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## Planning of work on the management of household waste landfills at the level of the territorial community

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Taking into account the existing experience of waste management in the EU countries, Poltava region is gradually implementing the practice of a cluster (subregional) approach, launched by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH project as part of the international project "Municipal Reform in Eastern Ukraine". Within the framework of this research, an approach to assessing the condition of landfills was proposed and tested on the example of the Novoorzhytska community in Poltava Oblast, based on which the landfills were classified, the status of each landfill was determined, and appropriate recommendations were made for their further closure/liquidation or the possibility of reconstruction/maintenance and further controlled operation

**Keywords:** household waste landfills, waste management, environmental management

## Планування робіт з управління станом звалищ побутових відходів на рівні територіальної громади

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Враховуючи існуючий досвід управління відходами у країнах ЄС, Полтавська область поетапно впроваджує практику кластерного (субрегіонального) підходу, започаткованого проектом Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH в рамках реалізації міжнародного проекту «Реформа управління на сході України». Саме питання управління станом звалищ побутових відходів є одним із ключових при формуванні та подальшому розвитку систем управління відходами на місцевих рівнях, зокрема на рівні кластерів. В ході проведення досліджень застосовувались методи натурних (польових) обстежень експлуатаційного стану звалищ побутових відходів, метод верифікації та систематизації зібраних даних. В рамках даних досліджень запропоновано та апробовано на прикладі Новооржицької громади Полтавської області, підхід щодо оцінювання стану звалищ за експлуатаційними показниками та показниками екологічної безпеки, основними з яких є: координати місця розміщення, площа відведеної земельної ділянки, фактичний обсяг розміщених відходів, фактична осереднена висота шарів розміщених відходів, наявність під'їзної дороги, дотримання санітарно-захисної зони навколо звалища, відстані до найближчих водних об'єктів, лісових масивів, сільськогосподарських земель, об'єктів ПЗФ, автомобільних й залізничних шляхів загальної мережі тощо. На основі результатів оцінювання було здійснено класифікацію звалищ згідно запропонованих категорій: за станом експлуатації, за розмірами та обсягом накопичення відходів, за станом функціонування звалища, за наявністю розташування найближчого санкціонованого/рекомендованого місця видалення відходів. Дана класифікація була використана визначення статусу кожного із звалищ та надання відповідних рекомендацій щодо їх подальшого закриття/ліквідації або можливості реконструкції/технічного обслуговування й подальшої контрольованої експлуатації. Висновком даної роботи є наступне: запропонований у роботі підхід може бути основою об'єктивного планування та організації робіт з управління станом звалищ побутових відходів на рівні будь-якої територіальної громади, крім того, даний підхід може стати основою для вибору оптимальних з технологічної та економічної сторін методів закриття/ліквідації й подальшої рекультивції ділянок даних звалищ

**Ключові слова:** звалища побутових відходів, управління відходами, екологічний менеджмент

## Introduction

Domestic waste disposal sites (landfills/dumpsites) that have been in operation for a long time are traditionally considered to be objects of increased environmental and sanitary-epidemiological hazard. Their operation is associated with risks caused by the emission of chemical and biological contaminants, migration of gas emissions, hard-to-predict deformations of the landfill body, spontaneous combustion effects and, as a result, fire hazards.

The absence of developed approaches to analysing and managing risks in the operation of household waste dumpsites and risks to adjacent territories leads to an unjustified choice of methods for their closure/liquidation and the lack of planning for the management of these dumpsites, which consequently leads to a long-term natural process of restoring the condition of land plots after the dumpsites cease to operate.

## Review of the research sources and publications

The National Waste Management Plan provides for specific measures for household waste disposal sites that do not meet sanitary and environmental requirements for their subsequent closure [1]. The main ones are: inventory and risk assessment of waste disposal sites; preparation and approval of lists of landfills and waste dumps that should be closed and a list of those that should be brought into compliance with the established requirements, with the development and approval of relevant action plans; decommissioning/closing of landfills and waste dumps that do not meet the established requirements; development of projects and reclamation of landfills and waste dumps.

