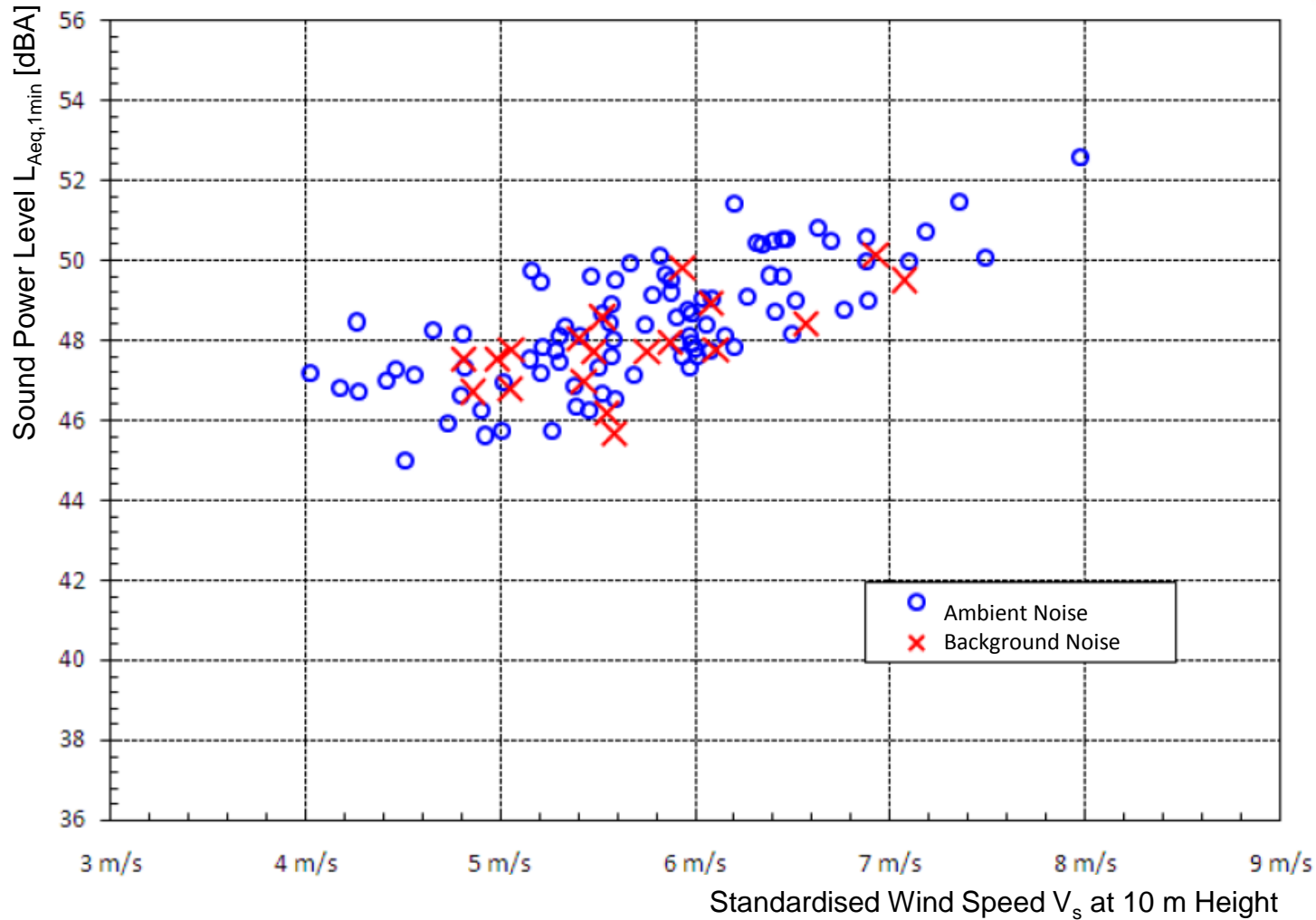


**France – Germany**

**A Comparison  
Of the Acoustic Assessment Procedures**

Pierre.Dutilleux@evergy.de

## Scatterplots at the Immisson Location

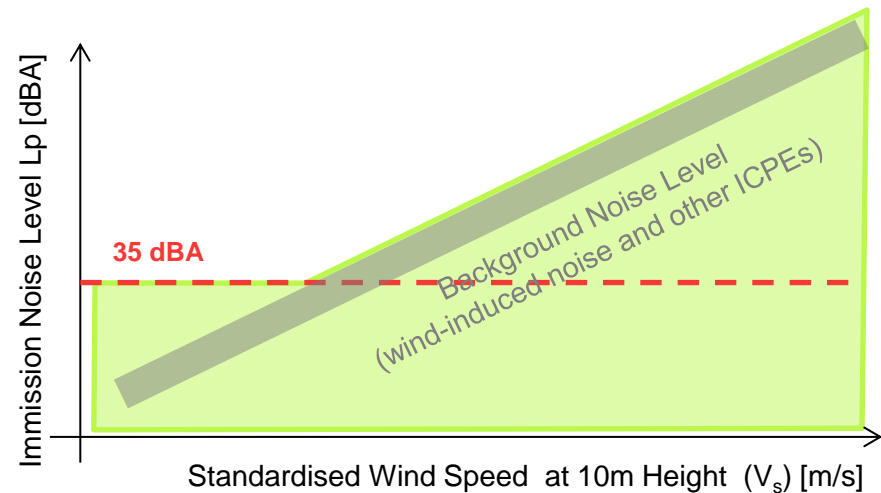


## France: Outline of the Assessment Method

- The noise level guidelines are defined by the ministerial order dated 23.08.2011 establishing the wind farms as installations which are classified for the protection of the environment.

NIVEAU DE BRUIT AMBIANT EXISTANT dans les zones à émergence réglementée incluant le bruit de l'installation	ÉMERGENCE ADMISSIBLE POUR LA PÉRIODE allant de 7 heures à 22 heures	ÉMERGENCE ADMISSIBLE POUR LA PÉRIODE allant de 22 heures à 7 heures
Sup à 35 dB (A)	5 dB (A)	3 dB (A)

- When several ICPEs contribute to the overall immissions, each ICPE is evaluated under consideration that the other ICPEs contribute to the background noise (as long as the operating company is different for each ICPE).



