The Determination of the Noise Pollution in a Production Hall and the Diseases Produced by It

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The paper describes how to determine the noise in a production hall where there are production machines and equipment. The chosen plant is a production unit where filling of the polyurethane foam tubes is performed. The main activity is the production of professional insulators and wholesale of other products from the same range enumerating the following: wholesale chemical products; production of professional insulators; trade in chemicals and chemical industry. The recommended maximum admissible value for a normal 8h work program is 85 dB (A). The objective is to determine the level of noise in the factory and how it acts as a physical professional risk factor and its effects on the human body. The way in which the proposed objective was achieved was to determine the value of the noise level with the specialized equipment. Following the determinations that will be presented in the following chapters, appropriate protective measures have been taken.

Keyworks: noise, determinations, hall, production, equipment

S.C. IZOLATII SRL - was started 19 years ago. Until 2008, the company owned only product warehouses. In 2008, the mother company in the Netherlands allocated funds for the construction of a polyurethane foam factory and its afferent warehouse in Romania, which is still active. Since its inception, the company's shareholding has aimed to exploit all the existing opportunities on the construction market in Romania, especially as at the time of entering the market, our country and, above all, the city of Bucharest were in full boom of the constructions, and the finding of works even for a new and relatively small company did not pose problems.

The current state of the problem under consideration for these noise determinations is the following: The company produces polyurethane foam [1].

The production process consists of 3 production lines.They have the following components: transport equipment, conveyors, liquid and gas dosing machines, shaking machines, printers, process automatic scales, box sealing machines. After a period of time we need to determinethe noxes: to determine the noise at the workplace where the workers carry out their activity. This is necessary because the equipment and machinery age and some features are no longer within the required parameters. The noise caused by the moving mechanical and pneumatic elements wears out and over time the noise level, in the work area where operators and qualified workers in specific occupations (mechanical locksmiths., cargo handlers, operators) carry out their activity, also increases [2].

Description of the working technology for the production of polyurethane foam

The mixture of substances, called polyol, is then blended into the mixer, reaching the manufacturing line with the help of gear pumps. The isocyanate also reaches the manufacturing line by means of gear pumps. When these raw materials get to the dosing machine for the polyol and isocyanate mixture, they are dosed in metallic tubes [3]. These are sealed with special valves, then passed through the gas dosing machine where the propellant gases (LPG, PROPANE, BUTANE) are dosed. After the propellant gas is dosed, the tubes get to in the tubes shaking machine where the homogenization of the substances in the tubes is carried out. After the homogenization operation takes place, the tubes are transported on the conveyor to the packaging area. Here 4 people wrap the tubes in boxes and then seal them with the Scotch machine, then the boxes are placed on pallets. After a pallet is finished, it goes into the warehouse where it is stocked and stored [4].

The company has ISO 9001-2008, ISO14001-2008 and OH&SAS 18001-2008certification. The company's activities are executed in accordance with these reference standards; the company also possesses certification for Integrated Management [5,6].

The company has a Certificate of Attestation issued by the legal bodies, observing the SSM measures. According to Law 319/2006, the company complies with this law, in taking measures to prevent the risk of injury. Hiring, workplace, and periodic training is done for all the positions in the organization [7].

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The company also respects the legislation in force, providing workers with protective equipment based on the nature of the risks and the Risk Assessments that are carried out (GD1048 / 2006);the company also complies with GD1146 / 2006 on Minimum Requirements for work equipment [8,9]. At all workplaces, the Risk Assessments and Specific Instructions of SSM and S.U. are executed.

Legislative requirements

Under Article 56 of GD 85/2006, it is required:

For the purposes of this Decision, the exposure limit values and exposure values from which the employer's action on worker health and safety is triggered in relation to daily exposure to noise and peak acoustic pressure are set out as follows [1].

