The forms and methods of garbage disposal in Petrozavodsk city

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Abstract. The article is devoted to the problem of utilization of solid household waste in a large city on the example of the city of Petrozavodsk (Russia). Authorized and unauthorized dumps of the city of Petrozavodsk are considered, the characteristics of enterprises specializing in garbage disposal at landfills are given. The role of Russian public organizations for the elimination of unauthorized dumps is analyzed, the open network resource “Interactive Landfill Card” is given as an example, where citizens can mark the place of illegal waste storage or illegal dumping themselves (this resource was created within the project - political organizations public movement All-Russian Popular Front (ONF). The current state of Russian lawmaking in the field of waste disposal is analyzed. An assessment of the state of separate garbage collection in Petrozavodsk is given, the most significant enterprises of this city dealing with recycling and recycling metallurgy, batteries and other special waste are given.

Nowadays an environmental problem related to the utilization of household waste is relevant in the world. The following types of waste are distinguished: household, construction, industrial, agricultural, radioactive. The goal of our research was, first of all, solid household waste disposed of in the city of Petrozavodsk.

The main enterprises that deal with garbage collection from Petrozavodsk and its surroundings to this landfill are:

- “Avtospetstrans” is the only municipal institution in Petrozavodsk for garbage collection today; over 2,000 eurocontainers are exported daily from Petrozavodsk and its suburbs.
- "Ozone" - a private enterprise.
- “Ecoservice” is a private enterprise.

In addition, smaller enterprises carry out garbage collection - about 20 organizations in total deal with garbage collection. Our tasks also included recording and analyzing uncharted dumps in Petrozavodsk and its environs.

According to our data there is one officially authorized dump of household waste in Petrozavodsk today; it is in the area of the Orzega village. About 200 tons of garbage is brought to the landfill daily. Waste placed at this landfill is compacted and left for self-decomposition. The landfill is fenced, guarded, there is an access system, no outside entrance to the landfill is allowed. Our car journey to this dump took about one and a half hour because of a very bad road, which only trucks and container ships
can drive. Note that there was a big fire, smoke and smell in 2015 at this dump, which was felt in the city and caused a great public outcry. The observation mode and the number of sampling points are adjusted in the process of monitoring at all stages of the landfill after receiving the results of observations for the hydrological year according to established MPC (maximum permissible concentration) (table 1).

Table 1. The results of the quantitative chemical analysis of surface water of the solid waste facility, Orzega (Minutes dated 09/01/2019).

| No | Name of indicators; measurement unit | MPC | Analysis data |
|----|--------------------------------------|-----|---------------|
|    |                                      |     | Collection points |
|    |                                      |     | No1 | No2 | No3 |
| 1  | PH medium: pH                         | 6.5-8.5 | 3.93 | 7.92 | 5.52 |
| 2  | COD: Mg / dm³                         | 73  | 710 | 70 |
| 3  | OD5: mg / dm³                         | 2.7 | 40  | 1.28 |
| 4  | Dry residue: mg / dm³                 | 1000 | 170 | 3020 | 87 |
| 5  | Chlorides: mg / dm³                   | 300  | 1.5 | 630 | 3.4 |
| 6  | Sulfites: mg / dm³                    | 100  | 1.22 | 18.2 | 2.6 |
| 7  | Ammonium ion: g / dm³                 | 0.5  | 1.5 | >4  | 0.9 |
| 8  | Nitrite ion: g / dm³                  | 0.08 | <0.02 | 0.108 | <0.02 |
| 9  | Nitrate ion: g / dm³                  | 40   | <0.01 | 0.47  | 0.161 |
| 10 | Lithium: mg / dm²                     | 0.08 | 0.013 | 0.151 | 0.012 |
| 11 | Mercury: mg / dm³                     | 0.00001 | <0.00001 | <0.00001 | <0.00001 |
| 12 | Oil products: mg / dm³                | 0.05 | 0.05 | 0.1 | <0.005 |
| 13 | Total iron: mg / dm³                  | 0.1  | 1.9 | 2.1 | 0.72 |
| 14 | Calcium: mg / dm³ 180                 | 180  | 1.82 | >50 | 2.4 |
| 15 | Magnesium: mg / dm³                   | 40   | 0.25 | >50 | 0.95 |
| 16 | Hydrocarbonates: mg / dm³             | –    | <10  | >300 | 16 |
| 17 | Copper: mg / dm³                      | 0.0001 | 0.0034 | 0.0039 | <0.001 |
| 18 | Arsenic: mg / dm³                     | 0.05 | <0.005 | 0.0012 | <0.005 |
| 19 | Lead: mg / dm³                        | 0.006 | 0.0026 | <0.002 | <0.002 |
| 20 | Barium: mg / dm³                      | 0.74 | 0.017 | 0.34 | 0.0099 |
| 21 | Chromium: mg / dm³                    | 0.07  | 0.0034 | 0.056 | 0.0019 |
| 22 | Cadmium: mg / dm³                     | 0.005 | <0.0001 | 0.00015 | <0.0001 |
| 23 | Organic carbon: mg / dm³              | –    | 13.32 | >250 | 104.6 |
| 24 | Cyanides: mg / dm³                    | 0.05 | <0.005 | <0.005 | <0.005 |

Notes. Point No1 at the beginning of the reclamation ditch at 20m from the western boundary of the landfill point No2, the source of the nameless stream 50 m east of the landfill, in the region of oil cards point No3 in the place of the confluence of the nameless stream into the river in the 2700 m southeast of the landfill.