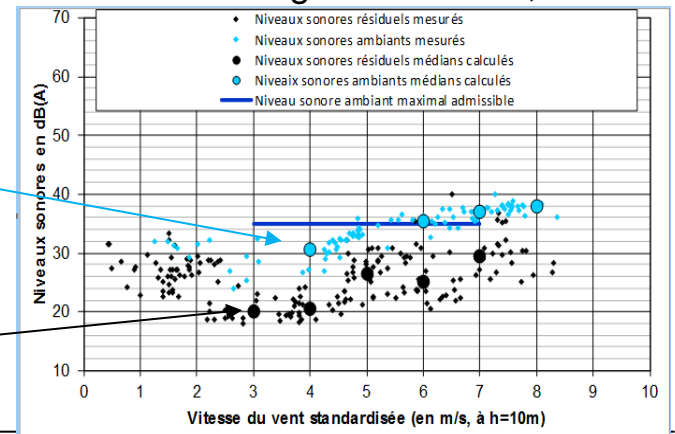
## France: Outline of the Assessment Method



- Ambient-noise & background-noise measurements at nearby dwellings ( $L_{Aeq,1s}$ )
- Operation of the wind farm in alternating ON/OFF phases of about 1 to 4 h each for an overall duration ranging from 3 to 14 days typically
- (Discard the erroneous or irrelevant data sets)
- Sort the measurement data in “homogeneous classes” (**day/night**; **wind speed**; wind direction; other criteria where appropriate)
- Scatterplots of the  $L_{50,10 \min}(L_{Aeq,1s})$  measurements against simultaneous standardized wind speed
- In each homogeneous class, comparison of the median noise level for the ambient noise with the median noise level for the background noise
- If the difference of these medians (i.e. the emergence level) is lower than 3 dB during nighttime and 5 dB during daytime, the wind farm is compliant for the considered homogeneous class,

Ambient noise  
(including wind farm)

