PILOT PROJECT

Development of the Concept "Collection, Separation and Processing of Solid Household Waste in Gusev Urban District, Kaliningradskaya Oblast, Russian Federation"

Information on the Status of the Waste Management System and Its Development Perspectives

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Introduction

Gusev Urban District is situated in the eastern part of Kaliningradskaya Oblast. The District's boundaries were established in accordance with the Decree No. 40 of the Regional Duma of Kaliningradskaya Oblast of June 4, 1998. №40. To the north the District borders Krasnoznamensky District, to the east it borders Nesterovsky District, to the south - Ozersky District and to the west - Chernyakhovsky District. The area of the Municipality "Gusev Urban District" is 642.7 square km. 28 100 residents live in the territory.
- area of the city – 16.25 square km
- area occupied by forests – 7.9 thousand ha
- agricultural land - 34 thousand ha, including tillage - 20 thousand ha.

Gusev Urban District incorporates the following territorial departments:
- Krasnogorsky – 1032.5 ha – 1796 inhabitants
- Mayakovsky – 1319.3 ha – 964 inhabitants
- Furmanovsky – 243 ha – 1477 inhabitants
- Maysky – 34.47 ha – 821 inhabitants
- Pokrovsky – 102.79 ha – 1115 inhabitants
- Lipoovsky – 312 ha – 1912 inhabitants.

The Town of Gusev, which is situated on the picturesque banks of the Pissa and Krasnaya Rivers, is the District's administrative center.

To activate efforts aimed at preventing pollution by household waste in the district's territory, the Program "Comprehensive Upgrading of Settlements' Territories for 2006-2011" was developed and approved by the Resolution No.103 of the District Deputies Council dated 26.07.2006.

A special waste collection and separation enterprise, the open joint stock "Managing Company," which has a license to collect, use, sterilize, transport and dispose of hazardous waste, dated March 22, 2007, and which incorporates a Sanitation and Cleaning Division, operates in Gusev Urban District. The Division operates six days a week, except for Sundays. It employs 15 people:
- 1 master in charge of upgrading settlements' territories;
- 5 drivers of container trucks;
- 1 tractor driver (a T-16 loader);
- 5 loaders;
- 3 workers in charge of upgrading settlements' territories.

The existing waste management system is outdated and can no longer meet the current-day needs of the district's residents. Unfortunately, a comprehensive, market-oriented system for management of production and consumption waste which would be based on ecological

principles has not been created in any of the Russian regions.

Not only has the overall amount of waste increased substantially within the past 10-15 years, but new types of solid household waste which require other waste management methods have emerged.

In Kaliningradskaya Oblast, up to 97% of waste is being transported to dump sites, which do not generally conform to the norms and standards. As a result, a number of ecological problems have emerged and they continue to worsen. At the same time, issues related to economical use of scarce land as well as rational use of secondary resources have become more important.

The presented Concept involves setup of a contemporary waste processing and utilization enterprise as well as proposals for optimization of the solid waste management system.

Section 1. The system for collection, separation and processing of solid household waste in Kaliningradskaya Oblast

Step-by-step transition to a modernized system for collection, separation and processing of solid household waste using advanced Russian and international technologies (biological, mechanical, physical-chemical and thermal processing) as well as development of new and ecologically safe landfills (dumpsites) are proposed.

Aim: creation of a contemporary and effective waste management system that would promote ecological recovery and economic development of Gusev Urban District (Kaliningradskaya Oblast).

The key projects are as follows:

- Optimization of the existing solid waste collection system in the district's municipality and rural settlements through technical re-equipment of waste collection sites and use of a rational container transportation system for the transportation of solid waste;
- Creation of a regional system for industrial processing of solid household waste through construction of a processing complex that will employ contemporary Russian as well as international technologies and equipment, ensuring environmental protection and ecologically safe operation of landfills;
- step-by-step re-cultivation and closure of existing solid household waste landfills (dumpsites), with processing of accumulated waste in garbage processing complexes; educative and advertising activities covering the fundamentals of ecological education for population . -{}-

The municipal unitary enterprise "Waste Utilization" was set up to facilitate implementation of the project and startup of industrial enterprises. Our Concept provides for agreed solutions to ecological, economic and social problems within administrative divisions. New well-paid employment opportunities, including ones for physically disabled employees and vulnerable social groups, are being created.

