Evaluation of Noise Levels in Olive Mills

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Abstract

Generally in Italy mills are family-owned business, with two or three employees. Due to the seasonal work a lack of attention of workers' safety is present and few investments on this subject are made. Because the machines utilized noise one of the most important risk is considered. The paper noise level in nine mills of central Italy investigated. It emerges that continuous plants are more noisy than traditional ones. Moreover safety signs are not present and workers didn't wear the required PPE. It is important to do a correct vocational training also to promote the safety culture.

Keywords: workers' safety, noise exposures

Introduction

In Italy the olives are harvested from November to December. The production is about 3.4 x 10^9 kg. Oil production by 4.660 olive mills is made. Often they are family – owned business with two or three workers. Due to work pace very intense and the presence of old plants lead to think a lack of attention of workers' safety. Moreover due to the seasonal work of olive mills, few investments are made. Occasional workers are involved in the work therefore vocational training often is not done. Due to presence of various machines noise is one of the most important risk.

The aim of the paper is to investigate level of noise and to identify possible strategies for its reduction.

Material e methods

To evaluate the workers' noise exposure level, some investigations in nine olive mills in the central Italy were carried out. They are family-owned business, organized in traditional (8 and 9 olive mills) or continuous plants (from 1 to 7 olive mills). The machines involved in the production were arranged in a single room (1, 3, 6, 7 olive mills) or in two rooms (2, 4, 5, 8, 9 olive mills). In all cases the owner and one employee were involved in the production. In particular, in the mills an operator took care the initial phases, such as delivery, weighing, defoliation and washing while the other one the extraction and storage of oil phases supervised.

The noise measurements were carried out according to UNI 9432:2008. A Brüel & Kjaer 2260 Investigator phonometer fitted with overload indicator was utilized (Fig. 1). The instrument and its prepolarized free-field microphone satisfied the requirements of Class 1 according to the CEI EN 61672-1 . Thanks to a Class 1 (IEC 60942) calibrator (pistonphone) the phonometer to a regular calibration was subjected to verify that the deviation from the calibration value did not exceed the 0.5 dB.

Before any measurement were acquired informations about:

- noise characteristics (e.g. constant, fluctuating, impulsive, cyclic noise);
- workers' positions;
- any period of rest.

The instrument was positioned at a height of 1.60 m above the ground, in the workers' positions. The microphone was pointed towards the direction of the prevailing noise source. Due to the workers' movements within the building, additional measurements at specified position were carried out. Such positions were really occupied by workers. The surveys were performed when all the machines were working.

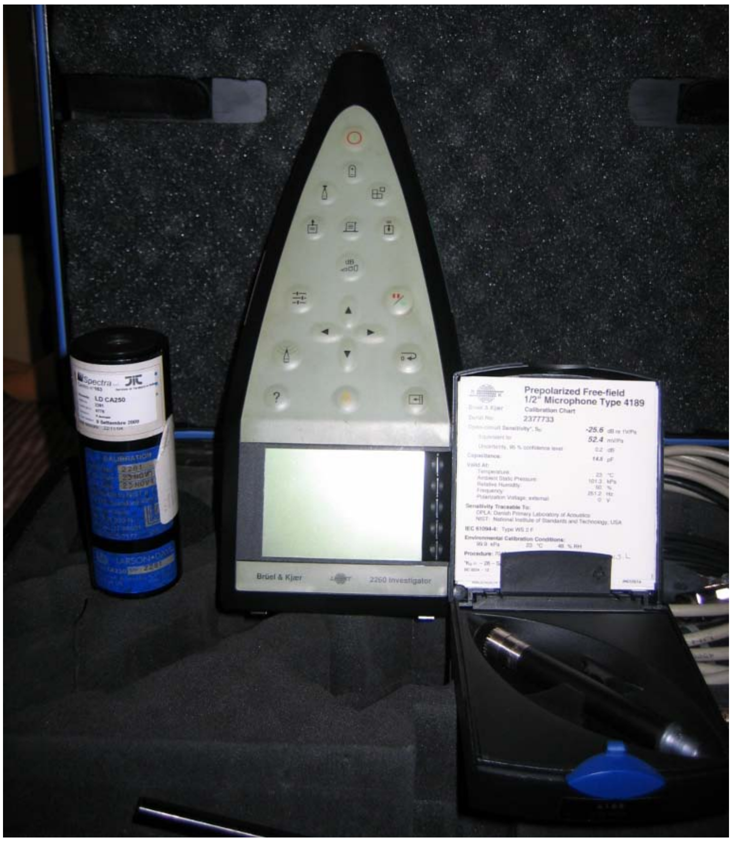

Figure 1. Instruments utilized.

Three surveys for each measurement point were carried out, able to obtain a stable value of equivalent continuous sound level within ± 0.3 dB. Thanks to a spreadsheet the final value (L_{Aeq}) was obtained by the mean of the three values listed above. However, the lenght of each survey was never less than 60 s.

