

# Assessment of the Level of Industrial Noise on Foundry-mechanical Plant

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**Abstract.** The purpose of this article is to assess the level of industrial noise at a Foundry and mechanical plant. To assess the level of industrial noise, measurements were carried out in the workshops of the Foundry and Mechanical Plant, such as: steel workshop, iron foundry, mechanical workshop. The foundry and mechanical plant uses a wide variety of equipment, the operation of which is accompanied by intense noise, which significantly worsens working conditions. Frequency and time static analysis is used to assess the harmful effects of high-level noise. People working in steel, iron foundry and machine shops, where the main sources of noise are noises arising during the technological process, expose their bodies to the harmful effects of noise. As a result of the measurements carried out, the most noisy workplaces were identified in the workshops of the foundry and mechanical plant. Based on the obtained measurement results, it can be concluded that there is an increase in noise in the range from 1,3-11,9 dB at the workplace of the shaper, the punching grid and the farmer.

**Keywords:** industrial noise, harmful effects of noise, human auditory organs, foundry and mechanical plant, harmful factors, dangerous factors, noise source, vibration, sound pressure level, noise level, hearing sensitivity, noise measurement, workplace of the farmer, shaper.

## Introduction

Kazakhmys Corporation is a successfully developing industrial complex, many employees of which are engaged in heavy work. The specifics of the corporation's production facilities require a careful approach to occupational health and safety.

One of such productions is the Zhezkazgan Foundry-Mechanical Plant. At the Zhezkazgan Foundry-Mechanical Plant there are such harmful and dangerous production factors as noise, vibration, gas contamination, dustiness, high temperature, humidity, high pressure and etc.

Zhezkazgan Foundry-Mechanical Plant consists of the following workshops: steelmaking workshop, iron foundry, mechanical workshop, electrical workshop and welding and forging workshop.

The development of production capacities of modern equipment in the mining and metallurgical complex leads to a steady increase in noise and vibrations harmful to the human body, which worsens the working conditions of the personnel directly working on it. The problem of noise is one of the most acute problems of the development of modern civilization. Almost every second inhabitant of our planet feels the unfavorable acoustic effect to

one degree or another.

The impact of noise on the human body in the conditions of a foundry-mechanical plant occurs against the background of other unfavorable factors of the production environment (vibration, dustiness, etc.). The combined effect of these factors increases the harmful effect of noise on the body [1, 2].

A person's life takes place when exposed to various noises and vibrations. Noise has a harmful effect on all human organs. The mechanism of action of noise on the body is complex and insufficiently studied. When it comes to the influence of noise, usually the main attention is paid to the state of the hearing organ, since the auditory analyzer primarily perceives sound vibrations and its defeat is adequate to the effect of noise on the body. Along with the hearing organ, the perception of sound vibrations can partially be carried out through the skin by vibration sensitivity receptors [3].

Medical research has shown that high-intensity noise has a negative effect on a person. When noise affects the environment, there are medical, social and economic aspects that should be considered in conjunction with each other [4].

Doctors note «noise sickness», which is

characterized by a complex of symptoms: decreased auditory sensitivity, changes in digestive function, cardiovascular insufficiency, neuroendocrine disorder [5, 6].

The sensitivity of hearing decreases during the action of noise. A temporary decrease in auditory sensitivity, called hearing adaptation, is a protective reaction of the body. Following the adaptation comes fatigue of the hearing organ – the first symptom of the pathological process, which gradually develops into deafness and complete deafness. The main sign of hearing loss is a strong decrease in hearing sensitivity at high frequencies. Hearing should be considered damaged if the average sensitivity of the hearing organ, determined by the audiometer at frequencies of 500, 1000 and 2000 Hz, has decreased by at least 25 dB [7].

### Research results

Frequency and time static analysis is used to assess the harmful effects of high-level noise.

To date, specialists have accumulated sufficient experience in combating industrial noise. The most well-known methods for reducing industrial noise include: sound insulation, sound absorption, the use of vibration-absorbing materials based on non-metals (plastics, rubber, etc.), increasing the rigidity of the structure in order to reduce the amplitude of vibrations, the use of damping devices, the use of steels and alloys with increased dissipative characteristics, rational arrangement of equipment, silencers, personal protective equipment, organizational measures.

