NOISE IN THE CERAMIC SECTOR

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1. INTRODUCTION

In recent years the ceramic industry (floor and wall tile) has made notable investments directed towards reducing acoustic levels in the work position, with a view to reducing worker exposure to high levels of noise.

The development of an acoustic map of the company by means of specialised technical studies has served as a basis for focusing the investments on the soundproofing of machinery, by means of different types of enveloping systems or acoustic screens, addressing the source of noise at its origin; organisational solutions have also been adopted, establishing worker rotation during the labour day in positions with different levels of noise.

2. PRESENT AND FUTURE REGULATIONS

Since 1989 Royal Decree 1316/1989, deriving from European Directive 86/188/CEE, has been in force, which sets out the equivalent daily levels of exposure, as well as the measurements that need to be adopted in each case. A new European Directive (2003/10/CE) will enter into force by 15 February 2006 at the latest, providing the member countries with stricter standards.

The following table sets out the most significant differences between present Directive 86/188/CEE and the forthcoming Directive 2003/10/CE.

	CURRENT DIRECTIVE (86/188/CE)	NEW DIRECTIVE (2003/10/CE)
Risk reduction	Risks shall be reduced to the lowest possible reasonable level	Risks shall be eliminated at source or reduced to the lowest possible level
Field of application	All the exposed workers except those in maritime and air navigation	Activities in which the workers are or could be exposed to risks
Evaluation of exposure levels	Daily exposure: 8 hours	8 hours or, in certain cases, weekly exposure
Exposure limit value		Daily exposure: 87 dB(A) Peak level: 140 dB
Control measurement programme	Daily exposure: 90 dB(A) Peak level: 140 dB	Daily exposure: 85 dB(A) Peak level: 137 dB
Training and information for the workers	Daily exposure: 85 dB(A) Peak level: 140 dB	Daily exposure: 80 dB(A) Peak level: 135 dB
Medical hearing check	Daily exposure: 85 dB(A) Peak level: 140 dB	Daily exposure: 85 dB(A) Peak level: 137 dB
Compulsory personal protection	Daily exposure: 90 dB(A) Peak level: 140 dB	Daily exposure: 85 dB(A) Peak level: 137 dB
Available personal protection	Daily exposure: 85 dB(A) Peak level: 140 dB	Daily exposure: 80 dB(A) Peak level: 135 dB

3. HOW TO MEASURE WORKER EXPOSURE TO NOISE DURING THE LABOUR DAY

A - Prior to the measurement:

- Breakdown of different tasks/conditions involved in the position and performance time of each task. Agreed by consensus with the Safety and Health Committee (SHC).
- Grouping tasks by work areas and similar conditions, for measuring in these areas. Example: control of the number of drum revolutions; area: in front of the drum. Completing production data sheets; area: in front of the

drum, both with the drum running and with glaze. Cleaning of the drum; area in front of the drum, with the drum running loaded with water.

B. - Measurement:

- Equipment: TYPE I Dosimeter or Sound level meter.
- Measurement takes place during the time needed to gather a representative sample of the existing noise, in the different tasks. (1/2 min. to 10 min.). Obtaining the weighted equivalent continuous sound pressure Level (weighted equivalent) $L_{Aeq,T}$
- This will be done if possible in the absence of the worker, placing the microphone at the height where the ear would be.

C – Data obtainment and treatment:

The equivalent daily Level is obtained. $L_{Aeq,d}$

a) the worker is exposed to the same level of noise for eight hours;

b) the worker is exposed to the same level of noise for a time other than eight hours;

c) the worker is exposed to different levels of noise throughout the day.