Background noise

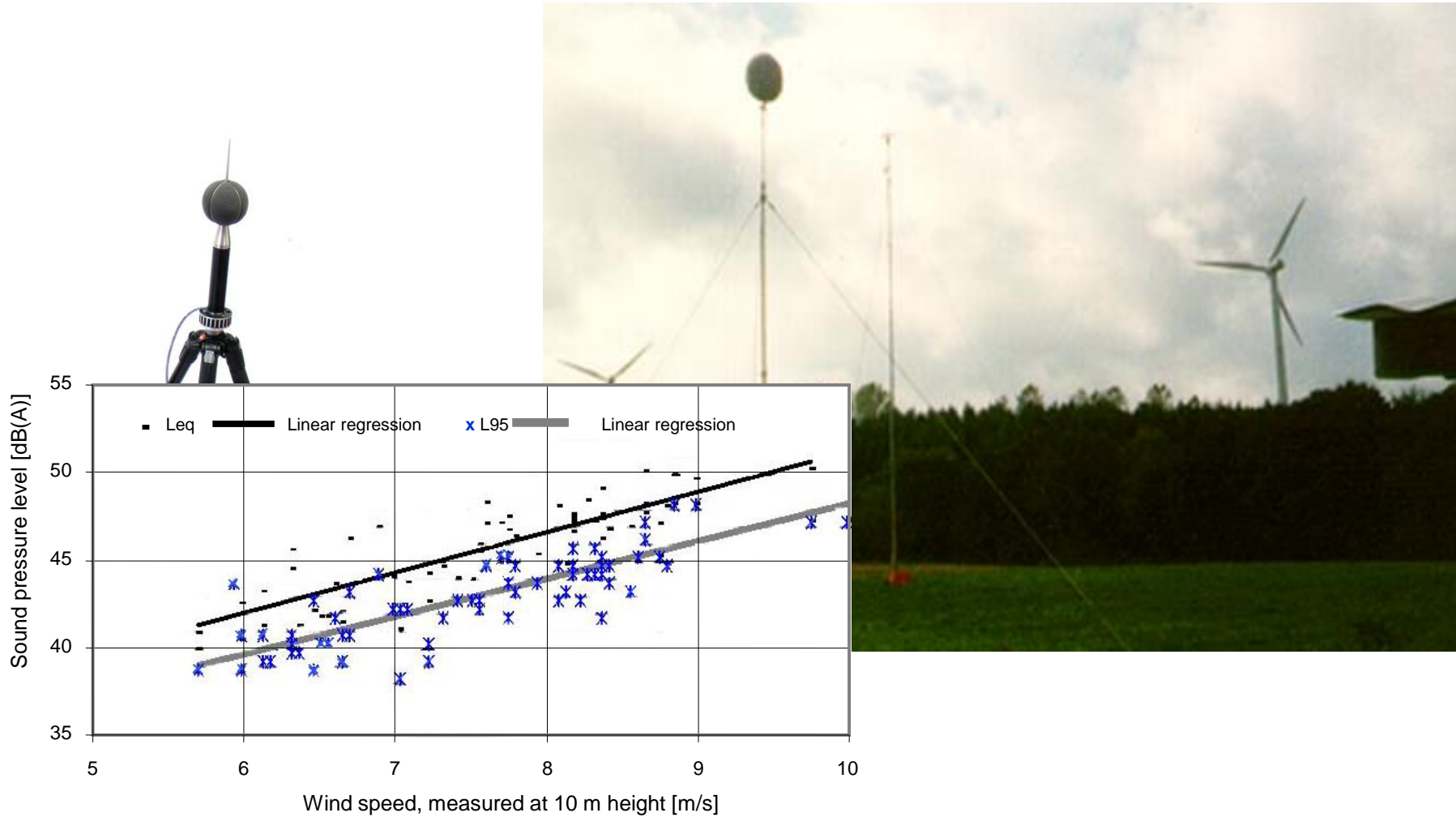


## Germany: Outline of the Assessment Method

- The technical guideline for noise (TA Lärm) defines noise level guidelines (Immissionsrichtwerte) depending on the type of use of the area

