Assessment of monitoring efficiency for the state of sanitary and epidemiological well-being of the population of metallurgical monocities

E G Zinovyeva, S V Koptyakova, N R Balynskaya and P Y Stepashkov
Magnitogorsk State Technical University n.a. Nosov, 38, Lenin ave., Magnitogorsk, 455000, Russia
E-mail: ekaterina_7707@mail.ru

Abstract. The relevance of the study is due to the importance of the health status and living standards of the population under negative impacts of a number of factors (the environment, large enterprises, nutrition, natural resources). The article presents the results of assessment of the main areas characterizing the sanitary and epidemiological well-being of the population of metallurgical monocities (the environment and its impact on human health, occupational morbidity). At industrial enterprises of Magnitogorsk, the number of workers working under harmful and dangerous conditions is 42.95%. In 2016, the share of workplaces that do not meet sanitary and hygienic noise requirements increased; the share of workplaces that do not meet vibration, microclimate, and illumination standards decreased; there were no violations of EMF standards. In 2016, chronic occupational diseases were caused by imperfect technological processes (36.65% of cases), imperfect workplaces (30.0%), constructive drawbacks of labor means (16.65%) and sanitary equipment (6.65%), and professional contacts with infectious agents (10.0%). The results of the study can be used to improve programs at the federal and regional levels.

1. Introduction
The sanitary-epidemiological well-being of the population includes public health, the environment without harmful environmental factors and favorable conditions for human activities.

Sanitary and epidemiological monitoring conducted by the Russian Federal Consumer Rights Protection and Human Health Control Service is an important element the system of well-being monitoring.

The monitoring system identifies factors that have a harmful effect on humans, assesses them, predicts the health status of the population and the environment, develops proposals for decision-making in the field of sanitary and epidemiological well-being of the population, identifies measures to prevent and eliminate the impact of harmful environmental factors on the human health. This allows for efficient identification of health indicators and living standards. The government can promptly respond to identified deviations.

The purpose of the article is to study the efficiency of monitoring of the sanitary and epidemiological well-being of the population of metallurgical monocities on the example of Magnitogorsk. To achieve this goal, a comprehensive study of the sanitary and epidemiological well-being of the population in Magnitogorsk was carried out.
2. Materials and methods
Issues of sanitary and epidemiological well-being of the population are studied by Russian and foreign researchers.

Theoretical and methodological issues of sanitary and epidemiological well-being of the population are analyzed in the works by Aksenov [1], Ivanov, Belyaev [2], Volkov [3], Butaev, Reshetnikov, Kucherenko [4], Kuzmin [5], Zaitsev [6], Steblyanko, Zinov'ev [7, 8], etc.

Theoretical and methodological issues of the quality of atmospheric air, soil and water, the level of occupational morbidity, emissions of pollutants are discussed in the works by Alferov [9], Yakovenko, Avaliani [10], Butorin [11], Onishchenko [12], Mayorova [13, 14], etc.

The use of foreign experience of sanitary-epidemiological well-being of the population was studied by Smolensky. [15], Toporkov, Leaves [16], Herbert, Jaakkola [17] etc.

The information base for the study of performance indicators are documents of the legislative authorities, regulatory acts of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare of the Russian Federation [18, 19], data provided by the Magnitogorsk Department of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare for 2014–2016 [20].

3. Analysis of efficiency of the sanitary-epidemiological well-being of the population of Magnitogorsk
The sanitary-epidemiological well-being of the population of metallurgical monocities of the Russian Federation is studied in the following areas: the human environment and its impact on public health; the medical-demographic situation and development of massive non-communicable diseases (poisoning) due to harmful environmental factors; occupational morbidity.

The article analyzes the level of occupational morbidity.

In Magnitogorsk, the level of occupational morbidity is affected by working conditions as one of the main risk factors for the development of professional and professionally determined diseases. At the industrial enterprises of Magnitogorsk (controlled by the territorial department), the number of employees working in harmful and dangerous conditions is 42.95%. Over the past three years, there has been no downward trend in the share of workers working in harmful and hazardous conditions; even a slight increase in the indicator has been observed: 2014 – 42.6%, 2015 - 42.8%, 2016 - 42.95%. In 2016, the state of industrial workplaces changed in comparison with 2015. In 2016, the share of industrial jobs that did not meet noise requirements increased; the share of working places that did not meet vibration, microclimate and illumination standards decreased (Figure 1).