Depending on the case the procedure is as follows:

a) The $L_{A,eqd}$ corresponds to the $L_{A,eqt}$

b) The $L_{A,eqd}$ is calculated from the following formula:

$$L_{A,eqd} = L_{A,eqt} + 10\log\left(\frac{T}{8}\right)$$

c) The $L_{A,eqd}$ is calculated from the following formula:

$$L_{A,eqd} = 10\log\left(\frac{1}{8}\sum_{i=1}^{i=m} T_i \cdot 10^{0,1L_{A,eqTi}}\right)$$

3. EVOLUTION OF NOISE LEVELS IN THE CERAMIC SECTOR

The concern of companies to know the noise levels to which their workers are exposed, by means of the corresponding specific evaluations per work position, has facilitated a great amount of data and evaluated workplaces.

	YEAR 2001	YEAR 2002	YEAR 2003	YEAR 2004
No. of evaluated positions	507	808	842	521

The most significant work positions in a ceramic company on which this sample has been collected are:

- Spray dryer
- Heads
- Forklift truck
- Sorting
- Automatic cutting
- Preparation of screen prints
- Kilns
- Laboratory
- Glazing facilities
- Milling
- Presses
- Polishing train

The number of evaluations per position are detailed in the following table:

	2001	2002	2003	2004
SPRAY DRYER	22	25	26	20
HEADS	68	96	107	58
FORKLIFT TRUCKS	43	68	104	72
SORTING	76	132	101	66
AUTOMATIC CUTTING	30	36	55	40
KILNS	55	104	93	50
LABORATORY	3	2	8	3
GLAZING FACILITIES	66	111	108	52
MILLING	40	73	72	49
PRESSES	80	118	120	84
SCREEN PRINT PREP.	10	20	17	6
POLISHING TRAIN	13	21	28	17
TOTAL	**507**	**808**	**842**	**521**

Tables 1 and 2 show in percentages the number of positions obtained with noise values in the ranges set by current legislation, below 80 dB(A), between 80 and 85 dB(A), between 85 and 90 dB(A) and above 90 dB(A).

It is interesting to note the evolution of the values exceeding 90 DB(A), in which the reduction in the positions stands out of *automatic cutting*, which have gone from 43% of the positions evaluated in 2001 to 22.5% in 2004; of the polishing train, which have gone from 61.5% of the positions evaluated in 2001 to 29.41% in 2004, and also of the number of positions above 90 dB(A) in kilns, presses, and polishing trains; the rest of the positions have low percentages or even zero.

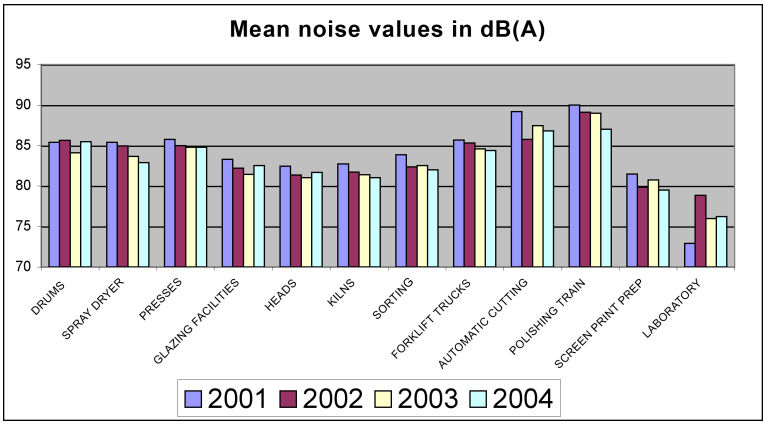
	No OF POSITIONS < 80 dB(A)				No OF POSITIONS 80 { 85 dB(A)			
	2001	2002	2003	2004	2001	2002	2003	2004
SPRAY DRYER	4,5 %	0 %	7,69%	20,0%	45,4 %	48 %	65,3%	50%
HEADS	5,8 %	26 %	30,8%	18,9%	77,9 %	69,7 %	66,3%	74,1%
FORKLIFT TRUCKS	2,3 %	10,2 %	17,3%	12,5%	34,8 %	30,8 %	36,5%	37,5%
SORTING	6,5 %	21,2 %	32,6%	21,2%	56,5 %	61,3 %	46,5%	71,2%
AUTOMATIC CUTTING	0 %	0 %	0%	0%	16,6 %	41,6 %	27,2%	35%
KILNS	7,2 %	24 %	33,3%	26%	76,3 %	67,3 %	58%	70%
LABORATORY	100%	100 %	87,5%	100%	0 %	0 %	12,5%	0%
GLAZING FACILITIES	3 %	12,6 %	26,8%	13,4%	71,2 %	74,7 %	66,6%	73%
MILLING	7,5 %	6,8 %	15,2%	4,0%	25 %	36,9 %	38,8%	32,6%
PRESSES	1,2 %	1,6 %	0%	1,1%	21,2 %	43,2 %	51,6%	48,8%
SCREEN PRINT PREP.	30 %	50 %	29,4%	50%	50 %	45 %	70,5%	50%
POLISHING TRAIN	7,6 %	0 %	3,57%	0%	0 %	14,3 %	10,7%	35,2%