Industrial noise has a harmful effect on the human body. Especially, pulse noise is very harmful.

A person has unequal sensitivity to sounds of different frequencies. Therefore, one of the important characteristics of noise is its frequency  $f$ , measured in hertz (Hz).

Noise of even small levels has a significant impact on the auditory analyzer, which is connected through the central nervous system with various organs of human vital activity. Therefore, noise has a harmful effect on the whole body. Prolonged exposure to intense noise on a person leads to diseases of the central and nervous autonomic system, cardiovascular system, internal organs and mental disorders. Pronounced psychological reactions manifest themselves, already starting with noise levels of 30 dB. Disorders of the nervous autonomic system and peripheral blood circulation are observed at a noise of 40-70 dB. The effect of noise in 50-60 dB on the central nervous system is manifested in the form of slowing down human reactions, violations of the bioelectric activity of the brain with general functional disorders of the body and biochemical in the structures of the brain. Intense noise with daily exposure leads to a decrease in labor productivity, an increase in general and occupational morbidity (hearing loss – noise sickness). Hearing impairment or complete loss of hearing is the main criterion for

noise exposure during physical work. For intense mental work, neuropsychiatric disorders caused by noise exposure come first. These conclusions are the basis for the hygienic regulation of permissible noise levels in various work activities [8, 9, 10].

Noise sources are the following FMP workshops: steelmaking workshop, iron foundry, mechanical workshop. The effect of noise on the human body depends on the sound pressure level and the nature of the spectrum.

The foundry-mechanical plant uses a wide variety of equipment, the operation of which is accompanied by intense noise, which significantly worsens working conditions.

The Foundry-Mechanical Plant enterprise is characterized by a large number and variety of noise sources. Among them, the highest levels of sound pressure (LSP) are characteristic of shock noise.

Measurements were carried out to determine the level of industrial noise in the workshops of the FMP (steelmaking workshop, iron foundry, mechanical workshop).

Unwanted vibrations occur in almost any technological process of a foundry and mechanical plant. At the same time, the useful use of vibration, the use of vibration and vibration impact machines is expanding. The characteristics of the noise (vibration) measurement results are given in table 1.

The sound power level of the equipment used in the FMP workshops (steelmaking workshop, iron foundry, mechanical workshop) generating shock noise is characterized by the values given in table 2.

At the foundry-mechanical plant, noises from the equipment used are present everywhere. It is known that prolonged exposure to noise and vibrations negatively affects a person's well-being. And therefore, knowledge of how to protect your health is very necessary.

People working in steelmaking, iron foundry and mechanical workshop, where the main sources of noise are noises arising during the technological process, expose their bodies to the harmful effects of noise.

### Conclusions

Based on the measurement results obtained, the production noise in the workshops of the FMP can be concluded that there is an increase in noise in the workplace of the shaper, the punching grid and the farmer in the range from 1,3-11,9 dB.

Exposure to noise levels of 85 dB and higher leads to hearing disorders. The risk of hearing loss in workers with 85 dB noise is 3%, at 90 dB – 10%, at 100 dB – 29%. In addition, the effect of noise on the circulatory system increases, the activity of the stomach and intestines worsens, there is a feeling of nausea, headache and tinnitus.

Thus, one of the noisiest workshops of the punching grid workplaces is the steelmaking workshop, which is 79,2-99,5 dB.

