The exposure of working environment noise in the agricultural service workplaces

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Abstract: The noise belongs to the leading harmful factors which pollute the environment and negatively influences human health. An overview measurement concerning the noise characteristics has been done in agricultural service workplaces. The sound pressure level has been measured and the length of the workers exposition has been elicited in each workplace. The obtained data has proved that some agricultural service workers have been exposed to a noise above the permissible exposure limit.

Keywords: auxiliary plants of agriculture; noise load of service workers; limits of noise exposure

The intensity of noise has been increasing in recent years as a result of the developed civilisation (industry, traffic, urban areas etc.). The noise and consequently the noisy working environment have an exceptional position because of their harmful effects. A long exposure to high levels of noise without any hearing protection leads to serious damage of hearing and even to deafness (a professional disease). Moreover the noise contributes to the occurrence of working accidents and injuries (at noisy workplaces more accidents and injuries occur). Besides that, the noise contributes to the development of some diseases and disorders caused by stressful conditions such as high blood pressure and other psychosomatic diseases (Havránek et al. 1990; Hlína & Geryk 1991). Through its negative influence on the workers’ concentration, the noise contributes to a significant increase of the number of mistakes in the production processes (Anonymous 2001).

The solution of the noise problems belongs to the major tasks of work hygiene as it is technologically and time demanding. Apart from a good orientation in law and legislative measures, the solution requires high professional knowledge in medical and technical fields. Furthermore, there is a need for the continual contact with new findings about the noise in the environment and in particular professional areas.

The Czech Republic has been participating in The Right Practice programme for several years. This is a project which supports the exchange of information and organises the campaign “The European Week of Working Safety and Health Protection”. This is held under the sponsorship of the European Agency of Health Safety and Protection, Bilbao, in the north of Spain. The programme The Right Practice focuses on modern approaches to the solution of the particular working problems. Last year, the campaign was focused on the problems of noise.

MATERIAL AND METHODS

The overview measurement concerning the noise load of workers was made in the selected agricultural service workplaces. Through the sound technology media (the sound-level meter type 00023, producer Robotron SRN, the preamplifier MV 102 and the condenser microphone MK 102 connected with the mobile PC via the tablet), the sound pressure level was measured at a frequency of 8 kHz and a weight filter A in the service workplaces of the agricultural production (Table 1).

The measurement and calculation method was carried out according to The Collection of Laws No. 148/2006, “Government regulation on health protection from the adverse reaction of noise and vibration”, Supported by the Ministry of Agriculture of the Czech Republic, Project No. QH 72134.

The value of the stable and flexible noises in the workplace was expressed by the equivalent sound pressure level $A_{L_{Aeq,T}}$, calculated according to the relation:

$$L_{Aeq,T} = 10 \log \left( \frac{1}{T} \int_0^T L(t) \, dt \right) \, (dB) \quad (1)$$

where:
- $L(t)$ – instantaneous sound pressure level in dB
- $T$ – time which the instantaneous level refers to

The measurement was repeated three times in order to get the objective results and the final equivalent sound pressure was calculated according to the relation:

$$L_{Aeq,T} = 10 \log \left( \frac{1}{T} \sum_{i=1}^{m} T_i \times 10^{L_{Aeq,T_i}/10} \right) \, (dB) \quad (2)$$

where:
- $L_{Aeq,T}$ – equivalent sound pressure level $A$, occurring in the time interval $T_i$

The hygienic limit of the stable and flexible noise exposition for other than eight-hour working time $T$ (480 min) was obtained by adding a correction to the permissible exposure limits for the eight-hour working time.

$$K_T = 10 \log \left( \frac{480}{T} \right) \, (dB) \quad (3)$$

where:
- $T$ – working time in the noise per shift (min)

The hygienic limit of the stable and flexible noise exposure of 85 dB was set for the eight-hour working time expressed by the equivalent sound pressure level $A_{L_{Aeq,8h}}$ according to The Collection of Laws No. 148/2006. The correction was added according to the Eq. (3).

**RESULTS AND DISCUSSION**

The value of the equivalent pressure level $A_{L_{Aeq,Te}}$ and the length of the personal day noise exposure of a worker $T_e$ in minutes per shift in each particular
The design of the measurement is displayed in the scheme below (Figures 3–8).

The noise load of the service workplaces in the monitored operations is displayed in exposition limits compared in Figure 1, 2.

Monitored operations

Meal machine operation 1 shown in Figure 3.

It appears from the measured noise values of a tractor and trailer with a vacuum air pump that the noise exceeds the acceptable limits for the work of this kind, even if the service workers spend there rather a short time necessary for switching the machine on and off and occasional checking. That place was the noisiest in the meal operation.

The measured noise came from the tractor, vacuum pump, and meal machine. Between the trailer and the meal machine, the measured noise was slightly lower. At the meal machine, where the service workers are necessary for switching the machine on and off and for the adjustment of the machine, the levels of the noise also exceeded the allowed exposure limits. In the interior work place at the meal supply (workplace A) where the noise comes mainly from the screw conveyors, the service operators check the function of the conveyors and the filling of the supply containers.