Table 1

	No. OF POSITIONS 85 { 90 dB(A)				No. OF POSITIONS > 90 dB(A)			
	2001	2002	2003	2004	2001	2002	2003	2004
SPRAY DRYER	40,9 %	48 %	23%	30%	9 %	4 %	3,85%	0%
HEADS	16,1 %	4,2 %	2,8%	6,9%	0 %	0 %	0%	0%
FORKLIFT TRUCKS	53,4 %	50 %	30,7%	40,2%	9,3 %	8,8 %	15,38%	9,72%
SORTING	34,2 %	15,1 %	17,8%	4,5%	2,6 %	2,3 %	2,97%	3,03%
AUTOMATIC CUTTING	40 %	44,4 %	47,2%	42,5%	**43 %**	**13,8 %**	**25,45%**	**22,50%**
KILNS	10 %	7,7 %	8,6%	4%	5,4 %	1 %	0%	0%
LABORATORY	0 %	0 %	0%	0%	0 %	0 %	0%	0%
GLAZING FACILITIES	25,7 %	11,7 %	6,48%	11,5%	0 %	1 %	0%	1,92%
MILLING	60 %	45,2 %	38,8%	51%	7,5 %	11 %	6,94%	12,24%
PRESSES	77,5 %	54,2 %	48,3%	50%	0 %	1 %	0%	0%
SCREEN PRINT PREP.	20 %	5 %	0%	0%	0 %	0 %	0%	0%
POLISHING TRAIN	30,7 %	47,6 %	28,5%	35,2%	**61,5%**	**38 %**	**57,14%**	**29,41%**

Tabla 2

The following graph shows the evolution in mean values of the levels of exposure in dB(A) of the years 2001 to 2004 by work positions.



5. PRACTICAL EXPERIENCES DIRECTED TOWARDS REDUCING EXPOSURE TO NOISE

1. Installation of inverters in large engines; this system has been installed in the kiln turbines.
2. Installation of silencers in fans and membrane pumps.
3. Separation of areas with absorbing envelopes, with a view to avoiding the repercussion of high levels of noise; this is the case of presses and glazing facilities.
4. Soundproofing by means of curtains; this system facilitates access to the installation when it is stopped. This has been installed in glazing drums and vibratory screens.
5. Soundproofing by encapsulation; this system is used when the noise source clearly located and the volume of the facility allows it; this is the case of the hydraulic manifolds of presses, polishing facilities, stackers.
6. Replacement of forklift trucks that have combustion engines with electric forklift trucks.
7. Replacing the continuous blower operation with an on-off operation when the piece passes.

Example of soundproofing of the glaze mills by means of a fixed soundproofing housing, with access doors locked with safety micros to avoid start-up when they are open.
A soundproofing is also shown consisting of sliding curtains on guide rails fitted at the top.

Silencer for a conventional fan.

Soundproofing of the hydraulic manifold of a clay press.
The envelope is fitted with a fan to dissipate the heat inside.