1.1 Content of the projects

The Concept provides for establishment of a contemporary, comprehensive solid household waste management enterprise in Gusev Urban District within **1.5-2 years.**

Garbage processing complexes, which will have the required equipment and infrastructure to process solid household waste at industrial scale while helping to minimize the amount of waste stored in landfills, are the essential component of the infrastructure being developed.

The following tasks have been planned:

- **Optimization** of existing organization of solid household waste collection in the district's municipality and rural settlements through expansion and modernization of initial solid household waste collection sites as well as use of new types of containers and rational transportation patterns;
- **Construction** of a garbage processing **complex,** which will be equipped with classifying circuits and solid household waste utilization machinery;
- **Construction of a landfill** to store residual solid household waste;
- **Setup of a transportation company,** which will have specialized contemporary machinery for container transportation and utilization of waste in landfills, **to facilitate** solid household waste management in the region;
- **Creation** of a network of enterprises **to collect secondary raw materials** and carry out advanced processing of **secondary raw** materials (as part of enterprises affiliated with the garbage processing complex) within 1-1.5 years;
- **Re-cultivation** of the existing landfill and unregulated dumpsites within 3-5 years, with removal and processing of accumulated waste in the garbage processing complex.

1.2 Infrastructure for the solid household waste management system

There are 3 regional service centers in Kaliningradskaya Oblast **(Kaliningradsky, Gusevsky and Nemansky)** that collect solid household waste from cities, municipal districts and rural settlements. .

Table 1. Regional centers and amount of collected solid household waste

№	Regional center (project name)	Districts served	Amount of waste collected per year (thousand tons)	Amount of waste collected per day (tons)
1	Kaliningradsky	Kaliningrad, Zelenogradsky, Gvardeysky, Bagrationovsky, Pravdinsky, Guryevsky and Polessky Districts; Yantarny Town, Svetlogorsk, Baltiysk	233,1	638
2	Gusevsky	Chernyakhovsk, Gusev, Nesterov, Ozersk, Krasnoznamensk	41,4	113,3
3	Nemansky	Nemansky, Slavsky, Sovetsk Town	28,3	77,6

The **Gusevsky** Regional Center is based in the territory of **Mayakovsky Territorial Department** and serves the eastern part of the Oblast**.** The Oblast incorporates:

- **A garbage processing complex**, with a throughput of up to **40** thousand tons of solid household waste per year;
- **A landfill** used for burial of residual solid household waste (with an area of 5.5 ha).

When choosing territories for the construction of the garbage processing complexes and the landfill, the following criteria were taken into consideration:

- Construction sites were adequately distant from residential constructions and water abstraction stations;
- Nature management and land-use management conditions in the building site did not prohibit this type of activity;
- Social influence conditions that will affect residents during operation of enterprises were assessed as minimal;
- Estimates regarding increase in solid household waste generation in the regions were considered when planning the productive capacity of the complexes.

1.3 Organization of initial solid household waste collection

The managing company ensures:
In the municipal solid household waste management sector:

- Modernization of existing solid household waste collection methods through construction and reconstruction of container areas and installation of additional tanks (wheeled lidded metallic and plastic containers, with a capacity of 1.1 m^3)

In the individual residential solid household waste management sector:

- Construction of initial solid household waste collection stations (concreted sites with container bunkers which, on a regular basis, are transported in container vehicles equipped with hoisting mechanisms).

1.4. Organization of solid household waste transportation

Container transportation from solid household waste collection stations to the garbage processing complex and technical-technological maintenance of the landfill is carried out using automotive vehicles of the municipal unitary enterprise “Waste Utilization.”

