Classification and solid municipal waste unauthorized landfills reclamation methods

Daria Penezeva\(^1\,\ast\), Yuriy Smirnov\(^1\) and Tatiana Gorynova\(^2\)

\(^1\)Saint-Petersburg Mining University, St. Petersburg, Russian Federation
\(^2\)Grand Project Company LLC, St. Petersburg, Russian Federation

Abstract. Due to the rapid production volume and consumption increase, the disposal of municipal solid waste (MSW) problems appeared. In Russian Federation stocktaking municipal solid waste accumulation objects close municipal waste landfills, building incineration and waste processing plants become a hot-button issue, which is one of the significant points in a national program «Ecology». Already formed illegal MSW landfills recultivation problem as well attracts wide attention. Nowadays, a recultivation system takes a long time for reclamation method choice, finding the contractor to perform this type of work. In this time, pollutants penetrate deep into the soil and pollute underground water horizons harming the population health as a result. It is proposed to adopt new definitions of the unauthorized landfill, cluster garbage, and focal Cluster garbage at the Federal level to simplify the system. And also divide those responsible for carrying out measures for liquidation and/or reclamation at the Federal, regional and local levels by category. The necessary recultivation method should be selected based on these results. This unauthorized dumping ground separation method can simplify the existing reclamation system in use, approval of technical tasks for remediation. Furthermore, the proposed classification does not require huge financial investments and save time when conducting procurement procedures. The work was carried out with the support of the center for collective use of the Saint Petersburg Mining University.

1 Introduction

Environmental pollution by industrial wastes is one of the major contemporary issues \([1]\). At the moment, a special place is occupied by waste generated as a result of human activity (landfills of solid municipal waste) and industrial waste (solid waste processing), which forms a significant amount of multicomponent waste \([2-4]\). According to estimates for 2018, the Russian Federation stores about 80 million tons of waste in landfills and tailing dumps \([5]\). Such structures are dangerous as a result of the release of pollutants into the atmosphere. Special attention should also be paid if the landfill or tailings pond does not have the proper shielding, as a result of which toxic substances can enter the groundwater together with water by infiltration, thereby polluting even more territories. \([6-8]\) Due to the

\(*\) Corresponding author: 040896_1998@mail.ru
increase in the number of production facilities [9-11] and a significant increase in the population, the landfills overflowed. What attracted the appearance of a new problem—the placement of waste on the territory not intended for this purpose, that is, to the appearance of large territories occupied by unauthorized landfills [10-11].

So, in December 2018, there were several national projects in the Russian Federation. The national program «Ecology» occupied a special place among them. The main task of this program is to develop a comprehensive system for solid municipal waste management and eliminate unauthorized landfills. Besides developing a remediation program of contaminated land. The program «Ecology» starting day is 24 December in 2018.

One of the difficulties in the quality implementation of the national project is that there is no single definition of "unauthorized landfill". The subjects of the Russian Federation apart from each other and attempted to define an unauthorized dump.

The law of Saint Petersburg of May 12, 2010, N 273-70 contains the following definition **unauthorized waste dump**—is a place where production and consumption waste are located with an area of more than 10 m², which is not equipped by the requirements of legislation in the field of environmental protection [12]. The resolution of the government of Moscow of December 09, 1999, N 1018 contains the other definition: **unauthorized dumping**- unauthorized placement or storage of solid household waste, bulky waste, production waste, and construction debris generated during activities of legal or natural persons, on an area of over 50 m² and with a volume exceeding 30 m³.

The Moscow Government in the same document identified two more definitions: **cluster garbage** and **focal cluster garbage**.

**Cluster garbage** is an accumulation of solid municipal waste and large-sized garbage that has occurred as a result of unauthorized dumping, in a volume not exceeding 1 m³ on a container site or any other territory.

**The focal cluster garbage** is an accumulation of solid municipal waste of bulky rubbish resulting from unauthorized discharge, up to 30 m³ in an area of up to 50 m² [13].