Monitored workplaces (servicing workplaces) is given in Table 1.

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At workplace B, the service operator adds some mineral additives into the meal. The levels of the noise were there lower than the acceptable ones at places A and B. The working hours at the meal machine are 3.5 hours a day (210 min), therefore the service operator is exposed to the noise level of 103.1 dB.

Those high values of the noise load during a long lasting and repeating exposure can lead to the damage to hearing.

Potatoes assorting line shown in Figure 4. At all the monitored places, the values of noise were higher than the limit allows (the service operator place C, 1.6 dB more than the limit). Therefore, the service operators at the potato assorting line can be endangered by the hearing damage (Havránek et al. 1990; Hlíná & Geryk 1991). The noise is mostly caused by the chain and geared transmissions of the conveyers, especially by the electromotor with the chain transmission, placed at the end of the conveyor.
where the protection cover had been removed. There occurs not only a high value of noise but also a heavy dust nuisance causing health problems. Moreover, the service operators are exposed to those conditions for 8 hours a day for 5 months.

**Meal machine operation 2** shown in Figure 5.

The loudest noise was measured at the meal machine (bag-filling machine Figure 1, column 11). The service operator spends there only the time necessary for switching the machine on and off and the regulation of the incoming amount of material. The measured values exceeded the acceptable limit. At the place where the service operator stores full bags, the noise level was below the acceptable limit. The service operator spends there more than 4 hours a day (260 min). He/she is exposed to the lower noise load than that allowed by hygienic limits. According to Havránek et al. (1990) and Hlína & Geryk (1991) the worker is not endangered by the harmful action of noise.

**Service garage** shown in Figure 6.

Transportation vehicles are repaired by three workers in that workshop area. Their working activity did not cause any especially high noise. The abnormal noise was caused by their own talking and the radio while the third worker spent another 1 hour at the lathe – diagram 4 (Figure 2, column 4). All the workers are exposed to a low noise load which is 20.2 to 13.9 dB lower than the acceptable hygienic limit, therefore they are not endangered by any harm to hearing (Havránek et al. 1990; Hlína & Geryk 1991).

**Lathe work shop** shown in Figure 7.

The lathe service worker is exposed to the noise load which is much lower than the acceptable limit allows. The average time of work is about 1 hour.

**Workshop** shown in Figure 8.

The workplace of the hammer service operator significantly exceeds the acceptable exposure limits. In the tillage season, the service operator is exposed to the noise for the whole work shift (8 hours). Off season, the exposure lasts about 6 hours. The grinding machine workplace is exposed to the noise which exceeds the acceptable limit. In the high season, the service operator at that workplace (the hammer and grinding machine) is exposed to the noise load of 99.1 dB for 8 hours a day. That high value of noise can cause the hearing damage during a repeating and long lasting action.
CONCLUSION

After measuring the sound pressure level at each operation service workplace and the evaluation of the noise load, it can be claimed that some workers in the agriculture production are exposed to an excessive noise which is above the acceptable hygienic limit.

The meal machine service operator is exposed to the noise exposure of 103.1 dB (14.5 dB above the acceptable limit). The noisiness could be reduced
by using wheels with a transversal tooth system, by using the missing protection cover, and also by using the right grease.

The hammer and grinding machine operator is exposed to the noise of 99.1 dB (13.4 dB more above the acceptable limit with 6-hour work shift, and 14.1 dB above the limit with 8-hour work shift).

The operator of the potato assorting line is exposed to the noise of 86.6 dB (1.6 dB above the limit); the noise at the monitored places is caused by the chain and tooth gearing systems, mainly by the electromotor with the chain gearing. A protection cover and the right grease could lead to the reduction of the noise to the acceptable hygienic limit.

The employer has to implement some measures to reduce the noise exposure. At least the employees should wear suitable personal protective facilities (e.g. ear plugs, ear defenders) which can contribute to the reduction of the harmful noise load to the acceptable exposure limit.

**References**


Received for publication October 1, 2008
Accepted after corrections January 21, 2009

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**Abstrakt**


Hluk patří mezi přední nebezpečné faktory znečišťující životní prostředí a negativně ovlivňuje lidský organismus. V pomocných zemědělských provozech bylo provedeno přehledové měření týkající se hlukové zátěže na pracovišti. Na jednotlivých pracovních místech obsluhy byly za provozu pomocí zvukoměrné techniky měřeny hladiny akoustického tlaku a zjišťována doba pobytu pracovníka. Ze získaných údajů lze konstatovat, že někteří pracovníci v zemědělských pomocných provozech jsou při práci vystaveni hluku přesahujícímu přípustný expoziční limit.

**Klíčová slova:** pomocné zemědělské provozy; hluk pracovního prostředí; přípustný expoziční limit

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