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MAIN SOURCES OF POLLUTION AND NOMENCLATURE OF INDICATORS OF SOIL SANITARY STATE

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✓ ***Resume***

The transformations associated with the active growth of cities, the development of various industries and agriculture are a source of soil pollution and contaminated soil is a source of secondary pollution of ground and surface waters, agricultural atmospheric air. This determines the possibility of exposure to soil pollutants on the human body.

The work is devoted to actual problems for Uzbekistan from the standpoint of maintaining the health of the population, these are the issues of soil hygiene and the state of cleaning the territories of populated areas.

Key words: soil hygiene, sources of soil pollution, soil pollutants, human body, preservation of public health, cleaning of populated areas.

ОСНОВНЫЕ ИСТОЧНИКИ ЗАГРЯЗНЕНИЯ И НОМЕНКЛАТУРА ПОКАЗАТЕЛЕЙ САНИТАРНОГО СОСТОЯНИЯ ПОЧВЫ

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✓ ***Резюме***

Преобразования, связанные с активным ростом городов, развитием различных отраслей промышленности и сельского хозяйства являются источником загрязнения почвы, а загрязненная почва источником вторичного загрязнения подземных и поверхностных вод, сельскохозяйственных атмосферного воздуха. Это определяет возможность воздействия почвенных загрязнителей на организм человека.

Работа посвящена актуальным проблемам для Узбекистана с позиций сохранения здоровья населения, это вопросы гигиены почвы и состояния очистки территорий населенных мест.

Ключевые слова: гигиена почвы, источники загрязнения почвы, почвенные загрязнители, организм человека, сохранение здоровья населения, очистка территорий населенных мест.

ТУПРОҚНИ АСОСИЙ ИФЛОСЛАНТИРУВЧИ МАНБАЛАРИ ВА САНИТАРИЯ ҲОЛАТИНИНГ КЎРСАТКИЧЛАРИ НОМЕНКЛАТУРАСИ

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Шаҳарларни фаол ўсиши, саноат ва қишлоқ хўжалигининг турли соҳаларини ривожланиши билан боғлиқ ўзгаришлар тупроқни ифлосланиш манбаи, тупроқни ифлосланиши эса ер ости ва ер усти сувларни, қишлоқ хўжалиги атмосфера ҳавосини иккиламчи ифлосланиш манбаи ҳисобланади. Бу эса тупроқни ифлослантирувчиларни инсон организмига таъсир имконини белгилайди.

Мазкур иш аҳоли саломатлигини муҳофазалаш нуқтаи назардан Ўзбекистон учун долзарб ва муҳим бўлган тупроқ гигиенаси ва аҳоли яшаш пунктларини тозалаш ҳолатига бағишланган.

Калитли сўзлар: тупроқ гигиенаси, тупроқни ифлослантирувчи манбалари, инсон организми, аҳоли саломатлигини муҳофазалаш, аҳоли яшаш жойлари ҳудудларини тозалаш.

Relevance

It is known that the degree of pollution of environmental objects is influenced by various factors that can be subdivided into 2 main groups: natural and anthropogenic.

In different administrative districts of the republic, the list of the main sources of soil pollution can vary significantly. They are determined by a complex of national economic and sanitary conditions, primarily the development of industry and agriculture, as well as the organization of systems for the treatment of household and industrial waste, the impact of other anthropogenic factors directly related to the life of people and society as a whole.

In the administrative districts of the republic, different types (types) of land use prevail, among which the main ones are settlements, recreation areas of the population and sanitary protection of sanitary facilities, areas of sanitary breaks of industrial enterprises, transport lands, agricultural land, forests, depending on which indicators and content of sanitary supervision over these territories.

Purpose of the study: To study the urgent problems of sanitary supervision over the territories of the country from the standpoint of preserving the health of the population, to study the issues of soil hygiene and the state of cleaning the territories of populated areas.

Material and Methods

Literary sources are analyzed, the main sources of soil pollution in different administrative regions of the republic and their influence on the health of the population are studied.