The first stage of the assessment (inventory) of household waste dumpsites was carried out in 2016-2017 as part of the development of the Comprehensive Solid Waste Management Programme for Poltava Oblast for 2017-2021 [2], the primary task of which was to establish the actual number of operating dumpsites and landfills in the oblast and assess their condition in accordance with the requirements established by the current legislation of Ukraine [3]. As a result of this work, the following procedure for the operation and decommissioning of landfills and dumpsites was prepared and approved at the regional level [4].

The methodological and practical aspects of the landfill assessment and the experience gained by Poltava Oblast specialists were outlined in a specially prepared manual on solid waste management, which was developed and published with the support of Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) [5] and taking into account scientific and practical approaches and experience in this area [8-10].

At the stage of developing regional-level state planning documents, such as the "Regional Waste Management Plan in Poltava Oblast until 2030" [6] and the Comprehensive Household Waste Management Programme in Poltava Oblast for 2022-2030 [7], experts of National University "Yuri Kondratyuk Poltava Polytechnic" also systematised data and analysed waste disposal sites, in particular the state of household waste

dumpsites, for all communities of the oblast and provided preliminary recommendations on their further status, which required a more detailed inspection of the dumpsites, making necessary adjustments and making decisions at the local levels on the further operation/closure of the dumpsites.

## Definition of unsolved aspects of the problem

The work carried out in Poltava Oblast in 2016-2021 to collect data on existing household waste disposal sites and to carry out an initial assessment of their condition was primarily aimed at creating a database of the locations and operational condition of these facilities. However, this work was carried out on the basis of officially provided data by local authorities, which was accompanied by a fairly significant amount of inaccurate and imperfect information.

Therefore, the issue arose of clarifying the objectivity of all the information collected, conducting field surveys to enable the use of the created database and planning and management of the landfills.

## Problem statement

The aim of this study is to systematise the experience gained and develop a methodological approach to assessing, planning and managing the state of household waste dumpsites at the local level, i.e. at the level of territorial communities.

## Basic material and results

The study on assessing the state of household waste dumpsites was conducted for the Novoorzhytska territorial community.

According to the data provided by the executive committee of the Novoorzhytska ATC, the total number of household waste dumpsites/landfills located in the community is 14. During the on-site survey carried out as part of the Global Project "Support to the Environmental Technology Export Initiative", 16 landfills were identified, which were assigned identification numbers 001 to 016, their locations (coordinates) and the presence/absence of technical documentation for land plots and the availability of other legal documents for the use of these land plots were clarified.

In the process of identifying the dumpsites, an analysis of the current household waste collection system in the Novoorzhytska community was carried out to identify those dumpsites that are spontaneous and illegally operated. Accordingly, it was found that:

- almost all settlements in the community have a centralised waste collection system, except for 5 small villages with less than 50 residents, and therefore household waste is taken out of them by people on their own to the nearest landfills;
- 8 landfills (identification numbers - № 001, 005, 006, 007, 011, 013, 014, 016) serve all settlements of the community (except for the 5 smallest villages);
- the remaining 8 dumpsites are spontaneous (identification numbers: 002, 003, 004, 008, 009, 010, 012, 015), 3 of which are already inactive (identification numbers: 002, 004, 012). Residents of the nearest villages (Kotliarevske, Novselivka, Lazirky, Karpylivka,

Hints, Yenkiivtsi) illegally dump household waste at these landfills.

In the course of the study, data on the state of household waste landfills in the Novoorzhytska community was verified, and their classification was carried out.

The classification criteria were selected based on the parameters that were formed when analysing a set of data on the state of household waste dumpsites collected as part of the development of the WFMP [6].

Accordingly, within the framework of these studies, an approach to the classification of household waste landfills was developed, on the basis of which the following categories of landfills were established:

1) when determining the **category of landfill, landfills were identified by their state of operation:**

- *authorised landfills* that are included in the system of household waste collection and removal defined in the community, which have documents for the land plot used for the landfill needs executed in accordance with the legal procedure: a land management project with a cadastral plan of the land plot, a state act for the right to use the land plot or an extract from the State Register of Real Property Rights on registration of ownership of the land plot or for which there are decisions of local councils on the allocation of land;
- *unauthorised landfills* that are included in the community's waste collection and disposal system, but these land plots do not have legal documents in accordance with the current legislation and do not even have local council decisions, or landfills that have local council decisions but are not included in the community's current waste management system;
- *natural dumpsites*, the right to operate which and the respective land plots was not granted by local authorities (therefore, there are no legal documents), these dumpsites are not included in the system of household waste collection and removal defined in the community, and waste is taken to them by the population on their own, i.e. spontaneously;