Based on available information on road conditions and seasonal restrictions on travel of automotive vehicles in Gusev District, the maximum load-carrying capacity of containers and other specialized vehicles used for the transportation of solid household waste has been set at 20 tons (at the initial stage).

The core unit of the enterprise, which must ensure technical maintenance, repair-and-renewal operations and regional transportation management, will be based in the garbage processing complex.

Key divisions:

- A service center repairing basic chassis of specialized vehicles as well as loading and unloading machinery;
- A detachable equipment service center, a repair shop for containers delivering solid household waste, a gasoline station;
- A data processing center with an automated control system supervising traffic routes and keeping track of wastes turnover in real-time mode.

Route maintenance is calculated separately for each individual territory by request of municipal services.

To ensure compliance with ecological standards, the following vehicles are used for transportation: refuse collection vehicles equipped with molding devices for solid household

waste, hermetical containers, baling of secondary raw materials, compression of solid household waste to be utilized and protective wrapping.
The vehicle pool is furnished with specialized automotive vehicles with a load-carrying capacity of 10-20 tons.

Table 1.2 Estimated quantity of primary automotive vehicles and specialized containers

Type of equipment, vehicle	Number of items	Producer, trademark, type
Refuse collection vehicles equipped with presswork machines to remove solid household waste collected in tanks in urban settlements: • medium-duty capacity – up to 10 m³, compression rate – 5/1 • heavy-duty capacity – 15-20 m³, rate – 6/1	4 2	Standard "Euro-3," a diesel engine, "Mercedes" auto chassis
Tractive vehicles with a combined "multilift" system, with a load-carrying capacity of 10 and 20 tons, used for transportation of: • bulky waste containers from urban settlements; • solid household waste containers from collection centers based in rural areas; • "KZM" containers from solid household waste collection and accumulation centers, equipped with compactors, with a load-carrying capacity of 20 tons	2 1 1	"Mercedes" auto chassis , Standard "Euro-3," a cross-functional "multilift" hub to help load containers of given module range
Modules; a hydraulic compactor PSG-1 with a "KZM" (enclosed-type) container, with a compression rate of 6/1, to cater for large trade complexes and public events, capacity - 8 and 15 m³	Compactors 1 Containers 3	Producer - "Ryazhsky Auto Repair Plant" (Russia), under Italian license
Containers used for collection of solid household waste in municipalities, with a capacity of 1.1 m³. Metal, zinc-plated, wheeled, lidded, equipped with mounts to facilitate transshipment onto refuse	800	Producer - "ZILSTROYMASH" (Russia), under German license

collection vehicles		
Containers (bunkers) used for accumulation of bulky waste in municipal districts and solid household waste in rural settlements	80	Placement of production orders to be fulfilled in Kaliningradskaya Oblast
Vehicles used for regular cleansing and disinfection of container tanks within solid household waste collection areas, with a lateral loading system	1	Detachable equipment (Italy, Germany)
Equipment used for maintenance of landfills and dumpsite rehabilitation (compactors, auto-loaders, compactors, excavating machines, bulldozers)	5	"BALA" (Sweden) "REDOX" (Belgium) "DOPPSTADT" (Germany)

Final clarification of quantity and modifications of auto vehicles and containers is conducted at the stage of contract signing with the producer.
The garbage processing complex and the landfill are furnished with specialized equipment in accordance with design specifications developed for each object.

Table 1.3 Planned technical provision for initial solid household waste collection in municipal okrugs and rural settlements of Kaliningradskaya Oblast

Regional design service centers	Population (thousand people)	Amount of solid household waste (thousand tons per year)	Unit requirements for solid household waste (tons per person per year)	Amount of solid household waste (tons per day)	Numb. of tanks (items)	Numb. of stations	Numb. of specialized vehicles
Kaliningradsky	734,4	232,9	0,29	638,7	2295	1089	35
Gusevsky	122,2	41,4	0,32	113,3	412	175	10
Nemansky	98,1	28,3	0,3	77,6	282	120	6
Total:	954,7	302,6		829,6	3016	1384	51*

* Additionally, 3 items of reserve vehicles and 3 items of container cleaning machines = 57 items of specialized vehicles

