

## ENVIRONMENTAL ASSESSMENT OF ATMOSPHERIC AIR COMPOSITION IN THE AREA OF LIVESTOCK COMPLEXES

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*Results of three-year studies of impact of a livestock complex on the quality of air in the area of its location are shown. Researches of ammonia and hydrogen sulfide concentrations are carried out depending on the distance from the livestock complex namely at distances of 10, 20, 50 and 100 m. According to the research it is determined that the gas concentration exceeded the maximum permissible concentration 26 and 11 times as much respectively.*

**Keywords:** *environmental assessment, atmospheric air, livestock complex, ammonia, hydrogen sulfide.*

Environmental protection in the area of the livestock premises is considered nowadays as one of the major problems not only of state but also of general biological significance. Without scientifically based and purposeful work in this direction the growth of animal husbandry is not possible.

Problem solving of air pollution by this time was important only in urban and industrial areas. Developing industrial animal husbandry caused a similar problem in rural areas. It is characterized by reduced areas and size of premises per unit of live weight of an animal, greater capacity of buildings and individual sections, insufficient gaps between buildings at presence of huge vent emissions and liquid manure effluents. In these conditions not only tasks of animal health but also problems of preventing environmental pollution by industrial animal husbandry wastes became urgent.

Main role in the maintenance of sanitary and hygiene state of air environment plays ventilation. Incorrect arrangement of air ducts in separate parts of premises causes appearing of "dead" zones, they accumulate a large amount of ammonia, hydrogen sulfide, dust, microorganisms [1]. Harmful gases that accumulate in premises, moisture, dust and microorganisms are removed through the air vent system and enter the atmosphere around the complex. The more livestock premises in the complex and the higher concentration of animals, the more air pollution around premises and the farther it spreads across the territory. It is supported by multipoint air release, improper location of buildings in relation to the prevailing winds, the way of animal welfare, lack of wind protection, tree planting, hard surfaces, inadequate treatment facilities and other things.

Also improper storage and use of liquid manure significantly affects atmosphere. If it is stored in open containers, it evaporates and ammonia, molecular nitrogen and its other compounds enter the atmosphere. Resulting gaseous decomposition products cause bad odor. From 1 m<sup>3</sup> of liquid manure of natural

moisture up to 8 mg of ammonia, 5 mg of hydrogen sulfide and 5 mg of carbon dioxide liberate per hour. Liberation of these gases increases significantly with increasing moisture content of manure, non-compliance of statutory microclimate parameters [2].

Researches of Myronenko M. A. (Moscow, 2002) showed that from the complex for growing and fattening of 10 thousand heads of cattle per day with ventilation exhausts more than 60 kg of ammonia enter the atmosphere. Specific odor of this complex extends over a distance of three kilometers. From a pig complex of 108 thousand pigs specific odor extends to a distance of 5 km. In air samples at 100m ammonia concentration is up to 3,4 mg/m<sup>3</sup>, hydrogen sulfide – 0,112 mg/m<sup>3</sup>, mercaptans – 16,7 mg/m<sup>3</sup>. In such a pig complex in the industrial area ammonia concentration is up to 4–18 mg/m<sup>3</sup>, hydrogen sulfide – 3,5 mg/m<sup>3</sup>, organic substances – 40–50 mg/m<sup>3</sup>, dust – 10 mg/m<sup>3</sup> [3].

