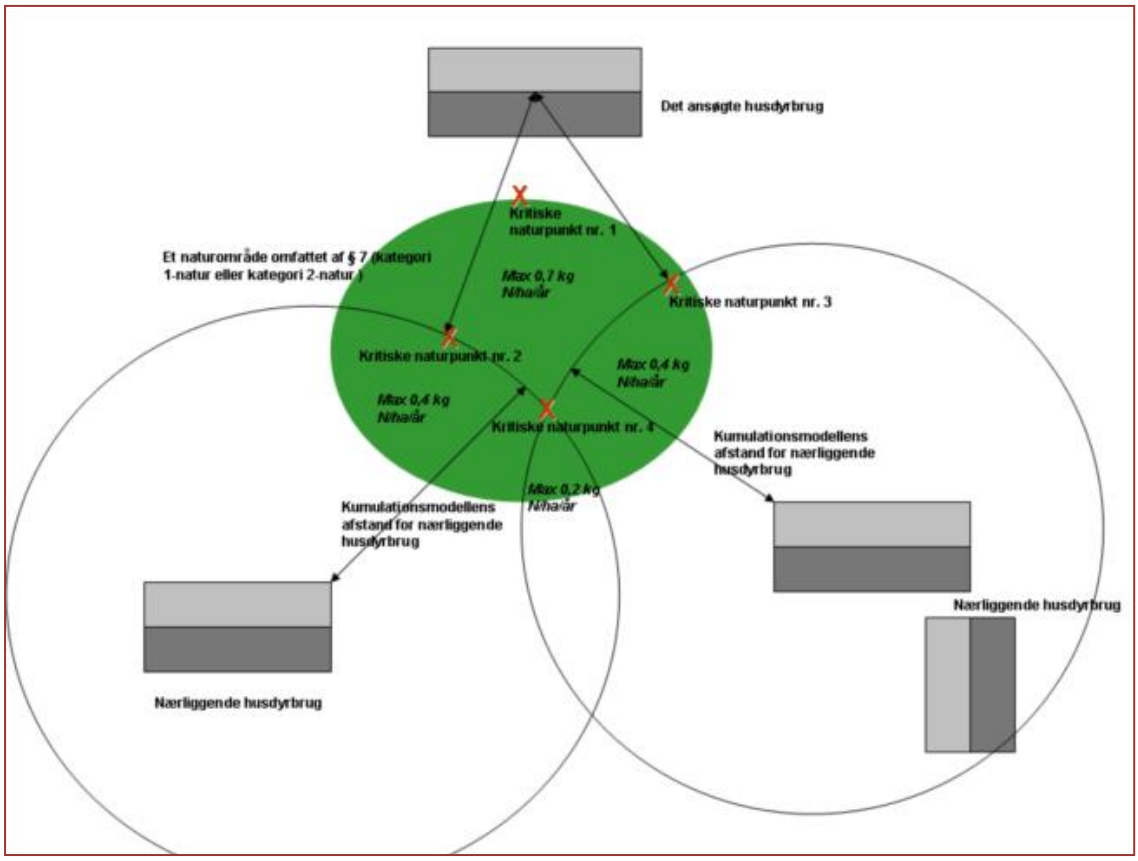

Figure 4. *Illustration of the complex 'accumulation model'*

The livestock installations to be taken into account in the accumulation model are determined by their ammonia emission and distance to the habitat as shown in table 6.

Table 6. *Farms to be included in the 'accumulation model'*

Size of installation	Within distance to habitat
More than 150 kg NH_3-N/year	200 m
More than 450 kg NH_3-N/year	200-300 m
More than 750 kg NH_3-N/year	300-500 m
More than 1.500 kg NH_3-N/year	500-1000 m
More than 5.000 kg NH_3-N/year	1.000-2.500 m

For *category 2 habitat types*, the maximum *total deposition* threshold is set uniformly at 1 kg N/ha/year.