-exposure limit values: L(EX, 8h) - 87 dB(A) and respectively, p (peak)-200 Pa;

-higher exposure values from which action is triggered: L(EX, 8 h) = 85 dB(A), and respectively, p (peak)= 140 Pa 2;

- lower exposure values from which action is triggered: L (EX, 8h)=80dB (A) respectively p (peak)=112 Pa 3;respectively p (peak)=112 Pa 3;

Under Article 7, in duly justified cases, for activities where daily exposure to noise has significant variations from one working day to the next, in order to apply the exposure limit values and exposure values from which the employer triggers action on workers' safety and health protection, one has to use the weekly noise exposure level instead of the daily noise exposure level to assess the noise levels to which workers are exposed, provided that for:

a) the weekly noise exposure level indicated by adequate monitoring does not exceed the exposure limit value of 87 dB (A);

b) appropriate measures are taken to minimize the risks associated with these activities.

Noise and vibrations are part of mechanical oscillations. Mechanical oscillations propagate in elastic environments from near to near through successful compressions and distractions of the environmental particles in the form of waves. Elastic environments may be of the following types: liquid, gaseous and solid [10, 11].

Noise is characterized by: period (T); frequency (f); wavelength (λ).

$$\Lambda = f \times T$$
$$T = \lambda / f$$

In our life there is another definition for noise: any disturbing, unwanted sound.

The definition of professional noise is the following: a complex of sounds with varying intensities and heights, (impulsive, simply audible), rhythmic or arrhythmic, produced continuously or discontinuously by machines, instruments, devices, within-the-company means of transport, human voice and during professional activity [12,13].

Types of noises:

-Of impact: Single or repeated shocks at a slow rhythm;

-Of hammering: rapid rhythm impact;

-Of friction: friction of parts between them;

-Of drainage: of some liquids or under pressure gases;

- Generated by the free or forced shocks of parts

From the point of view of the hearing organ perception, we perceive the following:

-infrasounds f<16Hz

-frequency sounds: f= 16-16.000Hz

-ultrasounds with f >16.000Hz

The occupational diseases related to this nox are found in the following table (table 1) [14,15].

In table 2 are presented the diseases caused by this nox: noise [16,17].

Descripton of work process

To determine the equivalent noise level, a SOLO-SLM integrator sonometer was used, with a 30-137 dB wide dynamic range and Leq functions. SOLO-SLM has peak level (Peak)with A, B, C, or Lin frequency weightings, and for the frequency of the noise source it has an octave filter option with a graphical and tabular display on the 1/1 octave, 1/3 octave spectrum [18,19].

Accoustic characteristics:

-Precision According to IEC804 and IEC65 I class 1 or class 2

-Included removableMCE212 de / inch prepolarized condenser microphonesi PRE21S preamplifier.

-Functions Lp, retention Max, Leq total, max, min, short, statistic analysis, frequency spectra (with the filters option).

-Time Weightings: Fast, S1ow, Impulse, Peak / Frequency : A,B,C,Z

- Lin Game30dB-137dB (class l, class 2)Dynamic110dB Resolution 0,1Db Linear O2dB Frequency 6Hz-80Hz

-Freq. Ref.1000Hz

-Lev.Ref.94dB of calibration

-Integration Leg: 1s-3s-5s-10s-30s-60s (unlimited duration)

-Statistics- Statistical indices L0l, Ll0, L50, L90 or defined by the user.

-Date of making the determinations: 11.04.2013

-The determination time interval: 14.30-15.00

Results of the determinations

The measurements were made, after havingclosed the windows and doors of the workplaces, near the employee, near the control panels, at the time of the noise-generating technological operations.The employees use individual

No.	Profession related diseases	Causalprofessionalfactors
1	Hypertension	Noise, vibrations, high temperature
2	Neurosesandotherneuropsychiatricd isorders	Noise, vibrations, high temperature, distress chemicalnoxes
3	Microfractures, pseudarthroses, pneumothorax	Vibrations

Table1
PROFESSION RELATED DISEASES

No.	Ear diseases	ProfessionalNox
1	Hypoacusis, deafness	Noise over maximum permissible limit; ototoxic toxic substances

Table 2
EAR DISEASES

noise protection equipment (soundproof plugs) in the insulating material manufacturing sections.The surface of the two halls, where noise-generating activities are carried out, is of 125 sqm for the packaging room and of 250 sq m for the polyurethane foam filling room. The number of employees in the technological sections: 12 employees in the packaging section and 30 employees in the filling section divided into two shifts: hours 6:00-14:00 and 14:00-20:00.