2) determining the **category by size and volume of accumulated waste:**

- landfills were identified by the size of the site: small landfills - site area less than 1 hectare, medium landfills - site area 1-10 hectares, large landfills - site area over 10 hectares;
- dumpsites were identified by the load of the site with the volume of waste removed: low-loaded - with waste volumes up to 1000 m<sup>3</sup> per 1 ha, medium-loaded - with waste volumes from 1000 to 5000 m<sup>3</sup> per 1 ha, heavily loaded - with waste volumes over 5000 m<sup>3</sup> per 1 ha;

3) by the **category of landfill operation:**

- *operating landfills* - landfills where household and other waste was disposed of during the last year;

- *inactive landfills* - landfills where no waste was removed in the current year and, accordingly, the removed waste masses have already been overgrown with vegetation and cannot be clearly identified by morphological composition;

4) landfills were **categorised according to the nature of the site's topography:** flat, pit, slope, watershed, gully and ravine, quarry, and mixed;

5) the **category was determined based on the location of the nearest authorised or recommended landfill:**

- an existing authorised/recommended landfill within 10 km;
- an existing authorised/recommended landfill is located more than 10 km away.

Analysing the status of the 16 identified household waste dumpsites in the Novoorzhytska community, each of them was assigned the appropriate categories:

- category by the state of operation: 3 authorized landfills (no. 001, 006, 007) that have developed land management documentation, 3 more landfills (no. 011, 013, 014) require updating of administrative documentation to allow authorized operation of these landfills, 2 landfills (no. 016) are part of the system of centralised collection and removal of solid waste agreed with local authorities, but this decision is not confirmed by administrative documents, which means that the dumpsites operate as unauthorised, and the remaining 8 dumpsites are spontaneous;
- category by the size and volume of accumulated waste: 2 authorised landfills are classified as medium-sized and 1 unauthorised landfill is classified as small but medium-loaded, while the remaining 13 landfills are classified as small and lightly loaded;
- category by the state of operation of the landfill: 3 inactive landfills, all of which are spontaneous.

In order to make further decisions on the operation of the 13 landfills (not including the 3 already inactive ones) or their closure/liquidation, an analysis of the state of household waste landfills was carried out in terms of operational characteristics (Table 1) and environmental safety indicators (Table 2).

Based on the results of the analysis of the operational condition of landfills and their environmental safety parameters, including the environmental condition of the adjacent territories, a generalised classification of landfills was made to determine their future status in terms of further operation or closure/liquidation, as follows:

1 group of landfills - landfills that have the status of active with the possibility of further operation: №006, 013, 014, 016;

**Table 1 – Analysis of the state of solid household waste landfills in the Novoorzhytska settlement territorial community by operational characteristics**

Identification number	The nearest populated point	Performance characteristics									Nearest authorised or recommended landfill / distance to it, km
		Cadastral number of the land plot where the landfill is located / geographical coordinates on GoogleMap	Landfill status / estimated life of the landfill	Land plot area allocated for landfill/dump, ha	Actual waste disposal volume since the start of operation as of 2022, thousand m <sup>3</sup>	Actual height of the waste disposal layer at the landfill, m	Availability of a checkpoint / information board	Technical equipment of the landfill *	Availability of a paved access road	Application of trench storage, raking, compaction, and waste backfilling technologies, etc.	
1	2	3	4	5	6	7	8	9	10	11	12
001	Voronintsy	5323 680400:00:007:0036 / 50.029594 32.693604	Active / since 2011	0,64	1,2	from 1.5 to 2.5 m	no / no	A solid waste storage area has been set up	no	no	Authorised landfill
002	Kotliarevske	-/ 50.012304 32.686828	Inactive / over 15 years old	0,26	0,11	to 1.5 m	no / no	no	no	Inactive, requires liquidation/sanitation	
003	Kotliarevske	-/ 50.010503 32.691738	Active / over 20 years	0,52	2,8	from 1.2 to 2.5 m	no	A solid waste storage area has been set up	yes	no	Landfill in Novoorzhytske (016) / about 6 km Landfill in Vyshneve (006) / about 8-9 km
004	Novoselivka	-/ 50.008292 32.731321	Inactive / over 10 years old	0,18	0,090	average - about 0.5 m	no	no	no	Inactive, requires liquidation/sanitation	
005	Cherevky	-/ 49.973393 32.762267	Active / over 20 years	0,12	0,9	to 2.0 m	no / no	no	yes	no	Landfill in Novoorzhytske (016) / about 6 km
006	Vyshneve	532368260 1:01:020:01 80 / 49.988735 32.628194	Active / over 20 years, according to the land management project - since 2019	1,11 75	5,3	from 0.7 to 2.0 m	no / no	A solid waste storage area has been set up	yes	no	Authorised landfill
007	Lazirky	532368300 0:00:001:00 04 50.099428 32.628164	Active / over 15 years, according to the land management project - since 2011	1,72	6,8	to 2.0 m	no	A solid waste storage area has been set up	yes	Hilling	Authorised landfill