TA Lärm	Technical Guideline for Noise	Tag Daytime	Nachts Nighttime
<b>6.1 Immissionsrichtwerte für Immissionsorte außerhalb von</b>	<b>6.1 Noise guidelines for immissions outside of buildings</b>		
a) In Industriegebieten	<i>a) In industrial areas</i>	70 dB(A)	70 dB(A)
b) in Gewerbegebieten	<i>b) in business areas</i>	65 dB(A)	50 dB(A)
c) in Kerngebieten, Dorfgebieten und Mischgebieten	<i>c) in cities, villages and mixed areas (farming)</i>	60 dB(A)	45 dB(A)
d) in allgemeinen Wohngebieten und Kleinsiedlungsgebieten	<i>d) in common residential areas</i>	55 dB(A)	40 dB(A)
e) in reinen Wohngebieten	<i>e) in exclusively residential areas</i>	50 dB(A)	35 dB(A)
f) in Kurgebieten, für Krankenhäuser	<i>f) in health resorts or for hospitals</i>	45 dB(A)	35 dB(A)
<p>Einzelne kurzzeitige Geräuschspitzen dürfen die Immissionsrichtwerte am Tage um nicht mehr als 30 dB(A) und in der Nacht um nicht mehr als 20 dB(A) überschreiten.  <i>Isolated short-term impulsive noise must not exceed the noise guideline by 30 dB(A) during daytime and 20 dB(A) during nighttime.</i></p>			

# Wind-induced Sound Pressure Level



## Germany: Outline of the Assessment Method

---

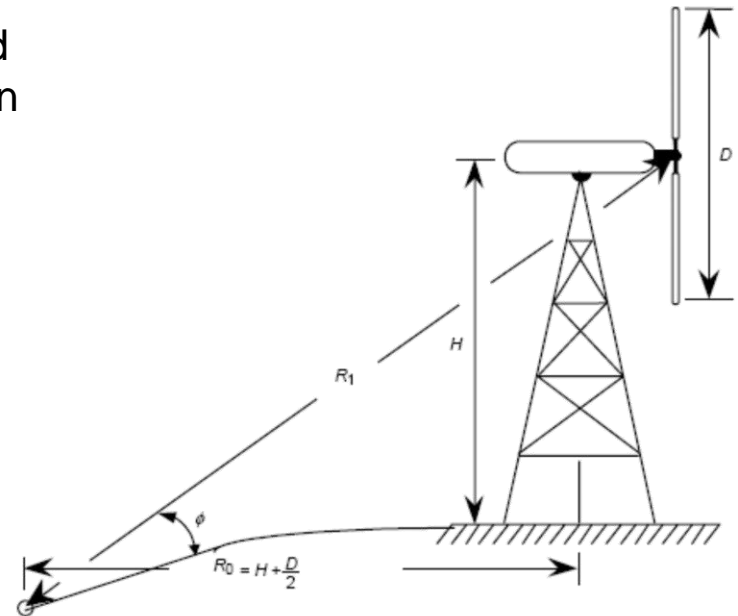
- When immission noise measurements are performed during the night, the loudest 1-h period is considered ( $L_{Aeq,1h}$ )
- The uncertainties during immission noise measurements are usually very high. For this reason, the technical guideline recommends to perform measurements at alternative locations
  - in the distance from the wind farm but at a quieter location and using a baffled microphone system