Constant exposure to industrial noise level of 85

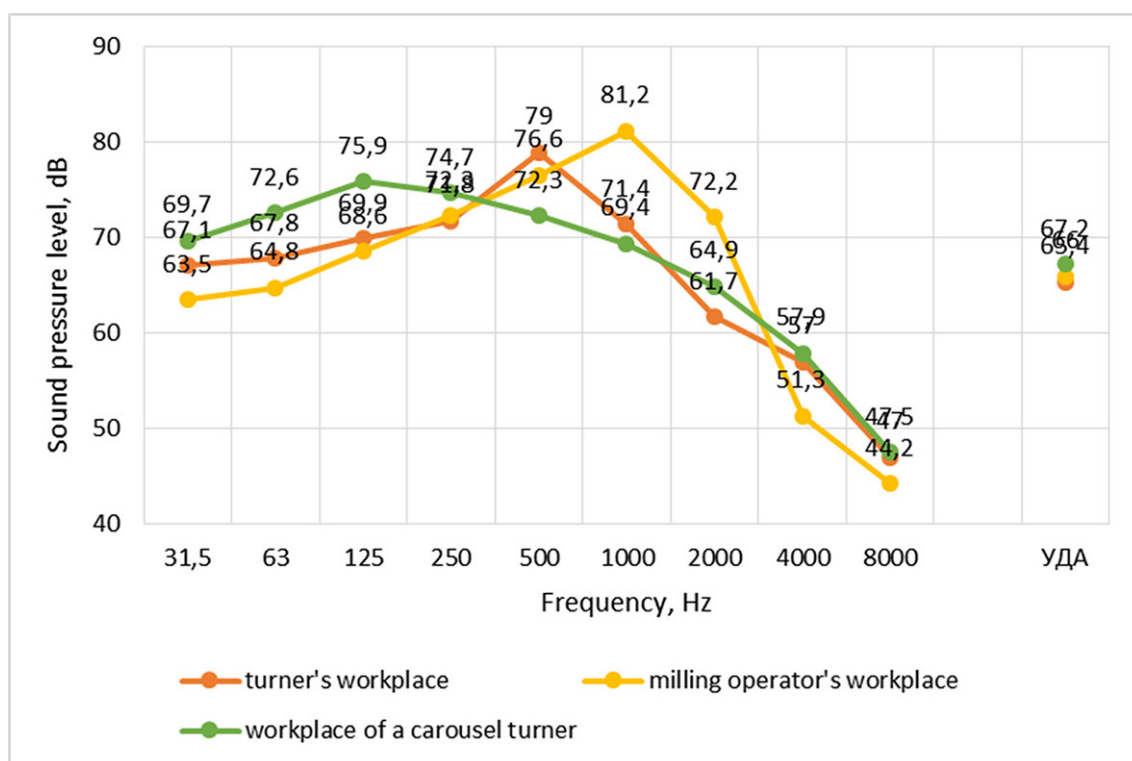


Figure 1 – Graph of the obtained measurement results of industrial noise in the FMP mechanical workshop