Result and discussion

One of the main sources of soil pollution from a sanitary and hygienic point of view is industrial enterprises that pollute it with various chemical compounds either directly at the places of their collection and storage (tailings and sludge ponds), or indirectly by emissions into the atmosphere and discharge of wastewater into water bodies. In these cases, such technogenic soil pollution can be observed at a fairly large distance from the industrial enterprise itself. A striking example of such soil pollution is soil pollution with fluoride compounds in a number of districts of the Surkhandarya region of Uzbekistan due to emissions from the Tajik aluminum plant (TAZ), the consequences of which are still observed.

It should be pointed out that W.H. Adylov (1994) was one of the first to characterize the unfavorable situation in the Saryassi district of this region. Confirmed the intensive pollution of its territory with fluoride compounds of environmental objects and found that their content in soil, vegetables and fruits was exceeded by tens of times, and the total fluoride intake into the body of children in the district was 4-5 times higher than the permissible levels (Table 1) [1– 3].

Table 1-Indicators of the levels of pollution and morbidity of the population of the districts of the Surkhandarya region (data of U.Kh. Adylov 1991-1992)

№	The name of indicators	Saryassiya	Jarkurgan	Boysun
1	Daily total intake of fluorine, mg	11,6	2,6	2,7
2	Pesticide consumption, kg / ha	12,1	13,3	2,8
3	Consumption of nitrogen fertilizers, kg / ha	282,6	293,7	92,6
4	Morbidity by referral to health care facilities (per 1000 people)			
	- adult population	2609,6	1834,6	1457,5
	- child population	2562,8	1789,4	1069,6
5	Morbidity according to medical examinations (per 1000)			
	- adult population	3623,3	2392,1	1519,0
	- child population	3527,7	2469,0	1427,8
6	Morbidity according to health authorities (per 1000)			
	- diseases of women in labor (anemia)	447,8	215,6	195,7
	- diseases of newborns	306,0	255,0	133,8

The author believes that the greatest role in the increase in the level of the general morbidity of the rural population, the deterioration of the indicators of the functional state of the body and the lagging behind in the physical development of children in the Saryassi region was played by the pollution of the environment with fluorine-containing emissions of TAZ. At the same time, the analysis of the morbidity rates of the residents of the district indicates the effect of emissions on all organs and systems of the body, mainly pregnant women and preschool children. Dental fluorosis was found in 16.9% of children of the Saryassi region, in the control Dzharkurgan and Baysun regions of the region, it was absent.

Technogenic pollution of soil with chemical hazardous substances is also observed in other regions of the republic. The research in this direction of the hygienists of Uzbekistan is well known. N.S.Tadzhibaeva (1973) at the Samarkand and Kokand superphosphate plants, L.N. Noskova and N.E. Borovskaya (1983) - at the copper and zinc production of the Angren Mining and Metallurgical Combine, E.R. Alieva (1988) - at the Fergana chemical plant of furan compounds, T.Yu.Doroshko (1991) - at the Uzbek plant of refractory and heat-resistant metals [4-7].

Soil contamination with solid household and toxic industrial waste can be observed with improper operation of sanitary cleaning systems for populated areas in the places of their collection and storage, transportation, neutralization and burial, including at special landfills and improved landfills.

In order to prevent such soil contamination, the following sanitary and regulatory documents have been developed and approved:

- SanPiN RUz No. 0128-02 "Hygienic classifier of toxic industrial waste in the conditions of Uzbekistan";

- SanPiN RUz No. 0149-04 "Sanitary rules and norms for collection, storage and disposal of waste from medical institutions";

- SanPiN RUz No. 0157-04 "Sanitary requirements for storage and disinfection of solid waste at special landfills in Uzbekistan";

- SanPiN RUz No. 0158-04 "Sanitary rules and norms for the collection, transportation and storage of asbestos-containing waste in the conditions of Uzbekistan";

- SanPiN RUz No. 0297-11 "Sanitary rules and norms for cleaning the territories of populated areas from solid household waste in the conditions of the Republic of Uzbekistan";

- SanPiN RUz No. 0300-11 “Sanitary rules and norms for the organization of collection, inventory, classification, neutralization, storage and disposal of industrial waste in the conditions of Uzbekistan.