These are methods of sampling held in accordance with international standards [1-8]. The selection of point samples is made in accordance with:

- the general requirements of GOST 17.5.05-85;
• the requirements for methods for the determination of petroleum products in natural and waste waters GOST 17.1.4.01-80;
• the requirements for storage and transportation.

229 unauthorized landfills and littered areas were found in Karelia in 2018 on a total area of 34.3 hectares with a volume of 46.7 thousand cubic meters. In total, 81 unauthorized landfills with a total area of 6.9 hectares were eliminated in 2018.

62 unauthorized dumps in Petrozavodsk in 2017 and 37 large unauthorized dumps were liquidated in 2017. It should be noted here that there are a number of public organizations in Karelia and Petrozavodsk, one of the activities is the elimination of landfills. For example, the coalition of social and political organizations, the All-Russian Popular Front (ONF), created in May 2011 at the suggestion of Russian Prime Minister Vladimir Putin, proposed the “General cleaning” project which allows people who are ready to participate in cleaning a number of “garbage facilities”, to contribute to the improvement of the environmental situation by becoming volunteers. In general, the project is aimed at increasing the effectiveness of public control by the citizens over the sanitary condition of their region. As a part of the project, an open network resource “Interactive Landfill Map” was launched, where the citizens can mark the place of illegal dumping of garbage or illegal dumping sites (figure 1).

Figure 1. Interactive Landfill Card (Electronic resource: Project: General cleaning / All-Russian People's Front. https://onf.ru/project/46338/news/).

One of the most famous landfills is located in New Vilga. We conducted a survey of this landfill. We were greeted by a rickety closed barrier unfenced territory and a large number of dogs. The dump itself is small and next to an unknown house where someone lives.

According to the Russian legislation, namely, the Administrative Offenses Code of the Russian Federation of 2001, organizing an unauthorized landfill provides liability in the form of a fine of 1,000 rubles for citizens, 10,000 rubles for officials and 20,000 rubles for organizations. Repeated committing of an administrative offense entails the imposition of a fine on the citizens in the amount of five thousand rubles; on officials - thirty thousand rubles; on legal entities - from fifty thousand to one hundred thousand rubles.
According to the Federal Law “On Production and Consumption Wastes”, December 31, 2017, wastes that are a subject to recycling must be recycled, they cannot be disposed anymore. This applies primarily to packaging, unusable clothing, household appliances. The list of this waste is currently inaccurate and will be compiled by the Ministry of Environment.

According to our data, there are several dozen companies in Petrozavodsk at the moment doing recycling metallurgy, batteries and accumulators. The largest of them are:

- Alliance Invest - scrap metal, st. Khalturina, 6;
- Production company "Valmet" - recycling, 5B Baltic Street;
- “KTV-Vesta” - a tree, 82 Pervomaysky Avenue;
- “MeteM” - non-ferrous metals, recycled materials, 70B Zaitseva Street;
- “PKF Vtormet” - recycled materials; 21 Varlamov Street;
- “Onega Industrial Group” - scrap metal, 1 Belomorskaya Street;
- “VUK” - batteries and accumulators, 14 Moscow Street;
- Ecological enterprise "Mercury" - mercury, 25 Rigachina Street.

Also, in the course of our study, we found out that the majority of the city ecological organizations in their activities place an important role on the organization of separate garbage collection. So, in PetrSU there is a movement dealing with the problem of garbage, “PetrSU for a separate collection!”, It organizes gatherings every first and third Sunday of the month together with the Ecological Movement “Green Wave”. These containers are used for recycling waste paper, plastic bottles, bottles, buckets and cans, glass containers, aluminum cans, plastic bottle caps.

Waste containing mercury (lamps, thermometers, etc.) belong to the highest – the 1st class of danger.

Reception of mercury waste passes every third Thursday of the month. Batteries contain heavy metals and are classified as hazard class 2. According to our data, they can be put into a container in the city hall in the White Nights apartment complex. The organizers of the collection of batteries and mercury waste are the Administration of Petrozavodsk and the private enterprise Mercury (figure 2).

![Figure 2. Separate collection of household waste in Petrozavodsk.](image)
a) A container for collecting batteries and accumulators in the White Nights appartment Complex (17 Entuziastov Street); b) Separate waste collection tank at Oktyabrsky Avenue, 59 (authors photo).

The first tanks for the first separate collection of garbage in Petrozavodsk began to be installed in 2010. In 2012, about 40 tanks were installed at closed sites in the HOA, medical and educational...
institutions. They are green rectangular cubes of 4 cubic meters with longitudinal slots for storing the cardboard inside. There is an inscription on the containers: cardboard, paper. The cardboard is folded longitudinally. In 2013, additional 50 tanks appeared for separate collection of garbage for the City Day in Petrozavodsk: cardboard and paper. They are installed on municipal container sites. This decision was made by the municipal enterprise Avtospetstrans. Nowadays there are many places with containers for separate collection of garbage in Petrozavodsk.

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