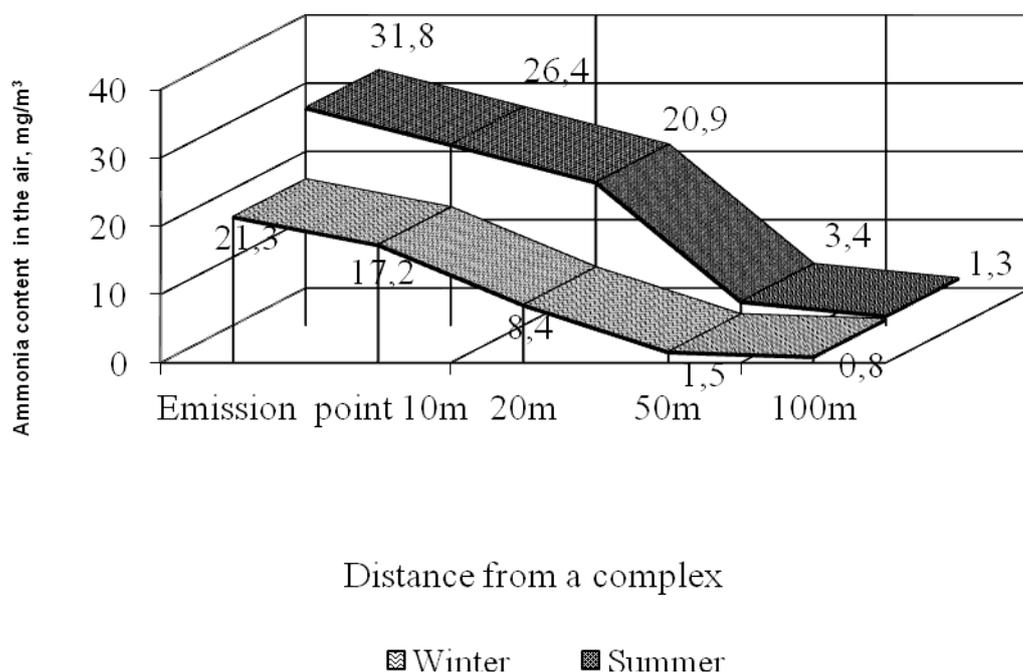
Source of air pollution can be not only livestock premises where livestock is kept, but also manure storages, storage ponds, structures of biological wastewater treatment. Such air pollution has the negative impact on soil properties and natural waters.

Special attention in the aspect of air pollution should be paid to large complexes of beef production that are characterized by a high level of production. Researches were carried out during 2011–2013, in LLC “E & M Beautiful Land” (Cherkasy region, Khrystynivka district, urban village Verhniachka). Main activity of LLC “E & M Beautiful Land” is fattening of young cattle. The farm has three cattle premises by total number of livestock – 2200 heads of cattle, two of them – 850, one – 500. Keeping calves is tethered, floor is meshed. Today the farm has no effective treatment facilities, working according to outdated technologies and using outdated equipment. Technology of livestock keeping at livestock complexes is without litter. Sewage treatment plants are unable to use and recycle efficiently a large amount of manure, especially of liquid consistency. Existing sediment basins that are serious environmental polluters do not solve environmental problems but only complicate them.

**Research methods.** To control the chemical composition of air we used versatile portable gas analyzer of UG-2 type. It determined ammonia and hydrogen sulfide concentration in the air of impact zone of livestock premises.

**Research results.** Source of ammonia in the air of livestock premises is the decomposition of urine and faeces, of which this gas is formed by the decomposition of organic substances, particularly under the influence of micro flora of uric acid which is the main product of protein decomposition. Also carbon dioxide is formed. Hydrogen sulfide is formed during the decay of organic sulfur compounds (protein, excrements), and appears with intestinal gases. Liberation of these gases increases significantly with increasing moisture content of manure, non-compliance of statutory microclimate parameters and excess density of animals. The main source of carbon dioxide emissions is an animal itself (including exhaled air).

Dynamics of ammonia content in the zone of livestock premises is shown in Fig. 1.