For *category 3 habitats,* the local authorities shall determine whether there is a need for setting a maximum *additional deposition threshold*. Such thresholds cannot be lower than 1 kg N/ha/year. The category 3 habitats are partly defined in Executive Order 916/2017 as heaths, bogs and dry grasslands that are registered as § 3 habitats according to the Nature Protection Act. The Executive Order also defines what could constitute "ammonia sensitive forests" as old

forests or naturally established forests (more than 200 years) or forests with a significant presence of certain "natural forest" species.

The local authorities must, however, determine whether the habitat type has a special regional or local nature interest. According to the Executive Order maximum thresholds should only be used if the habitat has either been designated as valuable in a municipal plan, is located within a nature conservation area, included in a nature management plan or has a high nature value. If these criteria are fulfilled the local authority must determine whether the anticipated deposition is acceptable or whether an additional deposition threshold shall be established. It will normally be decisive whether the critical load of the habitat will be exceeded considering the background load as well as the deposition from the livestock installation.[35]

3.b.4 Other ammonia restrictions

Despite the general as well as the specific ammonia requirements referred to above the existence of other nutrient sensitive habitats should according to practice also be taken into account in a permit procedure or in a separate case according to the relevant legislation. This is in particular relevant in relation to other § 3 habitats than those falling under the category 3 habitat types as well as in relation to Annex IV species.

For all § 3 habitats protected by the Nature Protection Act, e.g. ponds/lakes (more than 100 m^2) and meadows, it is in accordance with the Nature Protection Act decisive whether the project can lead to an alteration of the state of the habitat, e.g. by additional ammonia load. The Appeals Board has in a case rejected that an additional calculated annual load of 78 g nitrogen to a 600 m^2 pond – equivalent to 1.3 kg/N/ha/year – would alter the state of the habitat. The Board also rejected an argument that the fact that the estimated background load of 13.4 kg N/ha/year already exceeded the tolerance of a protected plant in the pond – assessed to be 5-10 kg N/ha/year – should lead to the conclusion, that any additional load would violate § 3 of the Nature Protection Act.[36] In another case an additional load of 6.5 kg N/ha/year to a dry grassland was considered to violate § 3 of the Nature Protection Act. [37]

According to the Nature Protection Act § 65(3) exemption from the § 3 prohibition can only be granted in special circumstances. An economic interest in livestock production will normally not constitute such a 'special circumstance' that can justify an exemption. If, however, the nature value of the § 3 site is low, it might be possible to grant an exemption, like in a case where the appeals board accepted an exemption for a pond protected by § 3 with reference to the general

[35] See Miljø- og Fødevareklagenet, NMK-131-00240, March 2017.

[36] Nature and Environment Appeals Board case no NMK-510-00756.

[37] Miljøretlige afgørelser og domme, 2014.375.

high ammonia load in the area as well as the establishment of another pond as a compensating measure.[38]

3.b.5 Annex IV species

As regards Annex IV species an assessment must be made prior to the granting of a permit to ensure that the project will not deteriorate or destroy breeding sites or resting places, cf. Executive Order 926/2016. In practice this implies that in case of presence of Annex IV species in the proximity of the installation the potential effects on breeding sites or resting places should be assessed.[39] According to the previous guidance note[40] the municipality must always assess whether there are areas (or habitats) suitable for Annex IV species within 300 m from the installation and whether there is a direct linkage between the project and the effects on breeding sites or resting places of Annex IV species. In such cases permit conditions should be imposed to reduce adverse effects.

There are, however, no known appeals board cases where Annex IV species have resulted in restrictions as regards ammonia emissions from livestock installations.

3.c Other legal instruments/measures, e.g. in relation to existing livestock installations that may cause unacceptable ammonia pollution

As mentioned above existing livestock installations with a permit may be subject to a reconsideration or update of the permit. When reconsidering/updating a permit BAT standards should be complied with, cf. § 39, Executive Order 916/2017. In addition a deadline for compliance with the total deposition threshold as regards category 1 and 2 habitats shall be set as stipulated in § 39 of Executive Order 916/2017. According to the Guidance Note the deadline should in view of the principle of proportionality take into account the expected remaining 'life time' of a stable – normally 15-20 years.