In the figures below we can find the types of equipment for the polyurethane foam production. In figure 1 we show the polyol and isocyanate mixture dosing equipment and/ as liquid chemical substances.The equipment is located in the filling section. The number of this equipment is of 3 pieces.We also have three pieces of equipment for propellant gas dosing in the same room. Moving the foam tubes from one equipment to another is done by metal band conveyors. These are driven by electric motors. Because it is located in a dangerous area all the equipment is built in AntiEx construction.

The equipment found in the packaging room is the following:

-tubes shaking equipment
- printers for writing on tubes and boxes;
-automatic process scale.

Fig 1 Mixture Dosing Equipment

Fig 2 Propellant Gas Dosing Equipment

Fig 3 Automatic Process Scale

Interpretation of results according to legal requirements

The results of the measurements made on 11.04.2013 in the measuring range 14: 30-15: 00 inside the workspaces (the packaging room and the filling room) of the polyurethane foam factory can be found in the table 4.

Table 3

POINT 1- PACKING ROOM- NEXT TO THE CONTROL PANEL PACKING LINE -INDOOR WORKSPACES

Place and conditions in which measurements are made	Noise Level Measured dB(A) At the moment of operating the installations and technological equipment with activity in the factory
Point 1- Packing room - next to the control panel packaging line - indoor workspaces	74.7
Point 2- Filling room-next to the control panel line no. 2-indoor workspaces	83.4
Point 3- Filling room-next to the control panel line no. 1-indoor workspaces	84.7
Point 4- Filling room-next to the control panel line no. 3-indoor workspaces	84.2

Table 4

THE RESULTS OF THE MEASUREMENTS MADE ON 11.04.2013 IN THE MEASURING RANGE 14: 30-15: 00

File	MAS 1					
Start	11/04/13 14:36:51					
End	11/04/13 14:39:51					
Channel	Type	Wght	Unit	Leq	Lmin	Lmax
#506	Leq	A	dB	74.7	71.0	79.4

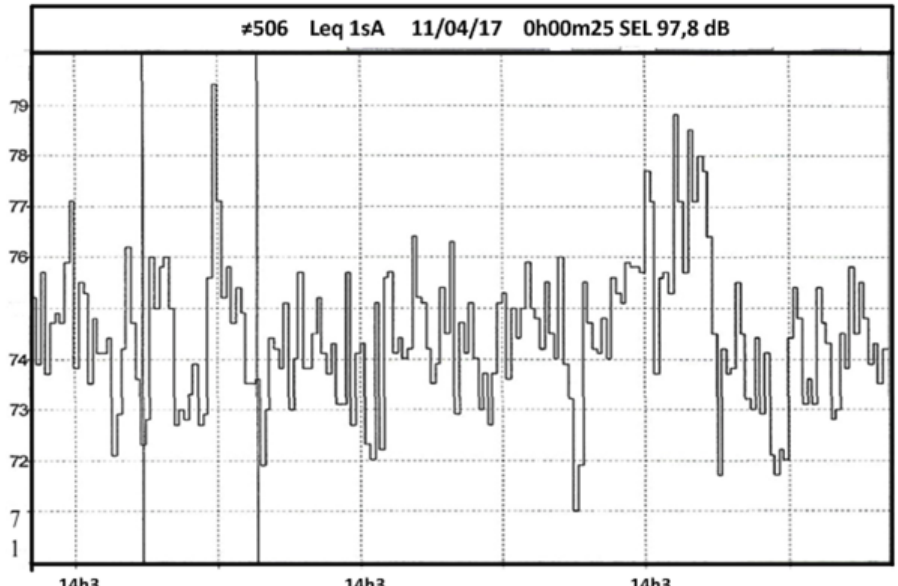

Fig. 4 The graph of the noise level variation in the measured range (Point no.1)

FILE	MAS 2					
START	11/04/13	14:49:44				
END	11/04/13	14:52:44				
Chanel	Type	Wght	Unit	Leq	L min	L max
#506	Leq	A	dB	83.4	79.8	89.0

