Thus, this measure will reduce the concentration of harmful substances in the air of the working area of operator of DCU at LLC «RN-Komsomolsk NPZ» to the limit values, thereby achieving a high level of performance and a minimum risk of worker poisoning with hazardous substances.

1. Gimaeva Z.F., Bakirov A.B., Kaptsov V.A., Karimova L.K. Major risk factors and cardiovascular disease prevalence among petrochemical workers. *Gigiena i sanitariya*. 2017; 96(2): 152-155. (in Russian)
2. Beigel E.A., Efimova N.V., Solodkova E.V. 3, Tsaplina T.N. Economic damage caused by morbidity with temporary disability of employees of an oil refinery. *Zdravookhraneniye Rossiyskoy Federatsii*. 2018; 62(5): 259-264. (in Russian)
3. GOST 12.1.005-88 Occupational Safety Standards System. General sanitary and hygienic requirements for the air in the working area (with Amendment No. 1). - Introduction. 1989-01-01. – М.: Standartinform, 2008 – 95 p.
4. Resolution of the Chief Sanitary Doctor of the Russian Federation of January 28, 2021 No. 2 "On the approval of the joint venture and SanPin 1.2.3685-21" Hygienic standards and requirements for ensuring the safety and (or) harmlessness of environmental factors for humans ": Official Internet portal legal information URL: www.pravo.gov.ru from 03.02.2021, art. 0001202102030022. (date of appeal 19.09.2021)
5. Course and diploma design for ventilation of civil and industrial buildings: Textbook. Manual for universities / V.P. Titov, E.V. Sazonov, Yu.S. Krasnov and V.I. Novozhilov. - М.: Stroyizdat, 1985. – 208 p. (in Russian)
6. Supply and exhaust ventilation unit Ostberg HERU 1600 T RWR [Electronic resource] // Climatic company "MirCli". М.: 2007 – 2021. URL: <https://mircli.ru/Ostberg-HERU-1600-T-RWR/#section-performance-overview/>. (date of appeal 19.09.2021)

Minakova P.S., Agoshkov A.I., Tychina A.A.
Improving air quality in the workplace of a cement packer

*Far Eastern Federal University
 (Russia, Vladivostok)*

doi: 10.18411/trnio-10-2021-73

Abstract

The article deals with the problem of air pollution in the working area of the cement packer, as well as the effect of cement dust on the human body. It is proposed to carousel sealing method carousel machine in order to reduce the concentration of cement dust in the air of the working area.

Keywords: cement packing process, cement dust, worker health, carousel machine.

Аннотация

В статье рассматривается вопрос о проблемах загрязнения воздуха рабочей зоны упаковщика цемента, а также влиянии цементной пыли на организм человека. Предложен способ герметизации карусельной машины с целью снижения концентрации цементной пыли в воздухе рабочей зоны.

Ключевые слова: процесс упаковки цемента, цементная пыль, здоровье работающих, карусельная машина.

The cement industry is the leading branch of the building materials industry, which determines the economic potential of Russia along with such industries as metallurgy, electric power, chemistry and mechanical engineering, allowing to expand production volumes and the range of produced goods. The importance of cement cannot be overestimated, since it is used as a binder for the majority of dry building mixtures and serves as one of the main components.

«Spasskcement» JSC, located in the city of Spassk-Dalny is the largest cement producer in the Far East. The enterprise uses a full production cycle as its production technology, from the extraction and processing of raw materials to the production of more than 20 types of cement [1].

Despite the importance of cement production, it also has a number of disadvantages. Cement production is due to the negative impact on both the environment and the employees of the enterprises.

The main pollutant in the cement industry is cement dust generated in workshops where the processes of cement grinding, packaging and shipment in bags or in bulk are carried out. The dust generated during these processes is one of the unfavorable factors that have a negative effect on working personnel. According to a special assessment of working conditions, the concentration of dust at the workplaces of cement packers significantly exceeds the MPC in Table 1.

Table 1

Actual and standard values of dust in the air of the working area

Name of substance (working area)		Actual value	Standard Value	Hazard class	Working conditions class	Exposure time, %
Silicate-containing dust, silicates, aluminosilicates 1), high-alumina refractory clay, cement, olivine, apatite, clay, kaolin chamotte, mg/m ³	Carousel machine VSELUG	9.62	-/8	3		85
	Shift-Average concentration values	8.658	8		3.1	100
	Dust load, mg	21645	20000		3.1	

The effect of dust on the skin mainly comes down to mechanical irritation. As a result of such irritation, there is a slight itching, an unpleasant sensation, and when scratching, redness and some swelling of the skin may appear, which is an indication of an inflammatory process [1].

When dust gets on the mucous membranes of the eyes and upper respiratory tract, its irritating effect, both mechanical and chemical, is most pronounced, causing inflammation - conjunctivitis, which is expressed in redness, lacrimation, sometimes swelling and suppuration [1].

The digestive organs can be affected only by certain kinds of toxic dusts, which cause intoxication (poisoning) when absorbed even in a relatively small amount.

Long-term exposure to cement dust most often leads to the development of bronchitis, while pneumoconioses develop rarely and only under special conditions [1].

As noted earlier, one of the sources of dust release in the working area is the cement packing process, which begins with the supply of already cooled and enriched cement to the VSELUG Turbo 8 carousel machine (Figure 1). The machine consists of several autonomous filling modules located along the perimeter of the bunker rotating around the vertical axis. Empty bags are sequentially pushed onto the filling nozzles of the modules at the nozzle point, filled during the movement of the module from the nozzle point to the discharge point, and successively dumped onto the receiving conveyor. Feeder 1 serves to feed the product into the rotating bunker of the filling machine.

Each filling module 2 simultaneously performs two functions: filling the bags and dosing the product. The product is forced into the valve bags under pressure generated by turbine blowers. After filling an empty bag, the following sequence of actions is performed: pressing the bag, checking the presence of the bag, zeroing the container, filling with a "full" flow, filling with a "thin" flow, dropping the filled bag. The valves of the bags are closed at the moment of falling onto the receiving conveyor 4. All operations, except for the filling of empty bags, are performed automatically.

Figure 1. Carousel machine VSELUG Turbo 8

During the operation time of the carousel machine, cement periodically spills out of the nozzles, falling into the spill discharge funnel **5**, as a result of which, to prevent breakdowns, the machine must be blown out with compressed air. At the moment of blowing, the settled cement dust rises into the air and through an open opening in the enclosure of the filling machine **3** enters the room where the workers are located.

In order to reduce the concentration of cement dust at the time of the blowing, it is proposed to install 3 radius doors on the enclosure of the filling machine. Radius doors are the kind of doors installed on openings that have a cylindrical shape with a certain fixed radius (Figure 2).

Figure 2. Diagram and components of automatic doors and drive of radius doors G100R

1. Supporting structure. 2. Bearing profile. 3. Rail. 4. Carriage. 5. Bracket with rollers. 6. Belt. 7. Front cover. 8. Top cover. 9. Bottom cover. 10. Central cover. 11. End cover. 12. Engine section. 13. Drive control unit.

By sealing the machine, the majority of dust particles will move through the ventilation, and the rest will crumble into the hopper. We can safely say that with the help of the proposed measure, the concentration of cement dust in the room will be significantly reduced, which will improve working conditions at the workplaces of cement packers.

1. Electronic Resource https://vostokcement.ru/manufacture/?ELEMENT_ID=151
2. International Journal of Applied and Fundamental Research No. 2, 2012 Effect of cement dust on the human body A.S. Seminenko, E.N. Popov, D.Y. Malakhov. pp. 93-94