The Gusevsky Regional Center

Settlements	Population (thousand people)	Amount of solid household waste (thousand tons per year)	Unit requirements for solid household waste (tons per person per year)	Amount of solid household waste (tons per day)	Numb. of tanks (items)	Numb. of stations	Numb of specialized vehicles
1.Chernyakhovsk	34,4	11,4	0,33	31,2	113	56	2
2. Ozersk	5,6	2,2	0,39	6,0	22	12	1

3. Selskoe	29,1	9,6	0,33	26,3	96	32	2
4. Gusev	20,4	6,7	0,33	18,3	66	33	2
5. Nesterov	5,0	2,4	0,49	6,6	24	12	1
6. Selskoe	27,7	9,1	0,33	24,9	91	30	2
Total in the region	122,2	41,4		113,3	412		10

Section 2. Processing of solid household waste and utilization of residual waste

2.1 Composition of solid household waste

Solid household wastes consist of a mixture of ingredients: paper waste, plastics, glass, metal, textiles and food waste, which, in the case of long-term storage, release harmful substances in various phase states.
The composition of solid household waste depends on the climatic zone, the season and the type of settlement. The average percentage composition of solid household waste which is typical for large Russian cities is shown below:

organic matters – 26.8%

plastics - 7%

stones – 0.7%

bones – 1%

wood – 1.8%

metals – 3.7%

glass – 4.4%

textiles - 5%

paper waste – 38.8%

Statistical data provided by operating solid household waste processing enterprises show that the composition of secondary raw materials depends on the wellbeing of residents (determined on the basis of the cost of 1 m² of occupied space).

Brief analysis of solid household waste processing and utilization methods

Thermochemical processing technologies

Waste pyrolysis (thermal destruction with a limited amount of oxygen) is carried out in high temperature blast furnaces charged with low-grade fuel. As a result of processing, refuse burnout, off-grade metal and combustible blast furnace gas (a mixture of hydrogen and carbon monoxide), which is used to generate electric energy and heat, are produced. In terms of its machinery arrangement, the plant resembles a metallurgic one, requires considerable capital expenditures and a large land area.
Plasma processing of solid household waste in high temperature blast furnaces.
The process involves manageable oxidation of solid household waste on the surface of melted slag within the plasma flames coverage zone, at temperatures reaching 2500-3000 K, with transformation of the components of solid household waste to molten metal, melted slag and the gas phase. Due to the use of plasma heating, thermal conditions and the composition of gas environment at temperatures reaching up to 3000 K can be controlled regardless of the composition of solid household waste.

Useful derivatives are as follows: refuse burnout, metal, synthesis gas and electric energy. However, high and, as a rule, excessive temperatures limit the operation life of the device and lead to unreasonably high levels of specific energy consumption used for the processing of 1 ton of solid household waste.

Waste burning plants (WBPs)

- Incineration on fire-grates equipped with scrapers, with incineration temperatures averaging 800-850 C
- Use of so-called "fluidized bed" technologies, with incineration temperatures reaching 900-950 C. During the process, ashes repetitively pass through the "fluidized bed" and break down into fine powder.

The relatively low solid household waste incineration temperatures generate highly toxic dioxins, which are collected in multi-component deactivation furnace systems and pollution abatement systems incorporating sorbent columns with activated carbon. Exhausted sorbents containing dioxins that have a half-life of around 200 years are stored in special storage rooms for long periods.

Experience of the Moscow-based waste burning plant was studied to facilitate critical decision making regarding identification of the waste utilization technology that will be used in Kaliningradskaya Oblast.

Annually, the No.2 WBP receives up to 150,000 tons of waste to be utilized. Heat which is generated as a result of waste incineration is utilized for electric energy production. Refuse burnout is used for production of curb stone and is used in road construction.

For Moscow residents, rates for solid household waste withdrawal are set at 242 rubles per person per year, which is 30% higher than that for residents of Kaliningrad. Nevertheless, funds received from residents are insufficient to cover the expenses for collection and utilization of waste at the waste burning plant.

