MONITORING OF ILLEGAL DUMPS IN DUBNA CITY, MOSCOW REGION

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Purpose. *This research is focused on identification of illegal dumps in the territory of Dubna, their geometrical sizes, composition, sources of education; assessment of ecological danger of dumps and analysis of dynamics of a situation over the last ten years: 2004-2014.*

Design/methodology/approach. *Researches were carried out by means of field, calculation, statistical and cartographical methods.*

Findings. *Hundred illegal dumps are founded in the territory of Dubna in 2014, over the last 10 years the amount of dumps has reduced much in a residential zone of Dubna, the situation has improved not so significant in recreational zones. Eighty percent of dumps are characterized as dangerous since they are located in relief depressions, in residential and "green" zones of the city, near reservoirs; they contain dangerous components in their own composition. Plastic, glass and wood waste have the greatest volumes in damps. Vacationers in "green" zones of the city and inhabitants of the private sectors are the main pollutants. The lack of containers for collecting waste in places of a recreation and around some garden associations is revealed. All obtained data are presented in the complex GIS-project that gives ample opportunities of processing and the analysis of data.*

Practical implications. *All obtained and processed data are communicated to the company responsible for the waste management in the city of Dubna (JSC "RFK Ekosistem"), the part of dumps is liquidated, container network and routes of export of waste are perfected.*

Keywords: *illegal dumps; waste; environmental; negative impact; monitoring; GIS-project.*

Modern scales of urbanization and constantly increasing economic activity of people create problems of protection of environmental from a negative impact on it [1, p. 150].

There is an intensive accumulation of the municipal solid waste (MSW) in the cities and settlements. It pollutes environment especially because of the wrong and untimely removal and dumps creating [2, p. 165; 3, p. 54; 4, p. 23; 5].

Illegal dumps appear in the register of waste placement objects as "other objects" [6, p. 124]. It is impossible to give an unambiguous assessment of ecological and epidemiological danger for the environment and the health of the population of illegal dumps because of their status. The population takes the most different types of waste and mixtures of their components can lead to unpredictable reactions between them in the places without any established control and approved project of land's allocation. There is data that the world quantity of illegal dumps waste is estimated at 98995672 tons and the leaders are China and India [7; 8, p. 95; 9].

Illegal dumps affect all components of the ecosystem. Municipal waste is a significant destabilizer of the geoecological situation [10, p. 21; 11]. Illegal dumps lead to degradation of the soil as a natural object that is manifested in destruction of many components that are responsible for the implementation of ecological functions of the soil cover [12, p. 5; 13, p. 179].

Furthermore, some components of municipal waste are amenable to decomposition processes of various degrees. Methane, carbon dioxide, ammonia, hydrogen sulfide, phenol, aldehydes, nitrates, organic acids are products of waste disintegration [14, p. 19]. The organic component causes waste favorable for reproduction of insects, birds, rodents, other mammals that can be messengers of pathogenic bacteria and viruses on long distances [15, p. 32; 7].

Existence of illegal dumps is a violation of a number of Russian Federation legislations [16, p. 4–6].

According to the previous information, the waste unauthorized storage process management is an extremely actual and economically significant task for any municipality in our country.

Monitoring of illegal dumps in Dubna city, Moscow region has been conducted since 2004. Dubna is a small town, it has the popula-

tion of about 70000 people and the square about 72 sq.km. During this monitoring we investigate: the location of dumps, their geometrical parameters (length, width, height), approximate structure of waste (as a percentage by types), the landscape near a dump (existence of water objects, decreases of relief, etc.), the degree of dump environment danger, the possible source of their formation [16, p. 5; 17]. It is necessary to add that abroad the analysis of space pictures and GIS-technology are used more often than field inspections [18, p. 258].

For the first time research was carried out for Dubna in 2004 only for the left-bank part of the town, then it was conducted actually every 4 years: in 2007–2008, 2012–2014 for the whole territory of the town. The results of the ten years' work are presented in the project on the basis of GIS "MapInfo Professional" and are brought to the attention of employees of the Russian-Finnish company "Ecosystem" that is responsible for the waste management system in Dubna. Periodically dumps are liquidated, community work days are held.

In 2004 [19, p. 18], 239 dumps were revealed only on the left-bank part of Dubna. The volume of the biggest one of them reached 10000 cubic meters. Dumps were situated in a residential zone of the town and in recreation areas. The main reasons of the situation were an insufficient number of containers (there were little number of them, especially in the private sector) and bad knowledge of the population of the problems connected with waste.

Results of the research in 2008 showed the reduction of dumps up to 134 pieces for the whole territory of Dubna. Foundation of the new company RFC "Ecosystem" which replaced the main approaches to the town waste management was the main reason. The volume of the biggest illegal dump reached 400 cubic meters. The quantity of dumps decreased in the residential zone, but the situation didn't improve in recreation areas.

100 dumps are revealed for the whole territory of Dubna in 2014: 52 on the right-bank part of the town and 48 on the left-bank part. The

total size of the territory occupied with dumps is estimated at about 2500 sq.m.

The degree of ecological danger of dumps is determined according to the methodology of the Ramensky Regional Ecological Center [17, p. 12]: 80 out of 100 dumps are referred to the "dangerous" category as they are located in the lowered relief places (ditches, pits), in residential zones and green areas of the city, close to water reservoirs, contain dangerous components (for example, the volatile, poisonous, igniting spontaneously, biologically dangerous substances).

