



## EFFECTS OF DUST FROM DANGEROUS BULK CARGO TRANSPORTED IN PORTS ON HEALTH AND DISEASE PREVENTION

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### Abstract

The authors assessed the state of the environment of the coastal areas under the influence of the dust of bulk cargo handled in the seaports of the Odessa region of Ukraine. The main negative contribution is made by handling processes with bulk cargo, accompanied by intense dusting and spills.

It is precisely because of the increasing danger to human health and the general environmental background that it is important to study the environmental risk in the territories of port cities in the zones of active handling and bulk operations, as a result of which dust is formed, which remains in large quantities in the environment.

The aim of the work was to analyze the ecological state of the coastal territories under the influence of the dust of bulk cargoes handled in the seaports of the Odessa region of Ukraine and its impact on human health.

Depending on the physical and chemical properties of cargo and the technology of handling operations during cargo operations, a significant amount of dust gets into the air, including the most dangerous - floating, finely dispersed fraction, which can migrate over long distances by wind flows (350 and more meters), far beyond the port, polluting the atmospheric air of port settlements. This is a risk factor for the occurrence of diseases of dust etiology in the population (lungs, mucous membranes, skin and allergic manifestations).

**Keywords:** *port areas, dusty dangerous goods, floating dust, diseases of dust etiology.*

## Introduction

The problem of the ecology of the human environment is now very urgent. The coastal territories of the Odessa region of Ukraine combine two important functions for the country: the largest seaports (Odessa, Chomomorsk, Yuzhny) and the largest sea resort in Ukraine [1-3].

Seaports are large transport hubs, their operational activities have a negative impact on the atmospheric air, marine environment, soil and, ultimately, on human health. The main negative contribution is made by handling processes with bulk cargo, accompanied by intense dusting and spills. The current state of the traffic of hazardous dust-forming cargoes transported by road, water and rail transport exceeds tens and hundreds of millions of tons per year.

The bulk of bulk cargoes that are transported and loaded onto ships pose a risk of harmful and dangerous effects of fine aerosol.

According to official data, in recent years, there has been a steady increase in cargo turnover by sea transport. The Black Sea ports handle 75% of the total cargo volume, of which the Odessa, Chomomorsk and Yuzhny ports account for about 80%. A significant share in the turnover of these ports is made up of hazardous dusty bulk and fumigated cargo. It is precisely because of the increasing danger to human health and the general environmental background that it is important to study the environmental risk in the territories of port cities in the zones of active handling and filling operations, as a result of which dust is formed that remains in a large amount of the environment.

**The aim of the work** was to analyze the ecological state of the coastal territories under the influence of the dust of bulk cargoes handled in the seaports of the Odessa region of Ukraine and its impact on human health.

## Results

Together with bulk dusty cargoes entering the ports, hundreds of thousands of tons of dust, not only visible, but also invisible, the so-called "floating", fall, and with it vapors and gases that have settled on the dust particles, harmful to the health of people living near the ports [4-7]. With

wind currents, dust can migrate long (350 and more meters) distances far beyond the port, polluting the atmospheric air of port cities. Dust clouds can occupy tens of thousands of cubic meters in volume, travel long distances, which poses a potential threat to human health.

We carried out a study of the air of the port areas for the presence of dust and found that the most dusty of the surveyed areas are the beach of the city park and the recreation park of the city of Chemomorsk (Fig. 1).

In the selected samples, dust particles of different sizes were determined: 0.3-1.0 microns; 1.0-2.5 microns and 2.5-5.0 microns (Fig. 2). In all the areas under study, fine-grained dust predominated in the air, which poses a great threat to health and environmental status. The size of the dust particles is of great hygienic importance, since the finer the dust, the deeper it penetrates into the respiratory system. If large dust particles, when inhaled, for the most part are retained in the upper respiratory tract and are gradually removed from there, then fine dust, as a rule, passes into the lungs and settles there for a long time, causing damage to the lung tissue. In addition, fine dust with the same mass has a larger surface of contact with the lung tissue, and therefore is more active. Fine dust is more dangerous than coarse dust, since it is suspended in the air for a longer time.

