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## Co-operative Noise Management

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### ABSTRACT

There is a natural conflict of interest between the operator of a noise producing facility and the residents in its neighbourhood. The operator wants to run the facility at full capacity to be as cost-effective as possible. The residents want to live in a neighbourhood as quiet as possible. Traditionally in Germany, this conflict is balanced by guidelines made by the relevant authorities that define objective noise measures and set limits (exposition values or action values) for these measures. Applying these guidelines, local authorities enact an approval for the facility imposing conditions for the operation to anticipate any violation: They are translating noise limits into operational limits restricting the use of the facility for now and the future. This is administrative noise management. After this procedure is done the operator has no further interest in noise reduction and the authorities are also done with it. In contrast, co-operative noise management is a permanent process that goes along with the operation. It really limits the noise and not the operation and confronts the operator with the noise problem on a daily base. This way of management has particular advantages if the facilities has changing plant utilisations. Hence, both the operator and the neighbourhood benefit from this management. The paper describes the basic principles of such a co-operative noise management and discusses a sample application to shooting facilities.

## 1 INTRODUCTION

Environmental noise is a more and more important aspect during the planning and the operation of noisy installation, including for example all types of traffic, recreation and industrial sources. Noise load strongly influences whether or not a new installation can be built and if, how it can be operated. For industrial installations, noise assessment determines more and more the profitability of the installation on one side and the quality of life in its neighbourhood on the other side. Noise is therefore a natural conflict between the operator and the residents in its neighbourhood.

It is the task of the competent authorities to define objective rules of noise assessment to solve or at least moderate this conflict. In an ideal world the authorities find a fair compromise between the basic interests of operator and residents and achieve acceptance on both sides. Anyway, the authorities, the operator and the residents are the main figures in this process. This process will be called 'noise management'.

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## 2 ADMINISTRATIVE NOISE MANAGEMENT

In Germany, complex laws and regulations on noise control, noise reduction and noise assessment prescribe the way, how the noise management is to be done. The operator requests a permission to run the installation in the modes that are foreseeable at that time. The authorities then apply the general rules to this particular case and decide with respect to the particular situation. This decision normally imposes operating conditions and enforces additional requirements that hold as long as the submitted operation of the installation does not change.

The process of noise management is done once. From the authorities point of view it is easy to monitor the correct operation of the installation by checking whether the operation correspond to the settled operation conditions. From the operator's point of view this administrative noise management is also done as long as no changes in the operational modes are necessary. Noise management is out of sight and out of mind for these two participants of the process. This is the traditional way of noise management that will be called the 'administrative noise management'. Figure 1 outlines the process.

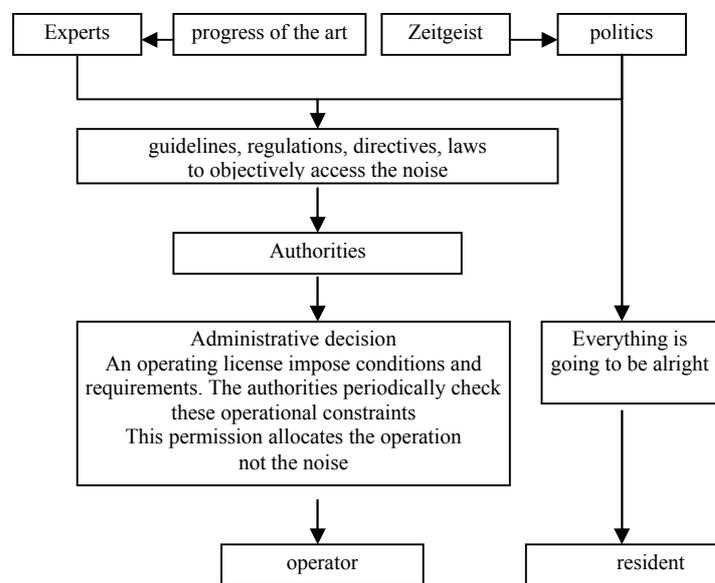


Figure 1: administrative noise management process

While the installation has a clearly defined repetitive operation, on a daily or weekly basis for example, and the residents attitude towards that kind of noise does not really change - this may hold to some extent for traffic noise for example - the administrative noise management normally settles a reasonable compromise.

There are disadvantages for all participants however:

The operator has to obey the imposed operating conditions that normally specify a rather narrow mode framework. The operator cannot short-dated respond to new challenges, even if the new operation would produce less noise because the permission is bound to particular operating conditions. New operation schemes must go through a new round of administrative noise management.