Table 5
POINT 2- FILLING ROOM-NEXT TO THE CONTROL PANEL LINE NO. 2-INDOOR WORKSPACES

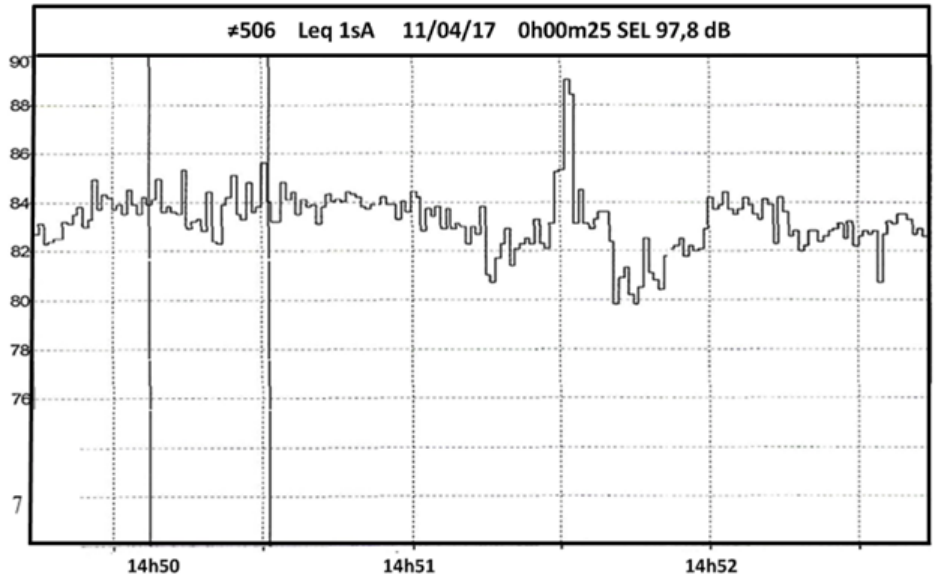

Fig. 5 The graph of the noise level variation in the measured range (Point no.2)

FILE	MAS 3					
START	11/04/13	14:53:40				
END	11/04/13	14:56:40				
Chanel	Type	Wght	Unit	Leq	L min	L max
#506	Leq	A	dB	83.4	79.8	89.0

Table 6
POINT 3- FILLING ROOM-NEXT TO THE CONTROL PANEL LINE NO. 1-INDOOR WORKSPACES

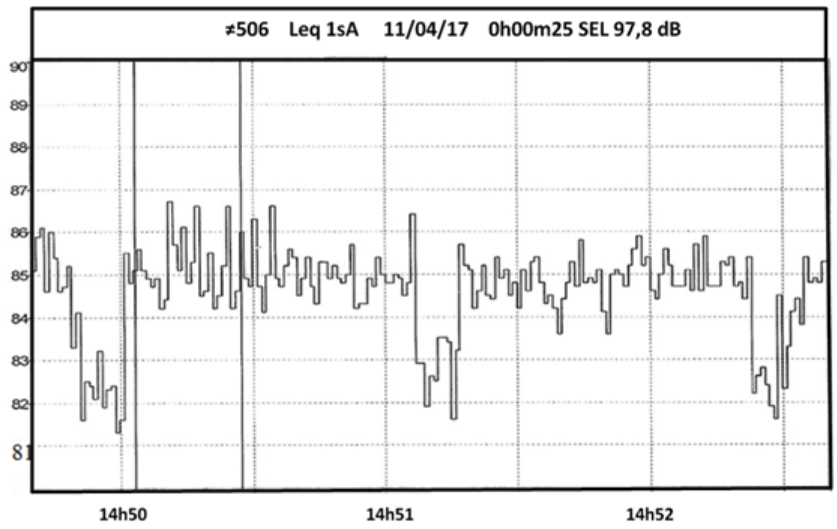

Fig. 6 The graph of the noise level variation in the measured range(Point no.3)

FILE	MAS 4					
START	11/04/13	14:57:13				
END	11/04/13	15:00:13				
Chanel	Type	Wght	Unit	Leq	L min	L max
#506	Leq	A	dB	84.2	82.1	87.6