![Figure 1. The share of industrial workplaces that do not meet sanitary and hygienic requirements, %](image-url)
The highest rate of occupational morbidity per 10 thousand workers was recorded at manufacturing enterprises - 3.93 (Table 1).

**Table 1. Occupational morbidity indicators by economic activities**

| Economic activities                                      | Indicator per 10,000 employees |
|----------------------------------------------------------|-------------------------------|
| All economic activities                                  | 1.72 1.81 3.19                |
| Manufacturing industries                                | 2.54 2.12 3.93                |
| Production of other non-metallic mineral products        | 4.31 - -                      |
| Metallurgy                                               | 2.71 3.11 6.60                |
| Production of finished metal products                   | - 4.54 1.13                   |
| Manufacture of machines and equipment                   | 1.64 0.55 2.91                |
| Recycling                                                | 11.16 11.16 -                 |
| Construction                                             | 1.99 1.33 2.24                |
| Health and social services                               | - 1.37 4.11                   |

In 2016, chronic occupational diseases were caused by imperfect technological processes (36.65% of cases), imperfect workplaces (30.0%), constructive drawbacks of labor means (16.65%) and sanitary equipment (6.65%), professional contacts with infectious agent (10.0%) (Figure 2).

![Figure 2. Circumstances and conditions of chronic occupational diseases, %](image)

The level of detection of chronic occupational diseases depending on the type of medical institutions and their specialization did not change much. In 2016, Magnitogorsk Center for Occupational Pathology identified 96.67% of occupational diseases (in 2015, 95.24% of the total number of diseases; in 2014 - 86.67%). Analysis of the dependence of the level of occupational morbidity on jobs, contacts with harmful production factors and the age identified individual professional groups who are subject to occupational diseases.

Analysis of occupational diseases allowed us to conclude about the relationship of the length of service, contacts with harmful production factors and the level of occupational morbidity; the maximum risk of occupational diseases is characteristic of male workers affected by harmful production factors for over 30 years and female workers affected by harmful production factors for over 20 years. In the group of male workers with a time record of 20–30 years, the share of registered occupational diseases.
is 31.82%; with a time record of 30–40 years - 63.64%. In female workers with a time period of 20-25 years, the share of occupational diseases is 66.7%.

Workers aged 50-60 years are most subject to occupational diseases: occupational diseases in men are 90.91%, in women - 66.67% of all occupational diseases. The following jobs are most subject to occupational diseases: electric and gas welders, coke machine operators, choppers. In 2014–2016, the share of occupational diseases was 36.21%.

Most of the occupational diseases were identified during regular medical examinations. All chronic forms were identified in workers aged over 50 who have been dealing with harmful production factors for more than 30 years. Despite the decline in the number of injured people, severity of occupational diseases and the degree of loss of professional fitness, the indicator remains higher than the national average due to low-level identification of occupational diseases during medical examinations of workers.

4. Conclusion

Thus, according to the results of the study, it can be argued that there are a lot of factors affecting the sanitary and epidemiological welfare of the population (the environment, food quality, working conditions). To reduce negative consequences, it is advisable to implement the following measures:

1) air protection:
   • construction of bypass roads in order to remove some vehicles from the city center;
   • ban on the construction of facilities that are sources of air pollution.
2) food quality and safety:
   • development of a city security program for the consumer market;
   • expansion of the range of local products enriched with iodine, other macro and micronutrients;
   • explanatory work in the mass media aimed at the prevention of diseases caused by insufficient intake of micronutrients;
   • promotion of the healthy lifestyle and nutrition.
3) healthy working conditions:
   • development of the target program “Improving the working conditions and medical support for the working population of Magnitogorsk”;
   • production control over sanitary regulations, hygienic standards and implementation of preventive measures;
   • regular medical examination of employees affected by harmful production factors;
   • implementation of planned measures aimed at improving working conditions, developing additional measures to improve working conditions according to hygienic standards (improving the efficiency of ventilation systems, replacing obsolete equipment, upgrading process equipment, and repair technologies for metallurgical furnaces and aggregates).

The primary task of any municipal body is to control the environmental situation, food quality, labor protection, and medical examination of workers.