If an existing livestock installation is not subject to a (new) permit requirement (or reconsideration of a permit) it must be assessed whether it is possible to impose restrictions as regards ammonia emissions from the installation. This depends on whether the existing installation has a permit or not. If the installation has an existing permit it is possible to impose orders to reduce significant pollution from the installation – or possibly to order the closure of the installation, cf. § 39 of the Livestock Installations Act. Within 8 years from the granting of a permit it is, however, only possible to impose new restrictions in specific circumstances, cf. § 40. If the installation does not have a permit (or has an older permit according to the previous

[38] Published in Miljøretlige afgørelser og domme 2013.3170

[39] See e.g. the case published in Miljøretlige afgørelser og domme 2013.2217.

[40] Environmental Protection Agency, 2016: Guidance note, available at https://oldwiki.mst.dk/Husdyrvejledning.Forurening.ashx

rules) it is possible to impose new restrictions or order the closure of the installation if it results in significant pollution, cf. § 42. In all cases the principle of proportionality should be taken into account.

3.d Short overview of ammonia regulation of other agricultural activities

3.d.1 General standards/regulations

Spreading of manure (and other fertilisers) is subject to a number of general restrictions as stipulated in Executive Order 865/2017. This includes requirements that liquid manure can only be spread using specific equipment (e.g. dragged hoses or injectors), cf. § 28(2). In addition spreading of manure shall in general be injected on fields with no established crops, cf. § 30(3).

According to the new legislation a general 20 m buffer strips along category 1 habitats as well as some category 2 habitats (active raised bogs and lobelia lakes) has been laid down in § 32(2). Specific technical requirements for manure spreading shall be applied within these buffer strips. The general buffer strip requirements replace the options for setting buffer strip conditions in individual permits. According to the preparatory works it will also ensure protection of breeding and resting sites for Annex IV species.

Some of the 43 Annex II habitats that are considered 'ammonia sensitive' are also classified as 'nitrogen sensitive' i.a. sensitive to runoff from nearby spreading of manure. For those it is recommended to take special care, e.g. to take measures to reduce runoff (Naturstyrelsen, 2016b).

3.d.2 Individual restrictions (e.g. on cultivation practices)

It has until March 2017 been possible as part of the permit system to lay down permit conditions as regards ammonia emissions related to spreading of manure, cultivation practices or other land use activities (e.g. field stacks [in Danish 'markstakke']). This could be in the form of buffer strips along sensitive habitats or breeding/resting sites for Annex IV species. The buffer strips could restrict manure spreading or set different technical requirements for spreading of manure. They might also restrict other cultivation or land use practices. The Nature and Environment Appeals Board has in a case[41] rejected a permit condition prohibiting field stacks within 300 m from what was considered as an 'ammonia sensitive' forest as not being founded in an individual assessment of the potential ammonia load to the forest areas. As a consequence of the new Livestock Installations Act manure spreading and other land use activities will no longer be part of the permit system from August 2017. Manure spreading and other land use activities will primarily be regulated through general standards or restrictions, e.g. the new 20 m buffer strip, replacing the individual restrictions in permits.

[41] Miljøretlige afgørelser og domme 2013.3262.

4 Concluding remarks

Ammonia emissions from farming – and in particular from livestock installations – contribute to the major part of ammonia emissions in Denmark. Furthermore, a large share of the protected habitats are sensitive to ammonia deposition and subsequent eutrophication – both within and outside Natura sites. In many cases the general deposition referred to as the background load is already exceeding the tolerance level of the habitats resulting in an unfavourable status or trend. Thus, there has been a political focus on reduction of ammonia emissions from farming activities – both from livestock installations and from manure spreading, e.g. as reflected in the 2004 Ammonia Action Plan and in the 2011 amendment of the Livestock Installations Act.