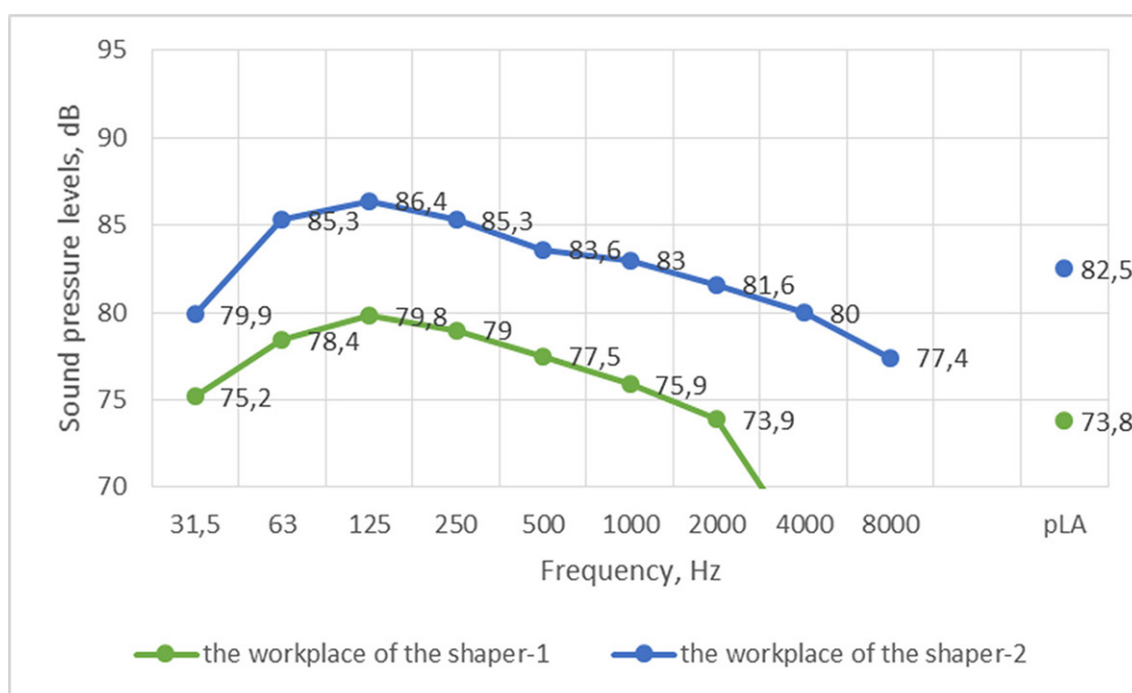


Figure 2 – Graph of the obtained measurement results of industrial noise in the FMP iron foundry

dB and above leads to hearing disorders. The risk of hearing loss in workers with 85 dB noise is 3%, at 90

dB – 10%, at 100 dB – 29%.

Table 1 – Characteristics of noise (vibration) measurement results

Point №. Place of measurement. Additional information (vibration) during the work shift	The nature of the noise		Sound level in dB; adjusted vibration level in dB
	By spectrum	By time characteristics	
	Broadband	Wavering	
Mechanical workshop			
1. Turner's workplace	+	+	65,4
2. The workplace of the milling machine	+	+	66,0
3. Workplace of a carousel turner	+	+	67,2
Iron foundry			
4. The workplace of the shaper-1	+	+	73,8
5. The workplace of the shaper-2	+	+	82,5
Steelmaking workshop			
6. Embossed grille	+	+	91,9
7. Farming workplace	+	+	81,3

Table 2 – Sound power levels in FMP workshops

Location of measurements	Sound pressure levels, dB, in octave bands with average geometric frequencies, Hz									Sound level, dBA	Acceptable sound level values, dBA
	31,5	63	125	250	500	1000	2000	4000	8000		
Mechanical workshop											
1. Turner's workplace	67,1	67,8	69,9	71,8	79,0	71,4	61,7	53,7	47,0	65,4	80
2. The workplace of the milling machine	63,5	64,8	68,6	72,3	76,6	81,2	72,2	51,3	44,2	66,0	80
3. Workplace of a carousel turner	69,7	72,6	75,9	74,7	72,3	69,4	64,9	57,9	47,5	67,2	80
Iron foundry											
4. The workplace of the shaper-1	75,2	78,4	79,8	79	77,5	75,9	73,9	66,3	58,4	73,8	80
5. The workplace of the shaper-2	79,9	85,3	86,4	85,3	83,6	83,0	81,6	80,0	77,4	82,5	80
Steelmaking workshop											
6. Embossed grille	93,4	98,9	99,5	96,4	92,3	90,6	89,9	87,1	79,2	91,9	80
7. Farming workplace	79,4	84,3	85,0	84,3	83,9	80,9	79,6	78,9	75,7	81,3	80