## Germany: Outline of the Assessment Method

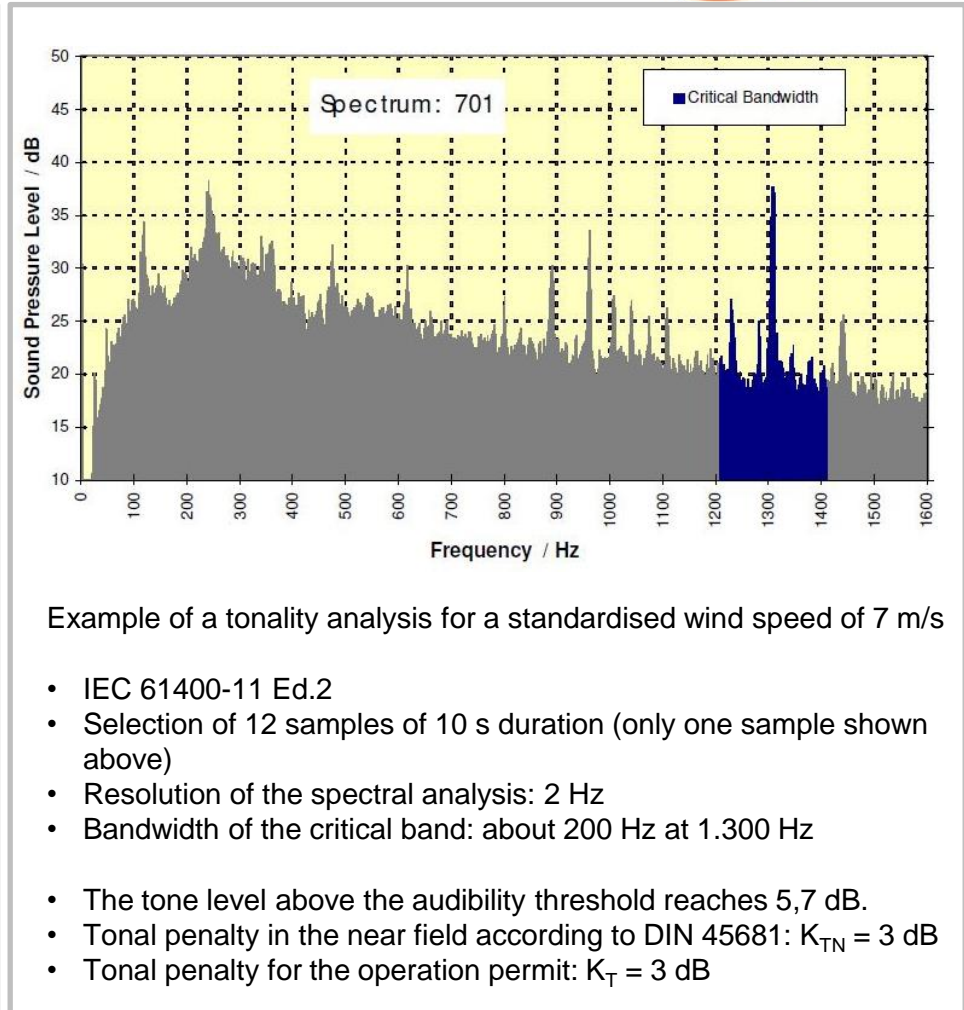
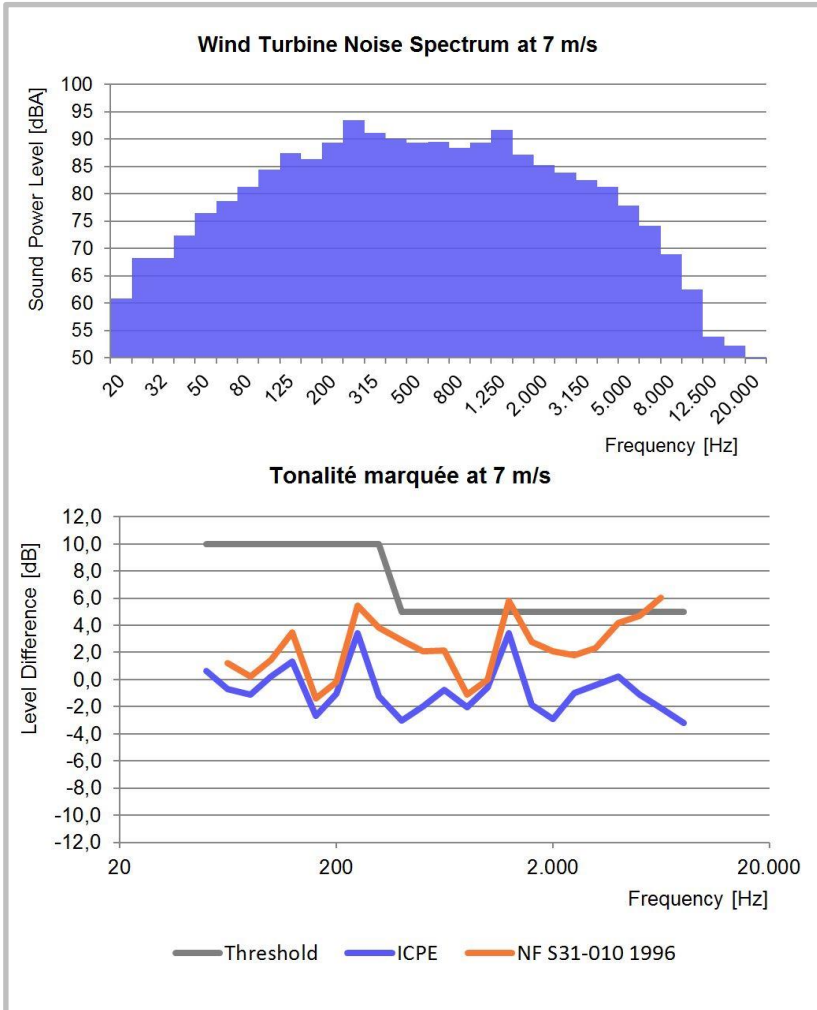