For residents, noise management is not a constant. Noise or noisiness is a judgement not only driven by physical stimuli like sound pressure and duration of impact. There are more aspects that influence the reaction of people. Even if the physical background, i.e. the stimulus, is constant the reaction of people to the particular sound may change because the attitude towards the source is changing over time. The fairness of the comprise is not

sustained, so to say. For shooting noise from military installation in Germany for example, there was a strong change in the acceptance of shooting during the last decades. Though the occupancy and the number of shots decreased, the number of complaints increased, highlighting in particular the above statement that noise and annoyance have more than a physical background. Hence, in order to keep a noise assessment up to date and better to say fair, noise management should react on such changes. And further more, ideal noise management should take the advantage to influence the human reaction, i.e. the attitude itself. This is impossible with a noise management that runs once and that leads the operator and the authorities into a ‘couldn’t care-less attitude.

For the authorities, the administrative noise management shows a principle weakness, it neglects the general goal of noise policy: the reduction of noise. Neither the best available technology nor the optimisation of the operation mode is a sustained feature in such a running-once management. To say it clear: operators need benefit and authorities need plaudit in order to continuously support the goal of noise reduction.

### 3 CO-OPERATIVE NOISE MANAGEMENT

A new approach to noise management intends to overcome the disadvantages for all, the operator, the residents and the authorities. This so called ‘co-operative noise management’ will keep all participants involved in a closed-loop or adaptive control. It is a process not a decision. Figure 2 outlines the principles.

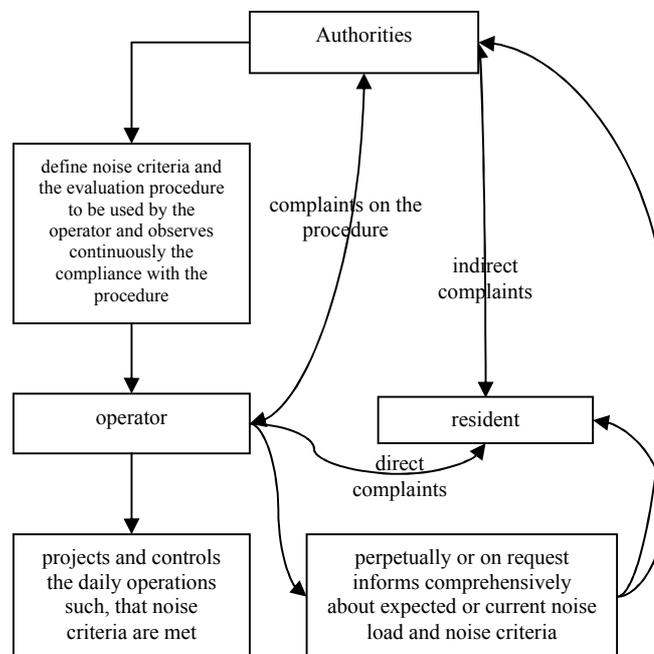


Figure 2: co-operative noise management process

The administrative operation permission is replaced by the clear definition of noise management rules that prescribe how to predict, to rate and to assess the noise. The operator has to apply these rules daily while planning the activities of the installation. There should be nothing left to the operator’s discretion. The rules must be that clear that they yield a simple ‘go’ or ‘no go’ for the day under consideration. For sure, the operation is to be documented in detail so that the authorities can monitor the compliance with the rules. If the operator gets a ‘go’ the operator can rely on this decision and the responsibility for any complaints turn to the authorities who have defined the rules. Co-operative noise management is public to the residents under two aspects. Firstly, the rules are public. Secondly, the daily noise load

calculated according to the rules is public so that the residents can see what is going on and how loud a day was or – more important – how noisy the next days will be. In addition, co-operative noise management comes with a clear and easy to use management of complaints.

The operator is confronted day by day with the noise around the installation and will consider the noise load in such a way that the operation will be below the limits. Now, the operation is not restricted by imposed operating conditions, the operation is restricted by noise load. The operator is free to change operation modes and the activities as long as the noise criteria are met. This is an important advantage for the operator and the authorities.

To support the operators ambition to run the installation ‘noise-optimised’, the rules of the co-operative noise management may contain more flexibility. For instance, the operator may be allowed to use a certain number of exceedance days where the operation can be louder than normal if these noise days are announced and the noise load is, so to say, saved over a period of time. As a consequence, the operator will try to decrease noise by operational measures because he can benefit from low noise loads in the future.