To ensure loss-free operation, the budget of Moscow provides subsidies to enterprises providing waste transportation services, amounting to 1250 rubles per 1 ton of waste delivered to the plant.. Сданных на завод отходов. The waste reception rate, which is 1380 rubles per ton, does not provide for coverage of investment costs, but merely helps to covers the enterprise's operating expenditures.

Capital investments required to set up a similar plant amount to 550-600 EUR per ton of rated capacity, 30% of which is comprised of expenditure on installation of an effective gas cleaning and ash disposal system.

Presently, the Government of Moscow has decided to dismantle the waste burning plant in Altufievo (the equipment was made in France and solid household waste is incinerated on fire-grates), grading it as an unprofitable and ecologically dangerous object.

Considering the high degree of ecological danger which emissions resulting from solid household waste incineration pose for smaller territories, high investment costs and the need for budget subsidies to cover operating expenses, construction of a waste burning plant in Kaliningradskaya Oblast appears unprofitable.

Biological processing technologies

As an alternative to incineration, non-thermal methods of solid household waste processing are used in international practice, aerobic and anaerobic fermentation (biochemical decomposition of the organic fraction of solid household waste by microorganisms, with generation of composts and utilization of released biogas) being the most widespread ones.

Aerobic processing (occurs in the presence of an oxidizing agent) of the organic fraction of solid household waste into composts is conducted in France, Italy, Germany, Netherlands, USA and Russia. A complete cycle of processing - approximately 3 months. Key disadvantages of the technology - high concentration of heavy metal salts in composts, which limits its use in the agricultural industry.

Anaerobic (without access to air) processing of organic components into biogas (50% - methane, 50% - carbon dioxide), which is the waste product of anaerobic bacteria; is carried out in hermetic methane tanks using anaerobic bacteria. Dried gas is transferred to a diesel generator as fuel and is used to generate electric energy.

Data received from waste composting (aerobic and anaerobic) facilities are effectively used in EU countries (Spain, Netherlands, France, Germany, Denmark). Among tested Russian technologies, engineering efforts of the Institute of Medical and Biological Problems are being implemented.

Solid household waste technologies used in landfills

In international practice, the majority of solid household waste is sorted depending on its type and is then reused in the production of goods.

A mixture of hand-sorting methods and mechanical sorting devices (which are commercially manufactured by Russian and international enterprises) is used.

Refuse collection vehicles are weighed and then directed to a reception area, from which solid household waste is submitted for processing. Consistency of solid household waste feed is ensured thanks to the required capacity and structure of the receiving bunker and use of plate feeders. The length of the receiving bunker equipped with a plate feeder is chosen depending on the number of unloading stations.

Burial of solid household waste in landfills

Isolation of waste storage sites themselves or sites where residual waste from garbage recycling plants is landfilled is the most widespread method of solid household waste utilization.

Even territory, which prevents atmospheric fallout from washing out waste into land and water, is one of landfill siting criteria. The distance between the sanitary-hygienic zone and a residential area should be not less than 500 m.

Non-rational choice of solid household waste burial sites and technologies as well as violation of environmental safety regulations may result in penetration of hazardous run-offs from landfills into underground reservoirs. Methane, which is generated in the core of a dump, self ignites periodically and causes waste to smolder, with results in the generation of dioxins from plastics contained in solid household waste. As decomposition progresses, waste settles and territories remain economically unusable for long-term periods. Solid household waste decomposition: paper decomposes within 10 years, polyethylene bags – over 200 years, plastic materials – within 500 years, glass – over 1000 years.

2.3 Proposed solid household waste processing technologies to be implemented in garbage processing complexes based in Kaliningradskaya Oblast

The modern solid household waste processing technologies which are implemented using tested equipment manufactured by Russian and international producers and will be used in garbage processing complexes that will proposedly be constructed in Kaliningradskaya Oblast are as follows.

In terms of the content of their technologies, garbage processing complexes are **full-blown sorting and processing** factories.