The regulation of ammonia pollution from livestock installations in Denmark is mainly embedded in general standards and in the environmental permit system. The regulation is aimed at protecting "ammonia sensitive" habitats and species both within and outside Natura 2000 sites.

The comprehensive permit scheme for livestock installations that has been in force since 2007 adresses ammonia emissions from livestock installations subject to an environmental permit requirement. The permit scheme has a wide scope covering also small farms. The ammonia related assessment and permit requirements play an important role in the permit procedures – as reflected in BAT, the general reduction requirement and the site-specific thresholds. The site-specific thresholds do not only consider the additional deposition resulting from the new project, e.g. an expansion of a farm, but also considers the total deposition from the new and existing farm activities. Furthermore, the site-specific thresholds take into account cumulative effects from neighbouring farms. The total deposition requirement may, however, lead to situations where an existing farm cannot be granted a permit for expansion despite an actual reduction of the total emission if this does not comply with the thresholds. Nevertheless, the permit scheme does not only address ammonia emissions from new parts of a livestock installation, but also from e.g. existing stables.

The regulation of existing livestock installations that do not require a permit (as they are not subject to expansion or alterations) remains a difficult issue. Existing permits are in some circumstances subject to reconsideration within 8 years and will in such cases be subject to the ammonia requirements. This does, however, not apply to small farms. Other options to review existing permits and issue orders to reduce unacceptable pollution do exist if a sufficient link can be established between the ammonia pollution from the installation and the poor state of a sensitive habitat.

As from August 2017 the spreading of manure is no longer part of the permit scheme. General standards as regards techniques etc. for spreading of manure do exist and specific requirements

apply within a new 20 m buffer strip along category 1 habitats in Natura 2000 sites has been imposed. Alternatively, individual restriction may be imposed through orders according to the Nature Protection Act.

References

Jacobsen, B.H. (2009). De økonomiske af forskellige grænser for BAT godkendelse i relation til proportionalitet. https://static-curis.ku.dk/portal/files/128337598/21_oktober_De_konomiske_konsekvenser_af_forskellige_gr_nser_for_BAT_godkendelse_i_relation_til_proportionalitet.pdf

Mikkelsen, M.H. & Albrektsen, R. (2017). Fremskrivning af landbrugets ammoniakemission 2016-2035. Notat fra DCE. Nationalt Center for Miljø og Energi, Aarhus Universitet. http://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Notater_2017/DCE_Notat_vedr_ammoniakfremskrivning_2016_2035.pdf

Miljø- og Fødevareministeriet (2016). Aftale om Naturpakke. Maj 2016. https://mfvm.dk/fileadmin/user_upload/Natturpakke-2016.pdf

Miljøstyrelsen (2011a). Vejledende emissionsgrænseværdier opnåelige ved anvendelse af den bedste tilgængelige teknologi (BAT) – Husdyrbrug med konventionel produktion af slagtesvin. https://www2.mst.dk/Wiki/GetFile.aspx?File=/BAT/Standardvilkaar/BATemissionsgraenser_slagtesvin_maj2011.pdf

Miljøstyrelsen (2011b). Vejledende emissionsgrænseværdier opnåelige ved anvendelse af den bedste tilgængelige teknologi (BAT) – Husdyrbrug med konventionel produktion af malkekvæg. https://www2.mst.dk/Wiki/GetFile.aspx?File=/BAT/Standardvilkaar/BATemissionsgraenser_malkekvaeg_maj2011.pdf

Miljøstyrelsen (2016). Habitatbeskrivelser, årgang 2016. Beskrivelse af danske naturtyper omfattet af habitatdirektivet (NATURA 2000 typer). https://mst.dk/media/128611/habitatbeskrivelser-2016-ver-105.pdf