- At the IEC 61400-11 location in order to determine the sound power level of the noise source.
  - Operation mode
  - Electrical power
  - Rotational speed
  - Wind speed (met mast, nacelle, elec power)
  - Wind direction
  - Pitch angle
  
- The immission level will then be derived by calculation of the acoustic propagation effects (worst case scenario)
  
- The maximum noise level after addition of **penalties** for impulsivity and tonality, if applicable, is used as a Rating Level (Beurteilungspegel)
- A decision is made on the basis of the **worst case operating conditions** (ungünstiger Betriebszustand)





# Tonality Assessment





- France

The method for the calculation of the acoustic propagation is not specified.

ISO 9613-2 is often used but more elaborate methods may also be used.

The calculations are typically performed for each octave band.

„Realistic predictions“ are needed during the project development phase but the acoustic acceptance procedure based on the emergence criterion is fairly immune to the uncertainties of the acoustic model.

- Germany

The acoustic propagation is calculated using the alternative method of the ISO 9613-2 standard. A single-value broadband level is required.

Looking for a worst-case result, the absorption coefficient for 500 *Hz* is assumed to be valid for the broad-band spectrum.

This simplified method is subject to discussions but it is used as long as the results are considered to lie within the expected confidence interval.

## Uncertainties

- France

In each homogenous class, the measured median noise level is compared with the noise guideline after consideration of the metrological uncertainties using an extension factor  $k$ .

*Median -  $k$ .Uncertainties  $\leq$  Noise Level Guideline*

*Which extension factor ( $k = 0, 1, 2$ ) ?*

*Which sign +/- ?*

*How large are the uncertainties allowed to grow ?*

- Germany

The calculated (or measured) average noise level ( $L_m$ ) is „extended“ by the overall uncertainties of the procedure using the factor 1,28 in order to determine the upper limit of the 90 % confidence interval ( $L_o$ ).

$$L_o = L_m + 1,28.Uncertainties$$

penalties for prototypes, tonality or impulsivity might then apply before comparison with the noise level guidelines.

$$L_o + K_T + K_I + K_{prototype} \leq Noise\ Level\ Guideline$$

- France: a wind farm is not compliant if the emergence level is higher than the noise guideline + k.uncertainties. The risk is low that unjustified limitations are imposed on the operation of the wind farm.

If a wind farm is found to be compliant and the remaining margin is used for the optimisation of the wind farm, the chances become very few, although they do exist, that the optimised wind farm is still compliant.

The sensitivity to varying meteorological and environmental conditions is high.

The standard NF S 31-114 is still under discussion. The various interpretations which are left open can lead to significant discrepancies in the appraisal of a project.

Cumulative effects: for a new wind-farm project, the already existing wind farms contribute to the background noise