The block diagram of waste disposal facilities by the decree of the government of Moscow is shown in the fig.1.

![Block diagram of waste disposal facilities](image)

**Fig. 1.** The block diagram of waste disposal facilities by the decree of the government of Moscow

Nowadays, the issue of elimination and reclamation of unauthorized landfills is being addressed at various state levels, in particular at the Federal and regional levels [14-16].

Order of the Ministry of natural resources and ecology of the Russian Federation №435 of August 4, 2017, establishes criteria for categorizing objects where accumulated environmental damage is subject to priority elimination [17].
Table 1. Accumulated environmental harm objects Criteria for categorization which is subject to liquidation

| The title of the criterion | Unit of measure | Index |
|-----------------------------|-----------------|-------|
| Volume of the pollutant     | million m$^3$   | from 0,75 – more than 60 |
| Waste weight (depending on the category) | million ton | 1 – more than 10 |
| Area of the territory (water area) | ha | 1 – more than 100 |
| The multiplicity of maximum permissible concentration | - | 0 – more than 50 |
| The number of people living on the territory of accumulated damage | thousands of people | 0 – more than 100 |
| The number of people living on the territory affected by accumulated harm | thousands of people | 0 – more than 100 |

There are various requirements for assigning an unauthorized dump to the regional level and allocating monetary means from the regional budget in the Russian Federation regions. For example, in St.-Petersburg to eliminate illegal dumping and funding necessary to its inclusion in the address program on the elimination of illegal waste dumps in the district [18], according to the order of the Committee for nature use of St. Petersburg Government №100-R.

In Moscow, there is a catalog of unauthorized dumps in the city, which was compiled by monitoring in 1992-2003 [19-20]. Regulations for the elimination and reclamation of unauthorized landfills have not been approved.

There are no processes in place for detecting, eliminating, and reclaiming unauthorized landfills at the local level.

2 Methods

Having studied this issue in detail, it is proposed to adopt common definitions for the entire territory of the Russian Federation, in the following wording:

Unauthorized landfill - a place of unauthorized placement of production and consumption waste generated during the activities of legal entities or individuals, on an area of more than 50 m$^2$ and a volume of more than 30 m$^3$, not equipped by the requirements of legislation in the field of environmental protection.

Cluster garbage — accumulation of production and consumption waste on an undeveloped territory per the requirements of legislation in the field of environmental protection, resulting from unauthorized dumping, in a volume not exceeding 5 m$^3$ and in an area not exceeding 10 m$^2$.

The focal cluster garbage - accumulation of production and consumption waste in an undeveloped area by the requirements of legislation in the field of environmental protection, resulting from unauthorized dumping, in a volume not exceeding 5 m$^3$ to 30 m$^3$ and in an area not exceeding 10 m$^2$ to 50 m$^2$. 

3 Results and Discussion

After analyzing the materials on this topic, we suggest the following categorization, method of treatment, and responsible state authority for the elimination and/or reclamation of unauthorized waste disposal sites.

Table 2. The block diagram of waste disposal facilities

| Title               | Volume                     | Territories area          | Necessary action                                      | Responsible government  |
|---------------------|----------------------------|----------------------------|-------------------------------------------------------|-------------------------|
| Unauthorized landfill | From 50,000 m³ to 50,000 m³ | From 50 m² to 3 ha         | Removal of waste matter and territory                 | Federal authority       |
|                     | From 30 m³ to 50,000 m³     | From 10 m² to 3 ha         |                                                       | Regional authority      |
| Cluster garbage     | From 5 m³ to 30 m³          | From 10 m² to 30 m³        | Removal of waste matter and removal of a contaminated soil layer (to 0.2 m) | Local authority         |
| Focal cluster garbage | To 5 m³ to 30 m³          | To 10 m²                   |                                                       |                         |

The authors propose a division of responsibility for the elimination and reclamation of unauthorized landfills, cluster garbage, and focal cluster garbage at different levels of government: federal, regional, and local.