The dumps are not higher than 3 m, 2 dumps are located in the suburbs of the town in rarely visited zones, they consist completely of wood waste that has maximum height (3 m).

The volume of waste in dumps is not more than 1-2 cubic meters in most cases. The biggest dump (10 000 cubic meters) is found in the garden association «Chayka» and 85% of its waste is plastic and glass, 15% wood waste.

Frequently there is an accumulation of several close dumps in places of recreation, for example, at the lake Lebyazh'e territory, on the banks of the Volga River, a dam of the Moscow Sea. These dumps are insignificant-scale individually, but in the general mass represent significant threat for the ecosystem.

Now the total volume of waste in illegal dumps in Dubna is estimated at about 12000 cubic meters. The greatest volumes are related to plastic (4552 cubic meters), glass (4190 cubic meters) and wood waste (2322 cubic meters). Other types of waste are represented by volumes 1–2 orders lower.

In the study the locations of illegal dumps are compared with places of organized waste collectings – containers, container platforms, bunkers for bulky garbage (figure 1). Dumps are actually absent in the places where the containers are installed, but the opposite is also true. Besides the analysis of a network of organized garbage collecting places distribution gives the grounds to claim that the number of containers is insufficient in recreation and green zones of the town.

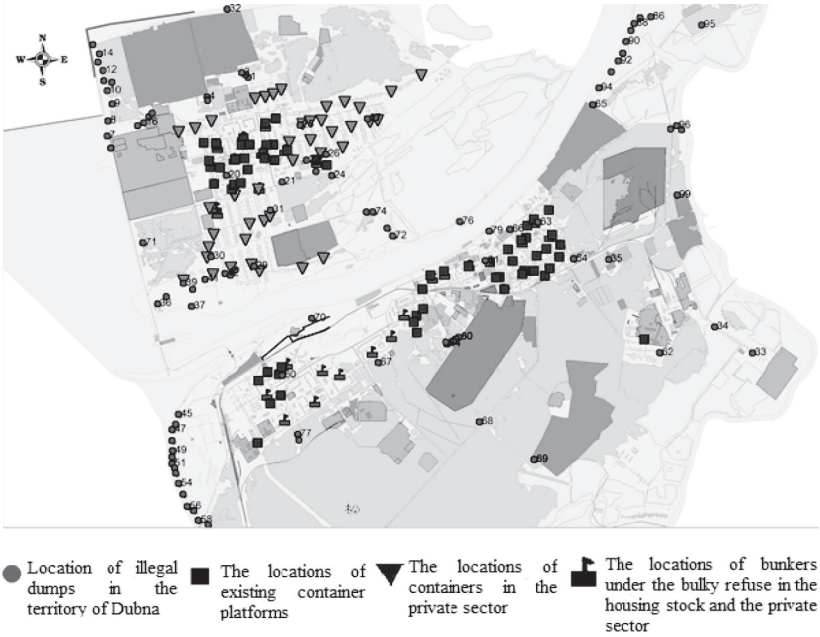

Fig. 1. Comparison of distribution of a container network and illegal dumps in the territory of Dubna, 2014

Nevertheless, studying the dynamics of illegal dumps problem in Dubna city allows to approve the significant improvement of situation during the last 10 years: the quantity of illegal dumps has been reduced in the residential zone of Dubna by 10 times. The improvement of the situation in recreational zone is less noticeable (about 1,5–2 times). RFC "Ecosystem" responsible for the waste management system in Dubna exists for the same period. It is known that many actions for the improvement of waste management have been realized during the existence of this company.

However, illegal dumps return to their places quite often and still occupy a rather representative area of the territory of Dubna. That is why other actions for the solution of this problem are necessary, not only technical solutions and ecological monitoring.

First of all we need to review the existing nature protection legislation with the aim to eliminate existing gaps and introduce tougher sanctions for violations caused by the presence of illegal dumps in the cities. For example in the USA the person guilty of illegal dumps creation according to laws of different states can be sentenced up to a one-year imprisonment. It depends on volumes of dumps, types of its waste and numbers of act participants [7].

Besides the problem of illegal dumps can't be solved without formation of the state policy directed on waste amount reduction, the involvement of waste into the secondary turnover, waste sorting and so on [20, p. 11].

The great emphasis needs to be made on the activity directed on the formation of ecological culture and personal responsibility of each citizen for the ecological wellbeing of the country. It is necessary to develop and introduce the programs of ecological training, education and illumination for various age groups of the population. It is necessary to inform residents of the cities about revealed dumps: the publication of notes in city newspapers and the local sites, messages by radio and television are possible [16].

In Dubna the work in the field of ecological education of the population has been conducted: employees of RFC "Ecosystem" and students-ecologists are organizing performances and meetings, articles and notes are periodically placed in mass media and on the Internet, education discussions are conducted in kindergartens, schools, Dubna International University for Nature, Society and Man, etc. In addition, authors consider that the perspective method is the involvement of town inhabitants in activities for elimination of dumps. So the community workdays and ecological actions should be conducted (collecting plastic, batteries, wastepaper, etc.).

Also it is possible to offer the creation of a special geoportal that will provide users with some information, give an opportunity to add new objects (dumps), and implement the mechanism of drawing up comments in cases of dumps liquidation [16].

Solution of the illegal dumps problem is possible only on the assumption of the high level of ecological culture of society, and knowledge, abilities, valuable orientations created on its basis and high credo and ideals.

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