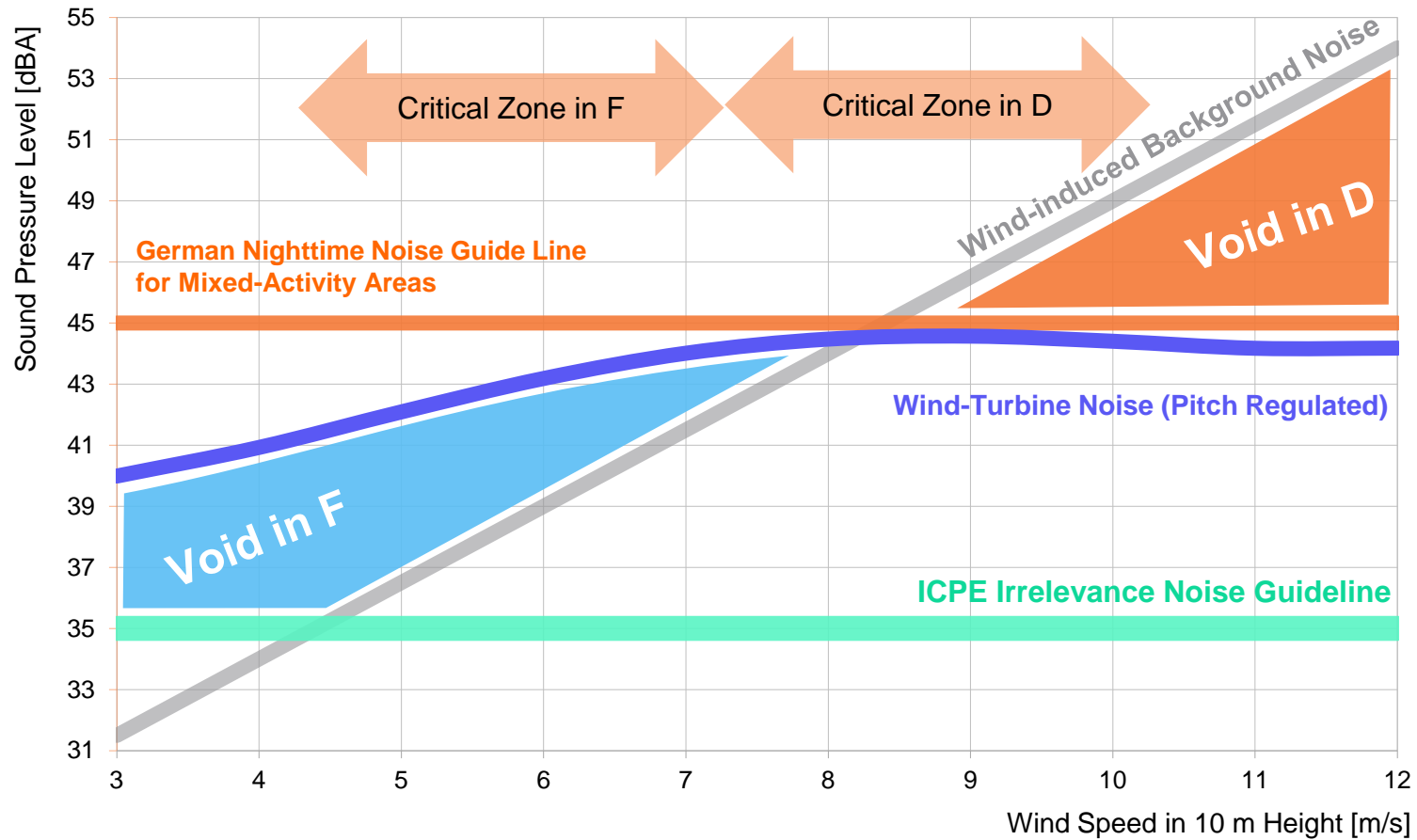
- Germany: If a wind farm is found compliant, there is only 10% risk that it is not. If a new measurement is performed, the risk of a significantly differing result is low. As a consequence, the administrative decision is stable (a few exceptions do exist however)

The procedure is designed for the worst case scenario.

The sensitivity to the weather conditions is rather low (exceptions do exist however).

The structured set of standards and of accreditations (FGW TR-1, DIN, VDI, IEC, §26 BImSchG, MEASNET) contributes to the high stability of the assessment results.

Cumulative effects: the noise budget for all the wind farm projects and industrial plants/installations is defined by the noise level guidelines (TA Lärm)



## Infrasound

---

- Overview

- Audible frequency range: 20 – 20 *kHz* (with a tonal perception)
- An infrasound is typically a sound which cannot be perceived in the frequency domain ( $< 20 \text{ Hz}$ )
- Low-frequency range in standards: (*G*) 1 – 90 *Hz* / (*F*) 1 – 150 *Hz*
- A number of specific investigations have been performed. The level of infrasound which is contributed by a wind farm is far below the threshold of perception (exceptions do exist however)
- Air transmission (infrasounds) / transmission by the ground (vibration)
- Natural turbulent phenomena contribute significant levels of infrasounds and vibrations

- France

- The French standard NF S 31-135 specifies how to **measure** in the low-frequency range
- The **rating** of the annoyance is **out of the scope** of the standard.

- Germany

- The German standard DIN 45680 specifies how to **measure** low-frequency sound and **rate** the annoyance.
- This standard has already been released and withdrawn several times because its application is still subject to controversies depending on the field of application.