Contamination of soil and water of reservoirs with wastewater from city sewers (often with an admixture of industrial wastewater) also required the hygienists of Uzbekistan to develop a number of sanitary-regulatory and methodological documents, including:

- SanPiN RUz No. 0129-02 "Sanitary requirements for sewerage systems in special natural and climatic conditions of the Republic of Uzbekistan";

- SanPiN RUz No. 0202-06 "Procedure for issuing permits for special water use, development and approval of projects of maximum permissible discharges (MPD) of substances entering with wastewater into water bodies and on the terrain";

- SanPiN RUz No. 0216-06 "Sanitary rules for the use of treated urban wastewater in industrial water supply";

- Methodical instructions "Sanitary and hygienic bases for the organization of protection from pollution of surface water sources in Uzbekistan" (No. 012-3 / 0113).

Requirements for the method of purification and neutralization of urban sewage wastewater using agricultural irrigation fields (ZPO) are devoted to 2 sanitary normative documents:

- SanPiN RUz No. 0180-05 "Hygienic requirements for the use of wastewater and their sediments in agricultural irrigated fields in the natural and climatic conditions of Uzbekistan";

- SanPiN RUz No. 0182-05 "Hygienic requirements for the quality of wastewater and their sediments used for irrigation and fertilization in the natural and climatic conditions of Uzbekistan."

- Evaluating the content of the above sanitary normative documents from the standpoint of their possible use in improving the methodology of the ecological and hygienic ranking of the administrative regions of the republic according to the degree of danger of soil contamination for the health of the population, the following indicators of the quality of wastewater suitable for use in wastewater treatment plants given in these documents are promising:

• the number of lactose-positive bacilli - less than 10,000 per 1 dm3, pathogenic microorganisms - no,

• viable helminth eggs - less than 1 in 1 dm3,

• viable cysts of pathogenic protozoa - less than 1 in 1 dm3.

The norms for the introduction of heavy metals provide for the possibility of their accumulation in the soil in the ZPO not higher than 0.7-0.8 kg / ha of their maximum permissible concentration for the translocation indicator of harmfulness, and the maximum value of the total nitrogen introduced into the soil should not exceed 300 kg / ha per year.

Soil contamination is distinguished by its peculiarities when using wastewater from livestock complexes (cattle and pig farms) and poultry farms for irrigation of agricultural crops.

The effluents of pig-breeding complexes after undergoing mechanical and biological treatment have high fertilizing properties, contain 1.0-2.0% of suspended solids, pH 7.5-8.3, dry residue - up to 2000 mg / l, total nitrogen - up to 850 mg / l, ammonium nitrogen - up to 240 mg / l, nitrates - up to 3.9 mg / l, COD - up to 1250 mgO2 / l.

In terms of contamination with organic substances and the content of nutrients, wastewater from livestock complexes of cattle is many times higher than ordinary municipal and industrial wastewater, which significantly complicates their biological treatment, including by soil methods.

These effluents represent a polydisperse medium of water, organic and mineral substances, fibrous inclusions and are characterized by a high fertilizing value. They contain from 1600 to 2250 mg / l of total nitrogen, from 430 to 500 mg / l of phosphorus, from 900 to 2000 mg / l of potassium, a large amount of organic substances.

The wastewater of poultry farms contains many nutrients, on average, 1000 m3 of wastewater contains 52 kg of ammonia nitrogen, 54 kg of nitrate nitrogen, 29 kg of nitrite nitrogen, 135 kg of total nitrogen, 2 kg of phosphorus.

The total number of bacteria in 1 ml of wastewater is at a maximum of 267 thousand before treatment and up to 179 thousand after treatment; the titer of Escherichia coli, respectively, 10-6 and 10-4.