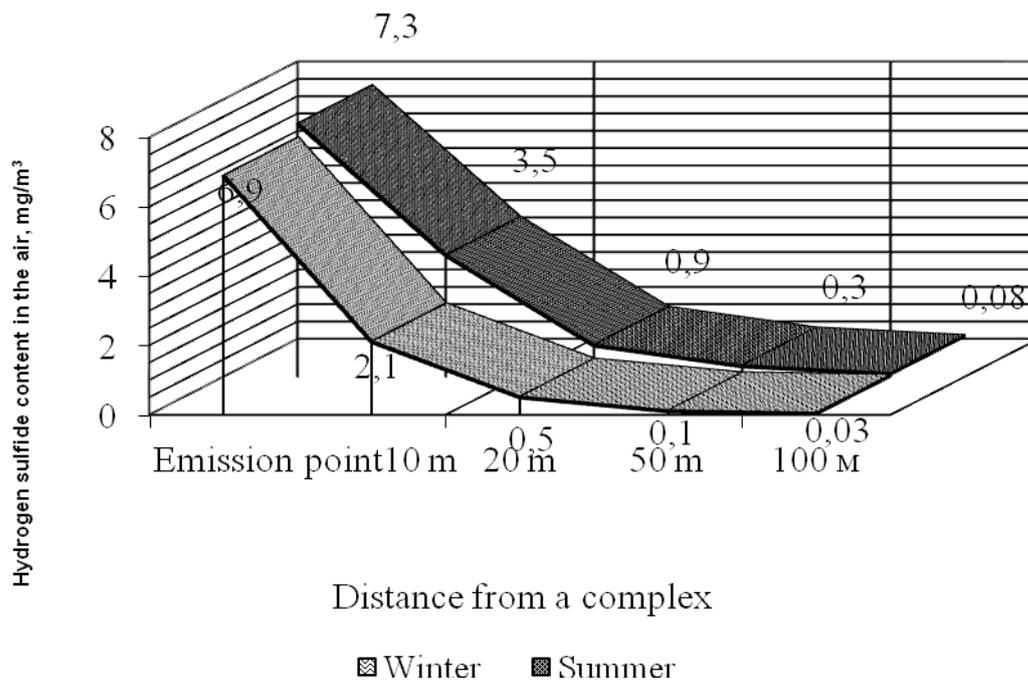
**Fig. 1. Ammonia content in the air depending on the distance from the livestock complex (MPC 0,04), mg/m<sup>3</sup>**

Analyzing results of the research it can be seen that the highest content of ammonia in the air is at the point of emission. On average during the years of research it was 21,3 mg/m<sup>3</sup> (in winter) and 31,8 mg/m<sup>3</sup> (in summer) which exceeds allowable sanitary and epidemiological standards on average in 2,5 times (permissible concentration in livestock premises – 10 mg/m<sup>3</sup> [5]).

Ammonia accumulating in livestock premises is removed through the exhaust system and enters the atmosphere. We have carried out researches of this gas concentration, depending on the distance from the livestock complex namely at distances of 10, 20, 50 and 100 m. According to the research it is determined that with increasing distance from the point of emission ammonia concentration decreases in the air: 20 m – 2,5 (in summer) and 1,5 times (in winter), 100 m – 27 and 25 times respectively.

Thus, the annual average actual concentration of ammonia exceeds the maximum allowable concentration in 26 times (the distance from the point of emission – 100 m). If we compare the results of research in summer and winter periods, it can be concluded that in winter pollution indicators are lower. This is due to high humidity during this period, which leads to rapid subsidence of ammonia on the soil, premises, snow cover and others.

Next stage of the research was to determine the concentration of hydrogen sulfide in the air at the point of emission (livestock premise) and at different distance from it (Fig. 2).



**Fig. 2. Hydrogen sulfide content in the air depending on the distance from the livestock complex (MPC 0,005), mg/m<sup>3</sup>**

Obtained research results of hydrogen sulfide concentration allow observing the similar to ammonia tendency of its decreasing with increasing distance from the point of emission. In livestock premises hydrogen sulfide content was higher than the permissible value of it in 1,4 times (maximum concentration in livestock premises is 5 mg/m<sup>3</sup> [4]) in an average year.

In an average year at a distance of 100 m from a livestock complex the actual concentration of hydrogen sulfide exceeded maximum allowable concentration in 11 times, despite the fact that in winter it was lower than in summer.

**Conclusions.** Analyzing the research results, we can conclude that the level of air pollution in the zone of a livestock complex is high on indicators of concentrations of harmful gases – ammonia and hydrogen sulfide. These gases have toxic properties. They cause severe irritation of mucous membranes, tearing, burns, impede the functioning of the respiratory system.

Studied contaminants spreading by air masses can react with acidic compounds of the atmosphere and then dropping along with fallout on the ground are the main cause of soil acidification. This can have an impact both on the presence in the soil of necessary for plant growth substances and toxic elements. At the same time ammonia contributes to eutrophication or enrichment of poor soils in nutrients with nitrogen that upsets the balance of sensitive ecosystems causing increased growth or disappearance of certain species.

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