The Federal level is subject to unauthorized landfills with an area of 3 hectares and/or the volume of accumulated waste of hazard class I-V with a volume of 50,000 m³. They are allocated money from the Federal budget. The procedure for entering accumulated damage into the register of objects, preparing documentation, and performing works remain unchanged. A mandatory condition for the elimination of unauthorized landfills at the Federal level is to conduct a full set of surveys to assess the state of the environment of the territory occupied by waste and areas of contamination for the remediation of disturbed land.

Unauthorized landfills with an area of 50 m² to 3 ha and/or a volume of 30 m³ to 50,000 m³ of accumulated waste of hazard class I-V are subject to the regional level. They are allocated money from the regional budget. To include an unauthorized dump in the register of the subject level, the following information is generated: the location of the unauthorized dump, its area and volume, the type and class of hazard of waste, the timing of measures for elimination, reclamation of the territory and the cost of work.

As part of the work on the elimination of unauthorized dumps at the regional level, it is mandatory to carry out the territory reclamation. The scope of work on land reclamation is determined based on the results of land surveys to the extent necessary to justify the scope of work, including soil and other field surveys, laboratory studies, including physical, chemical and biological indicators of soil condition, as well as the results of minimally sufficient engineering-geological and hydrogeological surveys.

The disposal of cluster garbage and focal cluster garbage is carried out at the local level. Waste elimination takes place without territory inspection and recultivation activity. A special organization transport to waste disposal, disposal, and/or disposal facilities. The surface layer of soil 0.2 m under the waste is subject to removal and removal to the waste disposal facility for use.
4 Conclusions

The proposed system of division of responsibility for the elimination and remediation of unauthorized landfills, **cluster garbage** and **local cluster garbage** at the Federal, regional, and municipal (local) levels will simplify the existing system and significantly reduce the area occupied by waste.

The area under unauthorized waste disposal is increasing every year and the inclusion in the system of the municipal authority will allow more quickly eliminate the centers of unauthorized waste disposal, without waiting for their significant increase.

References

1. T. Lytaeva, A. Isakov, Journal of Ecological Engineering, 37–42 (2017)
2. M. Barkan, A. Kornev, Eastern-European Journal of Enterprise Technologies, (2018)
3. Veselova, Journal of Mining Institute, 14 (2014)
4. M. Pushkevich, T. Petrova, Journal of Ecological Engineering, 27–33 (2019)
5. V. Matveeva, T. Lytaeva, A. Danilov, Journal of Ecological Engineering, 97–103 (2018)
6. Pushkevich, M., Petrova, T., Rudzisha, E., Journal of Mining Institute, 106 (2019)
7. G. Sarapulova, Journal of Mining Institute, 658 (2018)
8. O. Kachor, G. Sarapulova, A. Bogdanov, Journal of Mining Institute, 596 (2019)
9. V. Kuznetsov, I. Suprun, Journal of Ecological Engineering, 154–158 (2018)
10. O. Marina, M. Marinin, Journal of Mining Institute, 32 (2014)
11. M. Barkan, A. Machovikov, E. Kabanov, Journal of Mining Institute, 164 (2014)
12. The law of Saint Petersburg of May 12, 2010, N 273-70
13. The resolution of the government of Moscow of December 09, 1999, N 1018
14. Resolution of the Government of the Russian Federation of 13.04.2017 N 445 (ed. from 25.12.2019
15. Resolution of the Government of the Russian Federation of 05.03.2007 N 145
16. The Federal law dated 23.11.1995 N 174-FZ
17. The order of the Ministry of natural resources and ecology of the Russian Federation №435 of August 4, 2017
18. The order of the Committee for nature use of St. Petersburg Government №100-R
19. Resolution of Moscow of May 3, 2005, N 313-PP
20. SP 47.13330.2016 «Engineering surveys for construction»