Depending on the physical and chemical properties of cargo and the technology of handling operations during cargo operations, a significant amount of dust gets into the air, including the most dangerous - floating, finely dispersed fraction, which can migrate over long distances by wind flows (350 and more meters), far beyond the port, polluting the atmospheric air of port settlements. This is a risk factor for the occurrence of diseases of dust etiology in the population (lungs, mucous membranes, skin and allergic manifestations).

Direct effect of dust on the human body:

1. Respiratory effects: Prolonged irritation of the nasal mucosa with dust may lead to chronic rhinitis. Inhalation of large amounts of dust can affect the large and medium bronchi (bronchitis), as well as directly affect the lung tissue. Dust particles entering the alveoli are intensively captured by phagocytes, they can accumulate and die in large numbers in the lumen of the alveoli, which leads to

the growth of connective tissue. Connective tissue shrinks, forms scars, compresses blood vessels. All this leads to atelectasis of some areas and emphysema of others, disrupting respiratory function. Circulation is disturbed in a small circle, and stagnation occurs, so the picture of pulmonary fibrosis - pneumoconiosis.

2. Effects on mucous membranes: due to the ingress of dust on the mucous membranes may be conjunctivitis, gingivitis, etc.

3. Effects on the skin: Industrial dust can penetrate the skin and into the openings of the sebaceous glands, as a result it can lead to pyoderma, dermatitis.

In addition, dust can have an indirect effect through environmental factors. An increased concentration of dust in the air leads to a decrease in the level of clarity, a decrease in the transparency of the air, UV light cannot penetrate the dust curtain. Water (fog) can accumulate on dust particles and microorganisms can settle.

Prevention of dust effects on the human body [8]:

General principles of prevention of dust effects on the human body:

1. Compliance with sanitary norms and rules.
2. Reducing the harmfulness of factors
3. Reduction on distribution paths (special curtains, screens are being built)
4. Medical measures: Examination is carried out by a therapist, otolaryngologist with radiography of the thoracic cavity, examination of the function of external respiration, increasing the reactivity of the body and the accelerated removal of dust from it. General ultraviolet radiation, use of alkaline inhalations, general and respiratory gymnastics are recommended; special nutrition is organized to normalize protein metabolism and inhibit the coniotic process.

### Conclusions

A potential environmental hazard that arises from dusty cargo is that bulk cargo (lump sulfur, mineral ores, iron ore concentrates, etc.) are delivered in half-open wagons and during the movement the dust is weathering (backyards (vegetable gardens) of residential buildings). Dust contaminates the landscape as a result of spontaneous migration.

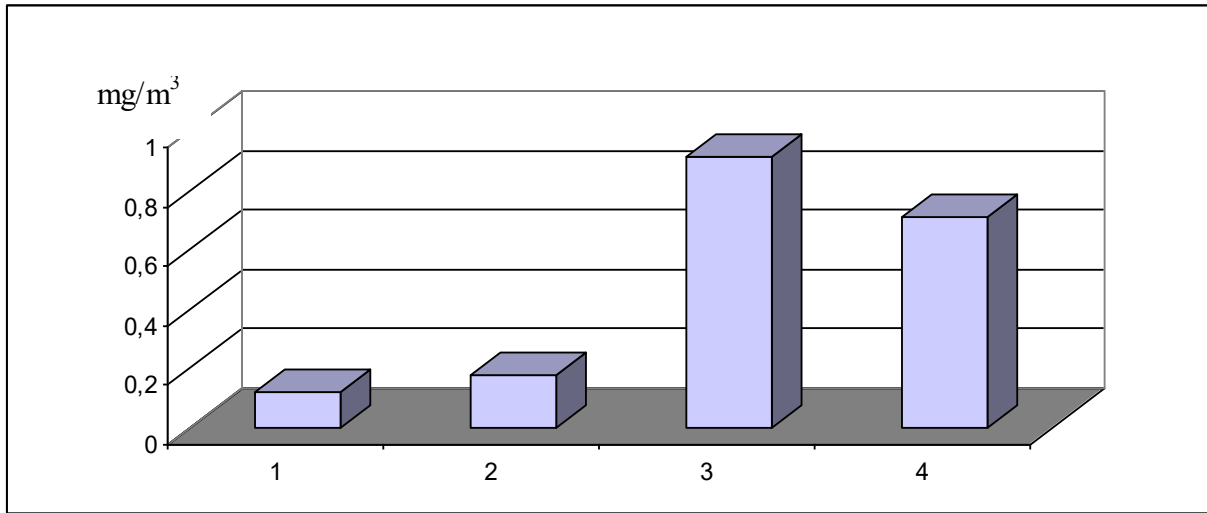
Different types of dust, having different physical and chemical properties, have different effects on the body and, thus, pose different dangers to humans. However, they all have some adverse effects on the body. There is absolutely no harmless dust.

