Noise Emissions from Farm Types and Spatial Planning

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ABSTRACT
Problems with noise disturbances in the sphere of agricultural homesteads increased noticeably in the latest past. Higher sensitization, structural changes and (wrong) spatial planning developments are the main reasons for this. The call for a noise focused spatial planning judgement basis arose in parallel to publication of the “Practice Guide Sound Technology in Agriculture” in 2013. This new manual was the first available document for detailed noise assessments of agricultural homesteads, but to date guidelines for spatial planning concepts in early stages of agricultural construction planning are still lacking. With the striven release of an additional “Farm Noise Manual” statements concerning the compatibility of expected sound emissions/immissions from projected farms with the surrounding land use planning will be possible in the future.

Keywords: Emission, Farms, Spatial Planning I-INCE Classification of Subjects Number(s): 14.4, 22.6

1. INTRODUCTION
The concrete project idea developed out of the huge number of reactions of affected persons and partners of the „Practice Guide Sound Technology in Agriculture“ published in spring 2013 (1).

Though with this guide the first basis for detailed acoustical assessments of farmsteads (including animal husbandry) is available, guidelines for farsighted spatial planning strategies for early phases of agricultural building planning are missing to the present day.

The practice is confronted with the fact that problems concerning noise emissions/immissions often arise very late during building permission proceedings. Subsequently time delays, rising building costs and additional necessary sound insulation measures are potential impacts. Within the scope of the objective project data of the relevant farm noise sources (dependent on the respective type of farm) is compiled, furthermore emission models are generated and hereafter proved by field measurement campaigns.

2. PROJECT AIM
The aim of the present project is the development and publication of a complementary guide considering noise emissions from farmyards (taking into account the different types of kept animals) in connection to landuse planning. In the future it should become possible in early (planning) phases of agricultural building projects that statements are made about to what extent the expected sound emissions of the regarded type of farm is compatible with the surrounding properties.

With the „Monograph M 154 – Noise Emissions from Business Types and Landuse Planning“ there is already an instrument for acoustic planning during regional planning procedures available (2) – however this publication only covers industrial buildings. Within the scope of the present project the “Monograph M 154“ will be interpreted especially for the agricultural sector and consider its very special aspects and needs.

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### 3. PROJECT STEPS

Below the main working steps towards project realization are mentioned:

- Standardized questionnaire survey covering all important types of noise sources (agricultural motor vehicles, technical equipment, kept animals inside stables and on the farmstead-area) on selected Austrian farms of different types of animal husbandry and size
- Characterization and grouping of the various types of farms (different kept animals, different number of animals, different mode of operation) concerning their sound- and noise-technical similarities and relevance
- Calculation of the specific Area-Related A-Weighted Sound Power Level $L_{WA''}$ of the examined farmsteads (out of the standardized questionnaire survey)
- Evaluation of the calculated Area-Related Sound Power Level by noise measurements on selected farmyards
- Adaptation and interpretation of the “Monograph M 154” for agriculture and publication of the planned additional agricultural sound guide in spring 2019

### 4. CALCULATION PROCESS ACCORDING TO “MONOGRAPH M 154”

#### 4.1 Planning Example

On the hatched area a farmstead with an Area-Related A-Weighted Sound Power Level $L_{WA''}$ of 55 dB should be established – the general possibility has to be investigated. The examined parcel of land covers an area of 950 m² and is associated to characterization category 3 according to ÖNORM S 5021-1 (3). The neighbouring properties are situated partly in characterization category 2 and 3. The decisive point of immission (IP) is located on the closest property line on a plot belonging to characterization category 2.

![Planning example](image)

**Source:** Monograph M 154, Federal Environment Agency of Austria, Vienna
4.2 Determining the sound emitting area

The sound emitting area is determined by the building of a margin strip of 4 m to the property line of the regarded plot. The property lines are moved in parallel motion to the centre, as you can see in the figure below. The resulting sound emitting area is 560 m² of size.

![Figure 2 – Determined sound emitting area of the interested building site](image)

Source: Monograph M 154, Federal Environment Agency of Austria, Vienna

The Area-Related Sound Power Level $L_{WA''}$ ($L_{WA''}^{\text{Berechnung}}$) of the concrete building site is calculated as following ($L_{WA''}^{\text{Betriebstyp}}$ corresponds with the $L_{WA''}$ of 55 dB of the projected farmstead):

$$L_{WA''}^{\text{Berechnung}} = L_{WA''}^{\text{Betriebstyp}} + 10 \cdot \log \frac{S_{\text{Gesamt}}}{S_{\text{Berechnung}}} =$$

$$= 55\,\text{dB} + 10 \cdot \log \frac{950\,\text{m}^2}{560\,\text{m}^2} = 55\,\text{dB} + 2,3\,\text{dB} = 57,3\,\text{dB}$$

![Figure 3 – A-Weighted Sound Power Level $L_{WA''}$ of the determined sound emitting area](image)

Source: Monograph M 154, Federal Environment Agency of Austria, Vienna

4.3 Sound propagation

The calculation of the A-Weighted Sound Pressure Level $L_{p,A}$ at the point of immission (IP) results in a value of 49,5 dB. The planning value for this characterization category 2 of building land is 50 dB (according to ÖNORM S 5021-1) and is not exceeded. Therefore the projected farmstead will be permitted.

The situation of the calculated sound propagation is demonstrated in Figure 4.
5. TARGET GROUPS OF THE PLANNED PUBLICATION
- Planning level (Chambers of Agriculture, engineering offices, civil engineers …)
- Acoustic experts, agricultural experts and responsible authorities
- Farmers (constructor of new farm buildings) and the Neighborhood (affected persons)

6. ENLARGING THE KNOWLEDGE

With the introduced project an intensive discussion regarding agricultural sound emissions from farmsteads and landuse planning takes place for the first time.

An essential job in early phases of agricultural building projects is to answer the question whether the building project – focusing on the expected sound emissions and/or immissions – is compatible to the valid planning scheme (considering the construction plot and the neighboring properties). In the absence of available judgement bases to date such a check is only possible in a limited degree.

The project „Noise Emissions from Farm Types and Spatial Planning“ and the planned additional “Agricultural Noise Guide” should bring a certain sense of relief and fulfill the demands arising from the practice. Currently such a planning tool is only available for commercial enterprises.

7. COOPERATION PARTNERS

The project is developed in cooperation with the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, the Austrian Chamber of Agriculture and the “Forum Schall”.

REFERENCES
3. ÖNORM S 5021-1: Schalltechnische Grundlagen für die örtliche und überörtliche Raumplanung und Raumordnung. Austrian Standardisation Body, Vienna, Austria, 2010