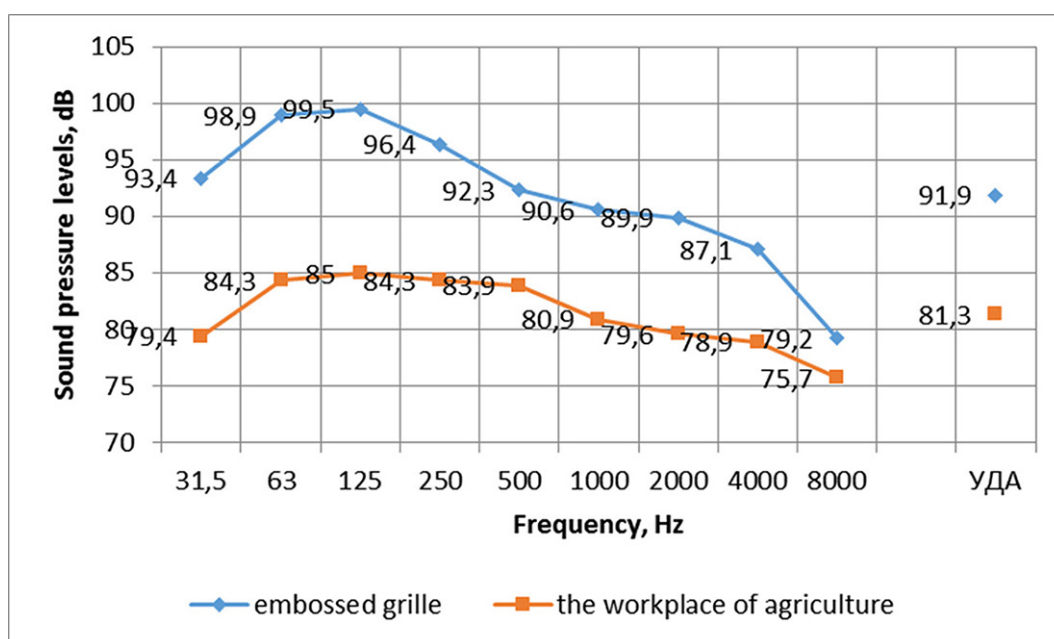


Figure 3 – Graph of the obtained measurement results of industrial noise in the FMP steelmaking workshop

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**Құю-механикалық зауытында өндірістік шу деңгейін бағалау**

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**Аңдатпа.** Мақаланың мақсаты – құю-механикалық зауыттағы өндірістік шу деңгейін бағалау. Өндірістік шу деңгейін бағалау үшін құю-механикалық зауыттың цехтарында мынандай өлшеулер жүргізілді, мысалы: болат құю цехы, шойын құю цехы, механикалық цех. Құю-механикалық зауытта әртүрлі жабдықтар қолданылады, олардың жұмысы қарқынды шуылмен бірге жүреді, бұл еңбек жағдайларын едәуір нашарлатады. Жоғары деңгейдегі шудың зиянды әсерін бағалау үшін жиілік және уақытша статикалық талдау қолданылады. Шудың негізгі көздері технологиялық процесте пайда болатын шу болып табылатын болат құю, шойын құю және механикалық шеберханаларда жұмыс істейтін адамдар ағзаларын шудың зиянды әсеріне ұшыратады. Жүргізілген өлшеулер нәтижесінде құю-механикалық зауыт цехтарындағы ең шулы жұмыс орындары анықталды. Алынған өлшеу нәтижелеріне сүйене отырып, қалыптаушының, соққы торының және топырақ дайындаушының жұмыс орнында 1,3-11,9 дБ аралығында шу пайда болады деп қорытынды жасауға болады.

**Кілт сөздер:** өндірістік шу, шудың зиянды әсері, адамның есту органдары, құю-механикалық зауыт, зиянды факторлар, қауіпті факторлар, шу көзі, діріл, дыбыс қысымының деңгейі, шу деңгейі, есту сезімталдығы, шуды өлшеу, егіншінің, қалыптаушының жұмыс орны.

**Оценка уровня производственного шума на литейно-механическом заводе**

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**Аннотация.** Целью данной статьи является оценка уровня производственного шума на литейно-механическом заводе. Для оценки уровня производственного шума были проведены замеры в цехах литейно-механического завода, такие как: сталелитейный цех, чугунолитейный цех, механический цех. На литейно-механическом заводе используется самое разнообразное оборудование, эксплуатация которого сопровождается интенсивным шумом, значительно ухудшающим условия труда. Для оценки вредного воздействия шума высокого уровня применяют частотный и временной статический анализ. Люди, работающие в сталелитейном, чугунолитейном и механическом цехах, где основными источниками шума являются шумы, возникающие при технологическом процессе, подвергают свой организм вредному воздействию шума. В результате проведенных замеров были выявлены наиболее шумные рабочие места в цехах литейно-механического заво-



да. Исходя из полученных результатов измерений, можно сделать вывод, что на рабочем месте формовщика, выбивной решетки и земледела есть превышение шума в пределах от 1,3-11,9 дБ.

**Ключевые слова:** производственный шум, вредное воздействие шума, слуховые органы человека, литейно-механический завод, вредные факторы, опасные факторы, источник шума, вибрация, уровень звукового давления, уровень шума, чувствительность слуха, измерение шума, рабочее место земледела, формовщика.

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