Ministeriet for Fødevarer, Landbrug og Fiskeri & Miljø- og Energiministeriet (2001). Handlingsplan til reduktion af ammoniakfordampningen fra landbruget. https://husdyrvejledning.mst.dk/media/186684/handlingsplan-til-reduktion-af-ammoniakfordampningen-fra-landbruget.pdf

Naturstyrelsen (2016a). Vejledning om de kommunale handleplaner til opfølgning af Natura 2000-planerne 2016-21. https://naturstyrelsen.dk/media/192801/vejledning-om-de-kommunale-handleplaner-til-opfoelgning-af-natura-2000-planerne-2016-21.pdf

Naturstyrelsen (2016b). Vejledning om kvælstoffølsomme naturtyper i Natura 2000-områder og udnyttelse af øgede gødningsnormer. 4. juli 2016. https://mst.dk/media/113972/endelig-vejledning.pdf

Annex I (Habitat types considered as 'ammonia sensitive' and 'nitrogen sensitive')

No	Habitat types present in Denmark	'Ammonia sensitive'	'Nitrogen sensitive'
1110	Sandbanks which are slightly covered by sea water all the time		
1130	Estuaries		
1140	Mudflats and sandflats not covered by seawater at low tide		
1150	Coastal lagoons		
1160	Large shallow inlets and bays		
1170	Reefs		
1180	Submarine structures made by leaking gases		
1210	Annual vegetation of drift lines		
1220	Perennial vegetation of stony banks		
1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	x	X
1310	Salicornia and other annuals colonising mud and sand		
1320	Spartina swards		
1330	Atlantic salt meadows		
1340	Inland salt meadows		X
2110	Embryonic shifting dunes	X	
2120	Shifting dunes along the shoreline with Ammophila arenaria (white dunes)	X	
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	X	
2140	Decalcified fixed dunes with Empetrum nigrum	x	
2160	Dunes with Hippophae rhamnoides	x	
2170	Dunes with Salix repens ssp. argentea (Salicion arenariea)	x	
2180	Wooded dunes of the Atlantic, Continental and Boreal region	x	
2190	Humid dune slacks	x	X
2250	Coastal dunes with Juniperus spp.	x	
2310	Dry sand heaths with Calluna and Genista	x	
2320	Dry sand heaths with Calluna and Empetrum nigrum	x	
2330	Inland dunes with open Corynephorus and Agrostis grasslands	x	
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	x	X
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto Nanojuncetea	x	X
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	x	X
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	x	X
3160	Natural dystrophic lakes and ponds	x	X
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation		
3270	Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation		
4010	Northern Atlantic wet heaths with Erica tetralix	x	X
4030	European dry heaths	x	
5130	Juniperus communis formations on heaths or calcareous grasslands	x	

6120	Xeric sand calcareous grasslands	x	X
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates(Festuco-Brometalia)	x	X
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)	x	
6410	Molinia meadows on calcareous, peaty or clayey-siltladen soils (Molinion caeruleae)	x	X
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels		
7110	Active raised bogs	x	X
7120	Degraded raised bogs still capable of natural regeneration	x	X
7140	Transition mires and quaking bogs	x	X
7150	Depressions on peat substrates of the Rhynchosporion	x	X
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	x	X
7220	Petrifying springs with tufa formation (Cratoneurion)	x	X
7230	Alkaline fens	x	X
8220	Siliceous rocky slopes with chasmophytic vegetation	x	
8330	Submerged or partially submerged sea caves	x	
9110	Luzulo-Fagetum beech forests	x	
9120	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercinion robori-petraeae or Ilici-Fagenion)	x	
9130	Asperulo-Fagetum beech forests	x	
9150	Medio-European limestone beech forests of the Cephalanthero-Fagion	x	
9160	Sub-Atlantic and medio-European oak or oakhornbeam forests of the Carpinion betuli	x	
9170	Galio-Carpinetum oak-hornbeam forests	x	
9190	Old acidophilous oak woods with Quercus robur on sandy plains	x	
91D0	Bog woodland	x	
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	x	
Sum		**43**	**19**