Secondary raw materials are thoroughly sorted in accordance with requirements of processing enterprises. In particular, paper waste is divided into cardboard and paper, polymer substances – into 5-6 fractions depending on the production technology, metal – into non-ferrous and ferrous metals, glass – depending on color etc.

Production units that will process individual types of secondary raw materials into capitalized products (the range of products is determined depending on profitability and market conditions) are envisaged.

Unusable waste undergoes deep compaction (with humidity reduction up to 2-5%), is wrapped in a film and, in the form of briquettes, is transferred to the landfill located near the garbage processing complex. The liquid fraction of waste that was exuded during compaction is transferred to disposal facilities.

The solid household waste processing technology used in garbage processing complexes is a systematic combination of waste sorting with production of secondary raw materials, biodegradation with generation of an energy carrier, the biogas, and production of electric energy and heat (cold) using biogas, both for own use and for submission to production units that process secondary raw materials into capitalized products.

Key technological elements of a garbage processing complex:

- **Automated entry control facility:**

Recordkeeping, registration, weighing of vehicles, cleansing and disinfection of vehicles;

- **Mechanized solid household waste unloading area**:

Platform for 5 items of vehicles; receiving bunkers equipped with devices for automated cleaning of unloading sites;

- **Mechanized sorting area**:

System of compact screen drums with 40-250 mm grids used for separation of solid household waste and ultraviolet disinfection, feed lines for transfer of sorted fractions (metal, glass, stones etc.) to receiving bunkers, feed lines for transfer of fractions according to their size (aeroseparation for paper, cardboard, films) and composition to hand-sorting and compression molding areas

- Compression molder used for molding of solid household waste residuals; compression molding line used for molding of secondary raw materials;
- Plastics processing unit.

Equipment: sorting lines for solid household waste and auxiliary equipment depending on individual projects developed for each garbage processing complex.

- **Biogas extraction industry (anaerobic attenuation of organic matter), focusing on the extraction of biogas** from ballast waste; an energy production unit (a co-

generator, methane tanks, methane-run diesel generators) generating electric and heating energy for the complex;

- **Compost production facilities** (extraction of toxic heavy metal salts and preparation of safe and biologically active soil blends from cleared waste);
- **Facility for collection** and extraction of filtered liquid residuum content from solid household waste, with biological cleansing which brings the material in line with sanitary norms;
- **Thermal processing facility** for processing of medical waste and expired-term medicines;
- Bulky waste **processing facility**;
- **Automobile tires and accumulator batteries processing facilities.**

Equipment: manufactured by Russian producers in accordance with the project documentation.

Comparative technical-economic indicators and ecological indicators of technologies used for industrial disinfection and utilization of 1 ton of solid household waste

Specific indicators	Unit of measurement	Landfill	Incineration, heat utilization	Sorting + aerobic composting	Sorting + anaerobic composting + electric energy and heat generation
Investment expenditures per ton per year	$/ton	individual	180-220	120-150	40
Operating costs	$/ton	3-4	32-40	24-26	22,5
Energy consumption	kW-hr/ton	3-6	26-50	22-28	27
Labor costs	man-day/ton	0,05-0,1	0,2-0,4	0,2-0,3	0,58
Metal consumption	kg/ton	0,3-0,4	9-17	19-21	3
Area	m²/t	-	0,25-0,5	0,4-0,6	0,17

Ecological indicators

1.	**2.**	**3.**	**4.**	**5.**	**6.**
Degree and period of disinfection		**Not less than 20 years**	**Complete within 1 hour**	**2 days (sporification excluded)**	**Complete - within 7 days**
Presence of production waste	**% from the mass of solid household waste**		**25-30 (ashes, refuse burnout)**	**25-30 (non-compostable fractions)**	**None**
Soil pollution		**Landfill area pollution**	**Insignificant (refuse burnout)**	**None**	**None**
Underground water pollution		**Possible**	**None**	**None**	**None**
Atmosphere pollution		**Possible, insignificant**	**Within the limits of marginal norms**	**None**	**None**