References

[1] Aksenova O I 2015 Hygienic aspects of providing the population with safe drinking water: problems and solutions (Moscow: Forum, SIC INFRA-M)  
[2] Belyaev E N, Fokin M V, Novikov S M, Prusakov V M, Shashina T A and Shayakhmetov S F 2013 Actual problems of improving the health risk assessment of the population to ensure sanitary and epidemiological well-being Hygiene and Sanitation [in Russian – Gigiena i Sanitariya] 5 53–5  
[3] Volkova N A 2015 Organization of supervision of nutrition of the population Ecology of Russia 2 34–42  
[4] Kucherenko V Z 2014 Organizational and legal framework of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare (Moscow: GEOTAR-Media)
[5] Kuzmin S V, Gurvich V B, Dikonskaya O V, Malykh O L and Yarushin S V 2016 Methodology of assessing and managing risk to public health in the system of legislative regulation of the sanitary and epidemiological welfare of the population Occupational medicine and industrial ecology 1 4–8

[6] Zaitseva N V, Popova A Yu, May I V and Shur P Z 2015 Methods and technologies of health risk analysis in the public administration system while ensuring the sanitary and epidemiological well-being of the population Hygiene and Sanitation [in Russian – Gigiiena i Sanitariya] 94(2) 93–8

[7] Steblyanko V L, Zinovyeva E G and Koptyakova S V 2019 Efficiency of monitoring the sanitary-epidemiological state of Magnitogorsk Steel [in Russian – Stall] 4 80–3

[8] Zinovyeva E G and Koptyakova S V 2019 Integrated assessment of sanitary and epidemiological safety management efficiency of the population in Industry–based cities in the Russian Federation Advances in economics, business and management research: proc. of the Int. Sci. Conf. Far East Con (ISCFEC 2018) vol 47 pp 512–6

[9] Alferov I N and Yakovenko N V 2016 The problem of providing high-quality drinking water to the population of the water-deficient region of the Orenburg region Human Ecology [in Russian – Ekologiya cheloveka] 4 3–8

[10] Avaliani S L, Novikov S M, Shashina T A, Skvortsova N S and Mishina A L 2012 Problems of harmonization of standards in atmospheric pollution and ways to solve them Hygiene and Sanitation [in Russian – Gigiiena i Sanitariya] 5 75–80

[11] Butorina N N, Bychkov A A, Samutin N M, Orlova I G and Pozdnyakov S A 2017 Modern approaches to the regulation of waste management of non-canalized facilities at the regional level Ecology and Industry of Russia [in Russian – Ekologiya i promyshlennost Rossii] 10 68–71

[12] Onishchenko G G 2012 Results and prospects of ensuring the sanitary and epidemiological welfare of the population of the Russian Federation Hygiene and Sanitation [in Russian – Gigiiena i Sanitariya] 4

[13] Kolokoltsve V M, Vdovin K N, Maiorova T V and Ponomareva O S 2017 Ecological indicators in the system of non-financial reporting at industrial enterprises CIS Iron and Steel Review 13 4–10

[14] Mayorova T V and Ponomareva O S 2015 Methodology for assessing the economic efficiency of environmental management of metallurgical enterprises Bulletin of Magnitogorsk State Technical University named after G I Nosov 4(52) 112–6

[15] Smolensky V Yu, Toporkov V P, Karnaukhov I G, Toporkov A V and Kutyrev V V 2012 Organizational and methodological aspects of international cooperation in ensuring the sanitary and epidemiological well-being of the population Problems of especially dangerous infections [in Russian – Problemy osoboy opasnyh infektij] 2(113) 5–13

[16] Leaves G D and Herbert R D 2002 Economic and environmental impacts of pollution control in a system of environment and economic interdependence Chaos, Solitons & Fractals 13(4) 693–700

[17] Jaakkola J J K et al 2000 Use of health information systems in the Russian Federation in the assessment of environmental health effects Environmental Health Perspectives 108(7) 589–94

[18] Federal law of 30.03.1999 no 52-FZ On the sanitary-epidemiological welfare of the population 1999 Collected legislation of the Russian Federation 14 1650

[19] Federal Law of 21.11.2011 no 323-FZ On the basis of the protection of public health in the Russian Federation 2011 Russian newspaper 263

[20] The impact of environmental factors on public health. Medico-demographic situation in the Chelyabinsk region, Available at: http://www.mineco174.ru/files/media/doklad/2014/6-1.htm