008	Lazirky	-/ 50.064143 32.668917	Active / over 15 years	0,1	0,08	to 0.7 m	no	no	yes	no	-
009	Karpylivka	-/ 50.147789 32.666975	Active / since 2006	0,7	0,07	to 0.5 m	no	no	no	no	Landfill in Dukhove (011) / about 8 km
010	Gintsy	-/ 50.150535 32.781517	Active / since 2005	0,3	0,08	to 1.5 m	no	no	no	no	Landfill in Dukhove (011) / about 3 km
011	Dukhove	-/ 50.148831 32.712115	Active / since 2005	0,5	0,17	to 1.0 m	no	no	no	no	Recommen ded landfill site
012	Gubske	-/ 50.108179 32.823507	Inactive / over 20 years old	0,12	0,07	to 0.7 m	no	no	no	Inactive, requires liquidation/sanitation	
013	Tarandintsy	-/ 50.074483 32.809811	Active / since 2012	0,6	0,38	to 2.0 m	no	no	no	Hilling , sprinkli ng	Recommen ded landfill site
014	Biyevtsi	-/ 50.157287 32.887475	Active / since 2009	1,05	0,31	to 1.5 m	no	no	no	Hilling	Recommen ded landfill site
015	Yenkiivtsi	-/ 50.114070 32.887493	Active / over 15 years	0,02	0,05	to 1.0 m	no	no	yes	no	Landfill № 013 or №014 / about 6 km
016	Novoorzhytsk e	-/ 50.015647 32.756776	Active / over 20 years	0,31 (subj ect to land expa nsion )	2,8	from 0.8 to 1.5 m	no	A solid waste storage area has been set up	yes	Hilling	Recommen ded landfill site

\* - Technical equipment of the landfill: access road; solid waste storage area; engineering structures and communications; truck scales; a set of hydraulic structures to protect against flooding by rain and melt water, to prevent leachate from entering external drainage facilities; treatment facilities; fencing; availability of a biogas collection and utilisation system; availability of a drainage system for leachate collection and disposal; availability of a land reclamation project; availability of a protective screen for the landfill/landfill surface; availability of impervious surfaces; deodorisation/disinfection/disinsection/deratisation; fire safety measures; availability of mechanisation equipment.

**Table 2 – Analysis of the state of solid household waste landfills in the Novoorzhytska settlement territorial community by environmental safety indicators**