Amount of derived products per 1 ton of solid household waste

Heat	**Gcal /ton**	**-**	**1,5**	**-**	**3**
Electric energy	**kW-hr/ton**	**-**			**220**
Composts	**%**	**-**	**-**	**60**	**20**
Ferrous metal	**%**	**-**	**2**	**3**	**1,4**
Non-ferrous metal	**%**	**-**	**-**	**0,2-0,8**	**0,01**
Fuel pellets	**%**	**-**	**-**	**-**	**-**
Paper waste	**%**	**-**	**-**	**_**	**28**
Plastics	**%**	**-**	**-**	**-**	**6,6**
Textiles	**%**	**-**	**-**	**-**	**2,8**
Glass	**%**	**-**	**-**	**-**	**1,8**
Wood	**%**	**-**	**-**	**-**	**0,8**

2.4 Waste disposal

161 landfills (dumpsites) operate in the District. Their distribution depending upon quantity, area and capacity is presented in Table 2.2, which shows the total area occupied by dumpsites under each group.

Table 2.2 List of operating solid household waste landfills located in Kaliningradskaya Oblast and areas served by them

1	Kosmodemyanskogo Village, Baltiyskoe Freeway	Kaliningrad
2	Kruglovo Village, Zelenogradsky District	Baltiysky Urban District, Yantarny Urban District, Poinersky, Zelenogradsky District
3	Sovetsk	Sovetsky Urban District
4	Gusev	Gusev Urban District
5	Chernyakhovsk	Chernyakhovsky Urban District
6	Elniki Village Ельники	Gvardeysky Urban District
7	Mamonovo	Mamonovsky Urban District
8	Ladushkin	Ladushkinsky Urban District
9	Ozersk	Ozersky Urban District
10	Pravdinsk	Pravdinsky District
11	Krasnoznamensk	Krasnoznamensky District
12	Ilyichevka Village Ильичевка	Guryevsky District
13	Slavsk	Slavsky District
14	Bolshakovo Village Большаково	Slavsky District
15	Dolgorukovnesterovo Village Долгоруковнестерово	Bagrationovsky District
16	Nesterov	Nesterovsky District
17	Polessk	Polessky District
18	Golovkino Village	Polessky District
19	Neman	Nemansky District

Table 2.3 Classification of dumpsites located in Kaliningradskaya Oblast

Group according to size	Area, m³	Number of sites		Area		Estimated overall volume	
		Items	%	Ha	%	Million, m³	%
1	Less than 100	75	46	10,6	8	0,004	0,01
2	100-1000	40	25	16,2	12	0,017	0,05
3	1000-10000	24	15	31,6	24	0,13	0,37
4	10000-50000	5	3	7,6	6	0,12	0,35
5	50000-100000	11	7	55	24	2,3	6.62
6	More than 100 000	6	4	60	27	32,1	92,51
	Total	161	100	182,1	100	34,7	100

Group 1 includes illegal dumpsites located in rural areas as well as stations that are no longer used.

Group 2 is located in rural areas in the south and west of the District.

Group 3 is used in settlements with 1500-2500 residents.

Group 4 serves larger towns; two dumpsites within this group have been closed.

Group 5 – 11 interdistrict dumpsites.

Group 6 – dumpsites located in the District's largest towns. This group includes the largest "Kosmodemyanskaya Dumpsite," which has been serving Kaliningrad since 1978. Its capacity is estimated at 22 million m³, which constitutes 2/3 of the overall capacity of the District's dumpsites. Other sites in this group serve Sovetsk, Chernyakhovsk, Zelenogorsk (2 sites) and Svetly Towns. 92.5% of the overall amount of accumulated waste is stored in the 6 sites that belong to this group.

2.5 Closure (rehabilitation) of existing landfills

Technologies for closure (rehabilitation) of existing landfills belonging to various risk classes

There are 161 unsanctioned landfills (dumpsites) that must be closed (rehabilitated). They occupy an area of 182.1 ha.

Category 1: burial area - less than 10 thousand m².

- Coverage of waste with a subsoil layer (75-cm) and a top soil layer (25 cm).