Overall, the residents will also benefit from co-operative noise management. The average noise load will decrease because the operator really benefits from any noise abatement measures. The operator will take care of the noise problem and look after the residents to keep their attitude towards the installation noise rather positive than negative. This is expected to reduce the annoyance and the number of complaints.

#### **4 CO-OPERATIVE NOISE MANAGEMENT ON MILITARY TRAINING INSTALLATIONS**

Below, co-operative noise management is discussed along the example of shooting noise from military training areas. Such a management is about to be introduced at these installations in Germany before the end of 2007.

German noise regulations rely on long term predictions of that operating conditions that yield the highest rating level assuming best sound propagation conditions at relevant receiver positions with highest sensitivity with respect to the noise criteria. Therefore, administrative noise management needs to specify the significant operation or occupancy which is to be assessed. And it must specify receiver positions that are representative for the whole neighbourhood. If these preconditions are not existent the German regulations and guidelines to objectively evaluate the annoyance criteria are not applicable.

For a military training area none of the above preconditions are met. Any occupancy is so to say unique and will probably never happen again. The occupancy with the highest rating level could only be determined if the receiver site is specified. Shooting along the west side of the area for example will affect the residential area on that side. Shooting at eastern facilities will affect the residential areas there. Due to safety reasons however, both occupancies will not happen simultaneously but the southern or northern facilities will probably fire weapons that do not interfere the safety zones with the west or east occupancy. What is the worst situation and for whom. There is no common answer to that question. Even if firing would be possible at two opposite sides of the training area, and for large areas it is, then according to the regulations in Germany all contributing sounds shall be predicted under downwind conditions which is not true towards opposite residential areas. Obviously, a military training area does not meet the preconditions of administrative noise management. In additions, authorities cannot impose operating conditions due to the variety of different shot configurations and the multitude of firing facilities. As a consequence in this particular case, administrative noise management fails. Actually, this was the reason to develop the co-operative noise management.

#### **5 THE RULES IN A NUTSHELL**

The rules of the noise management prescribe to plan the daily shooting activities such that two noise criteria are met at each point on a 250 m x 250 m grid around the installation: No

single event level should exceed a 100 dB CSEL, no noise load (the energetic sum over all single events weighted with the number of shots) should exceed 70 dB CSEL. These are the limits for daytime and 'normal' residential areas. There are different limits for the night time and for more noise sensitive areas. In all cases, the operator is allowed to exceed these limits at each point on 18 days per year (5 percentile) by 5 dB.

The authorities prescribe the noise prediction procedure including the weather conditions, give and maintain all acoustical source data of the each shot configuration and define the representative firing locations for planning purposes. Operator and authorities share the computer program and the whole management database that also contains the planned activities. There should be nothing left to the operator's discretion. The occupancy is automatically documented. At any time, the authorities can have a look at the data and remake the management to supervise the management at the installation.

There are more rules to control the management that are not discussed here. However, the computer program considers all rules. The results are simple messages for the operator for the sample occupancy of a shooting day under test: a 'go without restrictions', a 'go, but it is an exceedance day at some regions', a 'no go, because there is no exceedance day left' or a simple 'no go' because it is too noisy anyway. The operator will vary the occupancy through shifting the activities to other facilities, or restricting certain loud ammunitions or trajectories, or reducing the number of rounds and so on, until he finds a valid occupancy that meets all criteria.

## **6 OUTLOOK**

The advantages of such a management over administrative imposed restrictions for each facility are clear: The operator is confronted to noise problem day by day. He will optimise the occupancy not only with respect to military training requirements but also with respect to shooting noise. He will try to save as many exceedance days as possible to keep his installation prepared for a large training event. The operator gains options if he saves noise load. The residents will benefit because the average noise will decrease. Exceedance days have to be announced, so the residents can make their own plans.

The introduction of the concepts of co-operative noise management on German military training area will strongly influence the way of planning the shooting activities on the installations. After some period of time, long-term consequences are expected which may lead to a re-construction and re-distribution of the shooting facilities over the area of an installation under noise considerations. The noise management may also cause a different distribution of training activities over all available installations in Germany in order to find a fair noise distribution. This typically happens two years before the shooting takes place.

Generally, the co-operative noise management intends to gain more acceptance for the necessary training activities of the military. It is for instance proposed to publish a noise forecast map two weeks in advance through the internet to keep the residents informed.