Identification number	The nearest populated point	Environmental safety indicators								
		Maintain a sanitary protection zone around the landfill (at least 500m to the nearest residential and public buildings)	Compliance with the minimum width of coastal protection strips for surface water bodies	Maintaining a minimum distance of 50m to the boundary of the forest and forest plantations not intended for recreational purposes	Maintaining a minimum distance of 200m to the boundary of agricultural land (arable land)	Maintaining a minimum distance of 200m to motorways and railways of the general network	Avoiding waterlogging or flooding of the landfill site during floods	Absence of protected areas and/or the Emerald Network, cultural heritage sites, recreational areas within 500m around the landfill	Ensuring the recovery of secondary raw materials / hazardous fractions	Availability of a system for monitoring and ensuring environmental safety measures
1	2	3	4	5	6	7	8	9	10	11
001	Voronintsy	No (200 m)	yes (250 m)	yes	no (10 m)	yes	yes	yes	no	no
002	Kotliarevske	No (400 m)	yes	no (5 m)	no (7 m)	yes	yes	yes	inactive, requires liquidation/ sanitation	
003	Kotliarevske	no (320 m)	yes	yes	no (10 m)	yes	yes	yes	no	no
004	Novoselivka	yes	yes	yes	no (7 m)	yes	yes	yes	inactive, requires liquidation/ sanitation	
005	Cherevky	yes	yes	no (5 m)	no (10 m)	yes	yes	yes	no	no
006	Vyshneve	yes	yes	yes	no (8 m)	yes	yes	yes	no	no
007	Lazirky	no (400 m)	yes	yes	yes	yes	yes	yes	no	no
008	Lazirky	no (100 m)	yes (300 m)	yes	no (15 m)	no (2 m)	yes	yes	no	no
009	Karpylivka	yes	yes	yes	no (100 m)	yes	yes	yes	no	no
010	Gintsy	no (300 m)	yes	no (10 m)	no (60 m)	no (5 m)	yes	yes	no	no
011	Dukhove	yes	yes	no (next to)	no (10 m)	yes	yes	yes	no	no
012	Gubske	no (400 m)	yes	no (next to)	no (10 m)	yes	yes	yes	inactive, requires liquidation/ sanitation	
013	Tarandintsy	yes	yes	yes	no (5 m)	yes	yes	yes	no	no
014	Biyevtsi	yes	yes	yes	no (75 m)	no (137 m)	yes	yes	no	no
015	Yenkivtsi	no (20 m)	yes	no (next to)	no (75 m)	no (60 m)	yes	yes	no	no
016	Novoorzhytske	yes	yes	yes	no (25 m)	yes	yes	yes	no	no

1.1 as a separate subgroup - landfills that have the status of active landfills and can remain in operation only after appropriate adjustment of the size of land plots and appropriate landscaping: №007, 011;

2 group of landfills - landfills that have the status of operating landfills with the need for further closure:

№001, 003, 005, 008, 009, 010, 015;

3 group of landfills are inactive landfills: №002, 004, 012.

Based on the results of this classification, the following recommendations are provided for the 13 household waste dumpsites operating in the Novoorzhytska community:

- to leave 4 landfills in operation, including:

- 3 landfills near the villages of Vyshneve (№006), Tarandintsy (№013), Biyevtsi (№014), which are included in the existing waste management system in the community and function as authorised landfills, but require a range of works on technical and technological arrangement of landfills in accordance with legal requirements, and landfills № 013 and 014 also require updating of administrative documentation for the land plot and its relevant legal registration;

- 1 landfill near Novoorzhytske (№016), which is also included in the existing waste management system in the community, but does not have title documents for the land plot, requires expanding the boundaries of the involved plot and developing a land management project;

- **to consider the possibility of adjusting the landfill site in Lazirky village (№ 007)** to ensure the SPZ around the landfill is at least 500 m in size, or **to leave this landfill site as a reserve** with a set of works on landscaping the landfill site, partially releasing its territory from the removed waste and preserving the site;
- **4 unauthorised dumpsites** №003, 008, 010, 015 require priority closure and liquidation due to their significant non-compliance with environmental requirements, complete lack of maintenance and control over the condition of the dumpsites, their non-involvement in the centralised community collection and removal system, and, accordingly, the possibility of removing waste to authorised dumpsites at a distance of up to 10 km;
- **1 small authorised landfill** №001 also requires priority closure and liquidation due to its non-compliance with key environmental requirements and the inability to bring the landfill's condition in line with current legal requirements;
- **at the next stage (starting from 2024), 3 more landfills** № 005, 009, 011 may be planned for liquidation as small landfills that are not properly

maintained, do not meet certain requirements of environmental legislation and further maintenance of such facilities is irrational.

**Conclusions.** This study assessed the operational condition and level of environmental safety of household waste landfills in the Novoorzhytska community of Poltava Oblast, based on the proposed methodological approach to assessing household waste disposal sites. The results of the research showed sufficient objectivity of this methodological approach, which was discussed with representatives of local authorities and the utility company.

Accordingly, the approach tested in this study allows for further objective planning and organisation of work on managing the state of household waste dumpsites at the level of any territorial community. In addition, this approach can serve as a basis for selecting the most appropriate methods of closure/liquidation and subsequent reclamation of these landfills from the technological and economic aspects.

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