Category 2: burial area - 10.0 – 50.0 thousand m².

- Coverage of waste using the same system which is used for Category 1;
- If deposited waste is thicker than 5 m and organic waste is present, biogas discharge sites are set up.

Category 3: burial area - 50.0 – 100.0 thousand m².

- Coverage of waste with a gas drain layer (50 cm), a subsoil layer (75 cm) and a soil layer (25 cm) to reduce the amount of generated filtrate and eliminate landfill biogas emissions;
- Installation of a pipe network for biogas collection;
- Collection of the active filtrate if high concentrations of polluting agents exceeding norms established by legislation or set for protection of underground water are found in the filtrate;
- Removal of active landfill biogas and cleansing in a flare system or use of biogas as an energy source;
- Organization of monitoring and control of areas located above and below drilling areas;

Category 4: burial area - more than 100.0 thousand m².

- In addition to technologies mentioned under Category 3, reflecting drill-holes and protection measures against underground water pollution are used.

Section 3. Organization of work at landfills created for residual solid household waste utilization

Residual waste undergoes deep compaction in garbage processing complexes (with humidity reduction up to 1-2%) and is compacted into briquettes 300-500 kg each.

The briquette bundle is cylindrical, its dimensions are as follows: diameter – 120 cm, height – 120 cm, volume – 1.3 m^3.

The briquette is formed under pressure during continuous rotation, which ensures almost total absence of air inside the bundle.

The briquette is wrapped in polyethylene net, which fixes its shape, is covered with a film (a 6-layer one) and transferred to a conveyor.
Then, briquettes are transported to the landfill near the garbage processing complex using auto loaders.

At the landfill, the briquettes (bundles) are arranged in stacks, which, if need be, may be pulled down and placed on a prepared surface using a film-covered drain pipe system.

Stacks are covered with ground to preserve their durability and shape and ensure insulation against rainwater.

If stored in this manner, waste is not susceptible to climatic influences, does not generate smell, is not prone to wind drift, does not generate gas emissions, nitrate precipitation does not occur and the risk of spontaneous ignition is ruled out.

The height of landfills may be up to 30 m high above ground level (the loading is up 50 tons per square meter) and the length of their service may be up to 50 years.

Stacks look reasonably good and, when covered with a protective layer of compost ground, which is produced in garbage processing complexes, may be used for landscape transformation.

The equipment package includes: combined conveyors, compression molders with production capacity rates of 15 t/hr (landfill No.2) and 25 t/hr (landfill No.1) and loaders equipped with briquette grippers and carriers.

A logistic system recording the location, the morphologic composition of waste and the burial date is used during storage.

The technology and equipment have been used in 32 countries throughout the world since 1995, when they were first developed.

Thanks to the first visit of representatives of the Municipality of Odense, Mr. Sven B. Poulsen and Mrs. Helle Sehested, we were able to describe to our colleagues the waste management situation in Gusev Urban District and share our long-term plans. The guests visited an old solid household waste landfill, a municipal vehicle park and a new plot where a garbage processing complex will be built. During communication with the Danish experts we learned that a similar waste management model successfully operates in the Municipality of Odense. I studied, with great interest, the materials that were kindly provided by our Danish partners. They describe the solid household waste treatment technologies that are used in the Municipality as well as the

procedure that was used for the re-cultivation of an old dumpsite which operated from 1960 to 1994 and is currently being transformed into an Odense-based recreation zone. I heard from my colleagues about an International Training Center, which is based in the Municipality and where specialists gather together to exchange experience in the field of waste processing. This has been of great interest to us.

Due to the implementation of the pilot cooperation project between Gusev Urban District and the Municipality of Odense (Denmark) that is being realized with the assistance of the Danish Ministry of Foreign Affairs and the Embassy of the Russian Federation in Denmark, preconditions for the accomplishment of the key task – the setup of a modern waste management system in our District - have been created. Upon successful completion of this task the experience of Gusev Urban District may be used throughout the whole territory of Kaliningradskaya Oblast.