Table 7
POINT 4- FILLING ROOM-NEXT TO THE CONTROL PANEL LINE NO. 3-INDOOR WORKSPACES

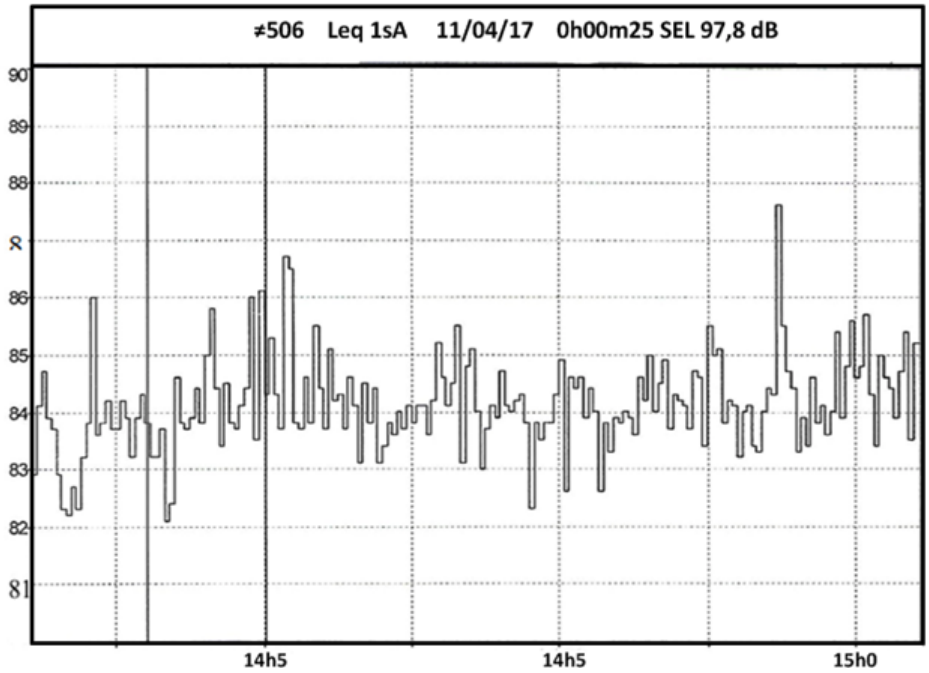

Fig. 7 The graph of the noise level variation in the measured range(Point no.4)

Conclusions

By analyzing these determinations, we see that it is still necessary to use the hearing protection equipment.The employer has taken protective measures for this risk factor since the beginning of the production when the risk assessment for the personnel working in the production area was made.

The most important effects of noise on the human body are: auditory fatigue, sound trauma, professional hypoacusis, professional deafness, stress, cardiovascular disorders and even aggressive behavior.

Noise-induced hearing loss, described by the World Health Organization as *the most common irreversible industrial disease*, is usually caused by excessive exposure to excessive noise of more than 85 decibels (dB (A)). Although rarely painful, the lesion is permanent. The first symptom is usually the inability to hear sharp sounds. If the exposure to excessive noise continues, the hearing continues to deteriorate and there is a risk that the less sharp sounds will not be heard either. As a rule, this phenomenon affects both ears.

Man perceives vibrations from the frequency of 1 Hz to over 1500 Hz, but with different sensations. Low frequency vibrations produce a whole body movement, creating a jolt or sway sensation while vibrations with high frequencies produce tingling or even burning sensation. It has also been found that high-intensity infrasounds at the 7 Hz frequency can severely traumatize the nervous system, the circulatory system, causing even death.

Hearing diminuations occur at frequencies above 3000 - 6000 Hz with the strongest effect at 4000 Hz. Hearing deficiencies may be accompanied by ringing in the ears. When increasing the exposure level LAeq, 8h and increasing the exposure time, hearing loss may occur even at 2000 Hz, however, at daily exposure levels of 75 dB (A) or less, hearing loss should not occur.

National law requires that the employer must provide individual noise protection equipment to employees at noise levels above 80 dB (A). At values above 85 dB (A) wearing personal protective equipment by employees is mandatory and the area in which these values are recorded shoul be properly signaled and the maximum exposure limit is 87 dB (A).

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