In order to ensure reproducibility of measurements were taken into account the most important contributions of the uncertainties, such as:

- uncertainty of sampling (environmental uncertainty) (u_a), determined by a spreadsheet;
- uncertainty on the instrument positioning (u_L), generally the value attributed is 1 dB;
- instrumental uncertainty (u_s), generally using class 1 instruments the uncertainty is 0.5 dB.

To know the time spent by workers in different locations inside the building, audio visual material was utilized. Thanks to a spreadsheet it was possible to calculate the equivalent continuous sound level (L_{Aeq}), the workers' daily noise exposure ($L_{EX,8h}$) and their related uncertainties.

Results

The collected data some differences between continuous and traditional mills show (Tab.1). Noise levels are higher in continuous olive mills than in traditional ones. The high noise levels in the defoliant/washing machines depend on both the noise generated by the machine and the impact of the product on the hopper surfaces.

The high L_{Aeq} value related to the washing machine of the mill number 9, is probably due to the restricted area in which the machine was positioned and to the reverb by walls.

Differences in the olive pressing phase between continuous and traditional plant are evident. They depend on the different machine utilized (crusher with hammers, millstone).

Due to the high rotatory speed the noise level values of decanters are 10 dB(A) ahead of presses. Due to the presence of the office inside the production area without any walls, high sound levels were recorded in some mills (e.g. number 1 and 6).

Generally the sound sources separation in two different rooms leads to a noise reduction (e.g. single room mills 1, 3 – double room mills 2, 4). Analyzing $L_{EX,8h}$ data (Tab. 2) it emerges that the workers "A" were subjected to levels of daily noise exposure range from 80 dB(A) to 85 dB(A).

Workers "B" were exposed to high noise levels, especially in the continuous mills, where in some cases the 87 dB(A) was exceeded.

Table 1. L_{Aeq} values referred to the phases and mills.

Work area	Continuous olive mills							Traditional olive mills	
	1	2	3	4	5	6	7	8	9
Delivery	64, 8	70,0	65,9	60,7	62,4	66,0	56,0	57,7	51,3
Weighing	80,4	83,1	70,0	83,5	81,5	-	65,5	-	77,1
External defoliator	-	74,9	84,8	81,3	83,8	-	-	-	-
Hopper	80,4	83,3	89,6	85,0	-	85,5	85,2	84,6	85,8
Defoliant/washing machine	90,7	86,1	90,5	88,8	90.8	88,7	86,9	83,3	92,5
Crusher/millstone	91,2	89,5	92,2	90,6	90,0	88,5	86,5	80,7	83,1
Kneader	90,2	88,3	84,5	88,6	90,0	88,5	84,2	82,1	83,1
Stacking machine	-	-	-	-	-	-	-	83,9	83,1
Presses/decanter	92,1	88,5	90,9	91,5	91,5	89,1	86,2	81,8	81,7
Centrifugal separator	91,8	90,8	88,6	84,4	91,1	88,8	85,4	83,8	81,7
Oil storage	90,4	67,7	78,5	67,7	79,5	89,1	77,5	66,3	-
Office/desk	88,2	70,0	70,0	83,5	78,1	86,7	65,1	66,3	81,6

The uncertainty values range from 1.1 to 1.5 dB.

Table 2. Daily noise exposure $L_{EX,\,8h}$.

Mills	$L_{EX,8h}$ [dB(A)]	
	A*	B**
1	83,0 ± 0,8	91,1 ± 0,8
2	81,5 ± 0,8	88,8 ± 0,9
3	82,6 ± 0,9	89,1 ± 0,7
4	83,1 ± 0,7	86,5 ± 0,7
5	81,6 ± 0,9	90,4 ± 0,7
6	84,3 ± 1,0	88,2 ± 0,6
7	79,3 ± 1,1	84,1 ± 0,7
8	81,5 ± 0,9	83,3 ± 1,0
9	83,6 ± 0,9	82,3 ± 0,9

*A: worker assigned to the delivery of the product.
**B: worker assigned to the phase of extraction (continuous mills) and to the stacking machine (traditional mills).

Conclusions

The Italian law on noise rules that owners must evaluate the noise risks and take measures to reduce it. The same law provides three limit values:

$80 < L_{EX,8h} < 85$ it is necessary to do vocational training, to equip workers with PPE (Personal Protective Equipment);

$85 \leq L_{EX,8h} < 87$ it is necessary to place safety signs, to impose the PPE use and to undergo annual medical tests;

$L_{EX,8h} \geq 87$ it is necessary to stop any kind of work, to identify the causes of excessive noise and to take measures to lower the exposure below the limit value.

Unfortunately vocational training was inadequate in all analyzed mills. Safety signs were not present and workers didn't wear the required PPE (Personal Protective Equipment), because they were not present or in poor use conditions (e.g. lack of brand or model needed to verify their efficacy).

It is important to plan a correct machines maintenance, especially for those who have rotatory movements. In such case the perfect working of ball bearings is very important.

Beyond the noise analysis to know the real conditions of workers at work it is important to take into account other risks such as: microclimate, manual material handling, repetitive manual operations.

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