The epidemic danger of sewage from poultry farms increases sharply when connected to the collection of household and fecal waste due to the possibility of the presence in them of various pathogenic enterobacteria, helminth eggs and cysts of pathogenic protozoa.

In the agricultural regions of Uzbekistan, one of the most dangerous from the standpoint of environmental pollution and impact on public health are pesticides used to combat pests and diseases of cotton and other crops.

The criteria for the hygienic assessment of the hazard of soil contamination are scientifically grounded maximum permissible concentrations (MPC) and tentatively permissible concentrations (APC) in the soil (SanPiN RUz No. 0191-05).

New drugs are being regulated in order to establish their permissible content in environmental objects (including soil), which are approved by the Ministry of Health of the Republic of Uzbekistan. At the same time, sanitary rules for storage, transportation and their application in agriculture are being developed in order to protect the environment from pollution, the health of workers and the population.

The above materials clearly confirm that one of the main tasks of the republic's sanitary supervision bodies is to protect the soil of residential areas and children's institutions in populated areas.

At the same time, the need for a sanitary and hygienic assessment of the degree of soil pollution in populated areas arises when choosing places for the construction of settlements, as well as monitoring the sanitary condition of the soil, determining the effectiveness of soil methods for neutralizing the resulting waste and wastewater.

At the same time, when monitoring the sanitary state of the soil and the degree of its chemical contamination, it is necessary to use unified methods and a certain set of chemical indicators.

Considering that in Uzbekistan after gaining independence, new industries were developing especially intensively, a wide variety of organic and inorganic chemical substances entered the soil with emissions, waste and wastewater. Therefore, the nature and levels of soil pollutants have changed significantly.

This, in turn, required a significant change in the requirements for soil survey programs. It was necessary to take into account the sanitary and epidemiological state of the surveyed administrative territories, the levels and nature of the technogenic load on the soil, types of land use and a number of other local conditions.

It is also recommended, first of all, to conduct soil studies in areas of increased risk in terms of the strength and potential impact of pollution on public health. All these points were taken into account in the development of SanPiN RUz No. 0183-05 "Hygienic requirements for the quality of soil in populated areas in specific climatic conditions of Uzbekistan" and the general nomenclature of indicators of the sanitary state of the soil. This document provides a general nomenclature of indicators of the sanitary state of soils. Indicators are grouped and divided into 3 parts: sanitary-chemical, sanitary-bacteriological, sanitary-helminthological and sanitary-entomological indicators. The choice of

appropriate indicators depends on the chemical composition of agricultural chemicals used in a particular area and on the nature of emissions from industrial enterprises.

Thus, the materials of this work convincingly confirm that the list of the main sources of soil pollution and the nomenclature of indicators mandatory for determining the indicators in different administrative regions are due to a complex of anthropogenic factors, including the development of industry and agriculture, the peculiarities of the organization of cleaning systems for their territories and a number of others related directly with the life of people and society as a whole.

At the same time, the main sources of soil pollution can be divided into the following groups:

- technogenic pollution due to emissions into the atmosphere and the discharge of wastewater from industrial enterprises into water bodies, as well as in the locations of tailing dumps and sludge collectors of enterprises of the non-ferrous and chemical industries;
- soil pollution with solid household and toxic industrial waste in the cleaning systems of the territories of populated areas;
- pollution of soil and water of water bodies with wastewater from city sewers (usually with an admixture of industrial wastewater);
- soil contamination during agricultural use and soil disinfection of wastewater in agricultural irrigation fields (ZPO);
- soil contamination by sewage from livestock complexes (cattle and pig farms) and poultry farms;
- in storage areas and areas of application of pesticides and fertilizers.

The danger of soil contamination with chemicals from a hygienic point of view is determined by the level of its possible negative effect on the contacting media (water, air), food products and indirectly on humans, as well as on the biological activity of the soil and its self-cleaning processes.

