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NOISE CONTROL IN HYDROELECTRIC STATIONS

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Abstract

One of the most important physical hazard agents very often present in the work environment of hydroelectric stations is noise. Noise is an aggressive hazard agent which acts in time on safety and health of the workers and is one of the main causes of accidents and occupational diseases occurred in such hydroelectric stations. The necessity of reducing the noise under the maximum accepted limits in the hydroelectric stations comes from the will to protect the safety and health of workers and well as from legal obligations to create a work environment according to the European Union regulations in force on the daily noise exposure of workers. The main target which needs to be followed for noise control in the hydroelectric stations is to reduce the recurrence of occupational deafness. The second target which must also be taken into account is represented by the protection under effects of noise (providing intelligible speaking).The third objective but not the last one which needs to be followed seriously when reduction to noise exposure is aimed at is the acoustic comfort in a human community, both in the work environment or outside it. Noise control in the hydroelectric stations is also a system matter, system which includes the source, means of transmission (routes of the acoustic propagation energy) and receiver. The methods which need to be taken into consideration when reduction of noise exposure of workers in the hydroelectric stations is aimed at must be incorporated in that system. Such methods of noise control are included in one or several of the following categories:

- methods on noise control at source;
- methods on noise control on the transmission routes;
- methods on noise control at the receiver.

1. INTRODUCTION

Noise, as an aggressive physical risk factor that exists in the working environment of hydroelectric stations, jeopardizes the workers' health and safety. It does also represent one of the stress and occupational disease factors to be found at such work places.

Therefore, there has been necessary to set up limit levels related to the workers' exposure to noise to protect them against noise.

In Romania, the minimum requirements in terms of workers' exposure to noise were set up through Government Decision i.e. HG 493/2006, a decision that entirely transposed the provisions of the Directive 10/2003 of EU.

The above decision establishes these minimum requirements for the workers' protection against the risks related to their health and safety, risks that are generated or might be generated by the exposure to noise, especially in terms of the risks for hearing.

The provisions of the above decision are entirely applicable to the activities in which the workers are exposed or might be exposed to the noise generated risks through the nature itself of their work.

In order to provide the workers' health and safety, the Government Decision from above sets up two kinds of limit values for noise exposure as follows:

a) The maximum admissible limit value for a worker's daily exposure to noise is 87 dB (A);
b) i – The high exposure value above which the employer should take action is 85 dB (A);
   ii – The low exposure value below which the employer should take action is 80 dB (A).

The above mentioned decision sets up that when the workers' daily exposure to noise shows significant variations from one day to another, the weekly noise exposure level shall be used instead of the daily noise exposure on condition that it does not exceed the limit value of exposure of 87 dB (A) and the employer takes appropriate measures to reduce the risks associated with the workers' activities to minimum.

Because of the great number of noise potential sources and also due to the specificity of the activity developed by the workers within the hydroelectric stations, their exposure to noise above the maximum admissible limits is possible in most of the cases.

Technical or organizational measures shall be provided against noise when there is ascertained the presence of an exceeding in the daily noise exposure for the workers of these hydroelectric stations based on the previously made noise exposure assessments.

The major objective which will be permanently had in view when a programme is envisaged to reduce the harmful action of noise within a hydroelectric station consists in ensuring protection in terms of the local effects that noise can have i.e. the diminution of the danger of occupational deafness occurrence. The fight against the noise existing in the hydroelectric stations resides in the measures meant to modify an acoustic field perceived so that to determine an acoustic field not exceeding the previously established objective to the receiver.

The approach of fight against noise within a hydroelectric station may be done as a matter of system. This system includes:

- the source of noise;
- the means of noise transmission in the station considered;
- the receiver i.e. the worker.

2. PROGRAMME FOR NOISE CONTROL

When applying a programme meant to fight against noise within a hydroelectric station one should not necessarily understand noise cutting out or reduction but rather its integration within some maximum or minimum limits that would be obtained in conformity with the objective pursued.

A useful analogy can be made between the fight against noise and speed control. The latter is not obtained as a result of a frequent use of the brake but rather through a speed regulator that removes the element of variability while also ensuring a predetermined constant speed.

2.1 Source

The source of noise shall be normally identified with the origin point of the noise that is considered to be harmful.

In case of the hydroelectric stations, there might be several potential sources of disturbing noise. Where such a complex distribution of sources exists, each of them shall be analysed and the fight against them shall start so that the total acoustic resultant of the whole complex shall determine an acoustic field not exceeding the proposed objective at the receiver.

One shall also notice that only one noise generating unit may be subdivided into more noise sources which can be individualized in terms of acoustic approach. In such cases, each origin point shall be considered as a distinct source of noise and an individual analysis shall be carried out to find out the most efficient means of fight.

2.2 Means of transmission

The route of acoustic propagation is to be identified with all the propagation mediums of the waves through which the acoustic energy is transmitted from the source to the receiver.

The propagation route includes one or more of the following elements:

- Direct transmission through the air;
- Reflected transmission of noise through the air;
- Reverberated acoustic fields;
- Pipe transmission;
- Solid medium vibration;
- Noise and vibration transmitted through liquids;
- Structural noise.

2.3 Receiver

The system final part is identified with the occupier of the most affected place by the harmful effect of the noise. In many cases, an individual only is concerned, either he/she is the operator of a noisy machine or he/she is the closest person to a noisy activity. However, numerous cases are reported when the receiver may consist of a group of persons or even a community in the whole.

Actually, it may happen that the receiver from the noise affected system is not a human being. Certain instruments of precision e.g. the electron microscopes or the high fineness photographical equipment may be more pretentious than the operators themselves as regards the requirements of low levels of noise and vibrations.

Irrespective of the receiver's identity, the quantification of the admissible exposure to noise should be possible so that optimum conditions could be assured. Such goals are stipulated as maximum and minimum recommended noise levels or as a recommended noise spectrum. The methods of fighting against noise within a hydroelectric station shall be incorporated into the noise fighting system being included in one of the following categories:

- methods of noise control at source;
- methods of noise control on the transmission routes;
- methods of noise control at the receiver (worker).

Noise control at source implies changes as regards the structure or the configuration of a noise source or its operating mode. Such an intervention may also include supplementary elements added to the source as for instance the noise attenuators when they are placed next to the source i.e. within the "neighbouring field".

Noise control on the propagation route includes any replacement, change or supplementary elements meant to fight against noise and placed in any point existing between the source proximity and the receiver.

Noise control at the receiver includes any treatment to be directly applied to the affected person or in the immediate proximity.

3. CONCLUSIONS

A systematic analysis of the modality of building up a programme for noise control starts from an inventory of all the potential that may be applied to the situation considered.

After an initial analysis of the possibilities of intervention, the next step has costs assessment as major objective to ensure the precise amount of work meant for noise fighting in both points considered (an attenuation excess may induce a waste of funds). Besides the acoustic and economic efficiency, there shall be taken into consideration other conditions, too, i.e. the equipment provided for noise control must be easily used so that not to reduce the efficiency of the production process and to diminish other comfort criteria in order to improve the acoustic environment.

Theoretically, each programme meant for noise reduction is unique. Each solution or method for implementing the programme will lead to a more or less significant diminution of noise depending on the specific details of the equipment and of the operating conditions.

When considering the significant number of potential solutions for each of the problems and also when taking into account the variability of the potential exchange resulting from each of them, an extremely important combination of procedures appears as effect; these procedures are worthy of being applied to reach the objective pursued. That is why it is not possible to hold the existence of "the best way" for noise control.

Building up and applying a noise control programme within a hydroelectric station shall start from the goal had in view while also being supported by the existing concrete resources.

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