### Acknowledgments

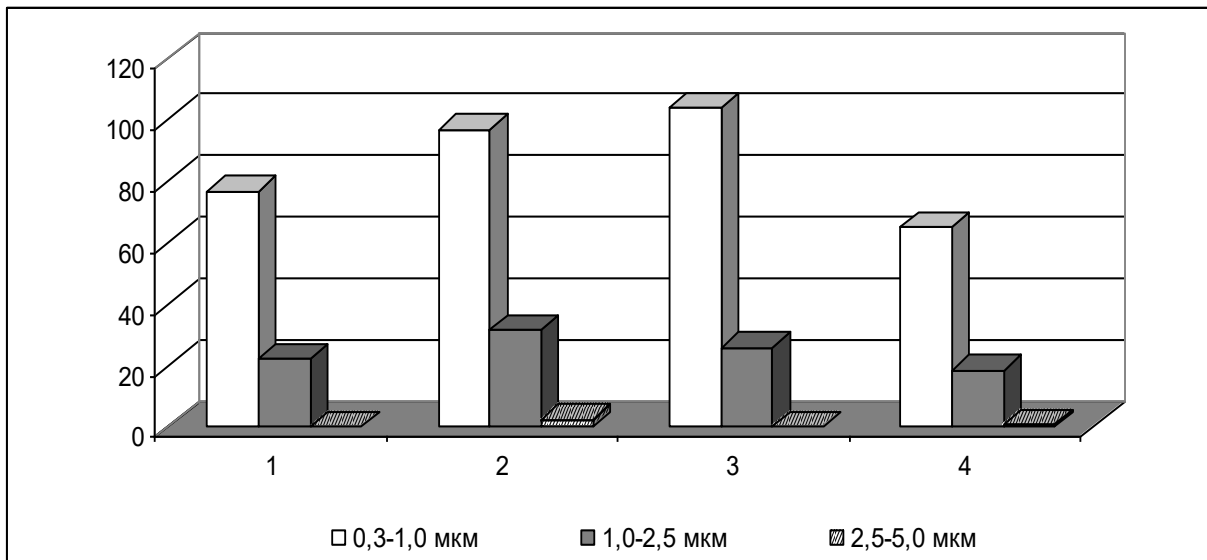
The authors declare that there are no conflicts of interest.

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**Figure 1.** The total amount of dust in the air of the study areas: 1 - the beach of Savignon settlement, Odessa; 2 - post of regulation of vessel traffic, port of Chornomorsk; 3 - the beach of the city park, Chernomorsk; 4 - recreation park by the beach, Chemomorsk



**Figure 2.** Distribution of dust particles by fractions in the air of the studied areas: 1 - the beach of the village of Savignon, Odessa; 2 - post of regulation of vessel traffic, port of Chomomorsk; 3 - the beach of the city park, Chemomorsk; 4 - recreation park by the beach, Chernomorsk