MPC and APC represent complex indicators of the content of chemicals in the soil harmless to humans. This is the maximum indicator of the possible migration of the drug into the environment adjacent to the soil (plants, water, air) in quantities that do not exceed the hygienic standards of this substance in these objects, and there is also no negative effect of the substance on the biological activity of the soil.

The AEC of a pesticide in the soil is determined according to the established hygienic standards - the permissible residual amount (MRL) of pesticides in crops. In this case, the maximum level of soil contamination for agricultural use is recommended.

MPC and APC guarantee the absence of negative or mediated through contact with the soil impact on human health, his offspring and sanitary living conditions of the population.

The values of MPC and APC of substances in the soil (mg / kg of absolutely dry soil) are presented in the SanPiN.

Hygienic assessment of the degree of danger of chemical harmful substances for humans is carried out taking into account their hazard class.

In the absence of indications on the hazard class of a chemical substance in the used regulatory and design documents, it can be determined by the so-called hazard index. In this case, calculations of the hazard index according to the MPC of the harmful substance in the soil, LD50 of the harmful substance, hazard class of the hazardous substance in the air of the working area can be carried out.

In the presence of MPC of harmful substances in the soil, which are given in SanPiN RUz No. 0055-96 "Maximum permissible concentrations (MPC) and approximate permissible concentrations (APC) of exogenous harmful substances in the soil", the calculation of the hazard index is given according to the following formula (1):

$$K_i = \frac{MPC_i}{(S_i + C_в)xi}, \qquad (1)$$

where MPCi is the MPC of a toxic chemical contained in

soil (mg / kg);

Si- is a coefficient reflecting the solubility of a substance in water (mg / l);

Sv - the content of this component in the total mass of industrial waste that is introduced into the soil (t / t);

i - is the serial number of this component or toxic substance.

Having calculated Ki for each substance, 1-3 leading substances are selected that have a minimum Ki value, and the ratio K1 <K2 <K3 is observed, as well as 2Ki≥ K3. Then the total toxicity index (KΣ) is determined according to the formula (2):

$$K_{\sum} = \frac{1}{n^2} x \sum K_i, \qquad (2)$$

where n ≤ 3.

The hazard class of chemicals in soil is determined according to Table 2.

Table 2 - Classification of the hazard of chemicals based on the MAC values of these substances in the soil

Total hazard index K	Class dangers	The degree of danger to the population
less than 2	1	extremely dangerous
from 2 to 16	2	highly dangerous
from 16 to 30	3	moderately dangerous
over 30	4	little dangerous

In the absence of the MPC of a harmful chemical in the soil, the determination of its hazard class is carried out for each substance separately according to formula (3), using the LD_{50} value for this substance:

$$K_i = \frac{\lg x(LD_{50})}{(S_i + 0{,}1F)xi}, \qquad (3)$$

where Si is the coefficient of solubility of a given substance in water, mg / l;

F - coefficient of volatility of a given substance,%;

i - is the serial number of the given substance.

When calculating, one should observe the conditions that K1 <K2 <K3 and 2Ki≥ K3; then KΣ is calculated according to the formula (2), an immeasurable coefficient is obtained, after which the hazard class of the substance is determined using auxiliary table 3.

Table 3-Classification of hazard of chemicals according to LD_{50}

The value of the total hazard index K	Class dangers	The degree of danger to the population
less than 1.3	1	extremely dangerous
from 1.3 to 3.3	2	highly dangerous
from 34 to 10	3	moderately dangerous
more than 10	4	little dangerous

Defining classes allows you to:

• systematize harmful components;

• provide uniform approaches to the processing of different types of waste;

• establish rational requirements for the procedure for the disposal of various types of waste;

• get the most positive results from disposal.

Findings

In connection with the constant increase in the anthropogenic process, the intensification of the impact on soils caused by the activities of industrial and agricultural enterprises, the issue of assessing the sanitary and hygienic state of the soil is acute. Thus, it has been established that the list of the main sources of soil pollution and the nomenclature of indicators mandatory for determining in different administrative regions is not the same and is due to a complex of anthropogenic factors.

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