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## THE REGIONAL CONCEPTION IN THE SPHERE OF INDUSTRIAL AND DOMESTIC WASTE HANDLING

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**Abstract:** The article considers problems related to education, collection, neutralization and treatment of industrial and domestic wastes on the territory of the Nizhny Novgorod region. The necessity to modernize the whole sphere of waste treatment is shown.

**Key words:** regional conception, industrial and domestic wastes, waste handling, solid domestic wastes

### Introduction

Human activities produce huge quantities of miscellaneous industrial and domestic wastes affecting the environment. A sharp growth of consumption for the last decade has resulted in a considerable increase of quantities of solid domestic waste (SDW), as well as the increase of quantities of hazardous matters being part of them. In average, the volume of solid wastes is doubled every ten years.

Industrial and domestic wastes are sources of pollution of surface and underground waters, atmospheric air, and soil. Hundreds of thousands hectares of land are withdrawn from the economic circulation for their disposal. Arrangement of SDW landfills is the simplest and cheapest way of waste handling in Russia; therefore, about 95% of solid wastes are subject to the landfill disposal. It should be noted in this respect that in other countries this method of waste treatment is considered as one of the most low-ranked. The landfill disposal has significant drawbacks, which are greenhouse gas emission into atmosphere, filtrate discharge into ground waters and landfill area growth. The issue of waste utilization and processing is one of the most important ecological, sanitary-epidemiological and socio-economical tasks. In this connection, scientific foundations of waste neutralization, placement, storage and processing are to be developed. The concept of industrial and domestic

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waste treatment should be based, primarily, on the prevention of waste occurrence or on their minimization. In those cases when their occurrence is inevitable, wastes should be neutralized, processed and utilized. Untreatable wastes should be disposed with minimum risks for the environment. The prevention of waste occurrence can be achieved by applying low-waste resource-saving technologies, designing ecologically clean products, and using modern efficient technological processes. A basic principle of a modern system of waste management is to reduce quantities of wastes subjected to landfill disposal (Gubanov et al, 2011, Gelashvili, Koposov, Laptev, 2008).

Recycling of selective materials forming the wastes should be applied more widely. Recently the SDW composition has changed and become more complex because about 50% of SDW volumes consist of packing materials manufactured of various polymers.

#### **Actual problems of waste treatment. Discussion.**

The fundamental principle of modern system of waste management should consist in reducing quantity of waste to be disposed (Gubanov et al, 2011).

The method of recycling of selective materials contained in waste should be used more. Recently SDW content has changed and become more complex due to 50 % of its volume is consisted of packaging materials made of different polymeric materials.

The solid domestic wastes present reach resources for recycling (including ferrous, non-ferrous and rare metals). They include carbonaceous components that can be processed into fuel for power engineering.

SDW disposal or neutralization for each city and village is, first of all, an ecological problem (Gelashvili et al, 2008). It is most important that the processes of solid waste utilization do not affect the ecological safety of the city, normal functioning of its economy, living conditions of the population.

At the same time it should be noted that there is no just one general technology covering the whole spectrum of works with SDW, which are capable to process the entire flow of the wastes without harmful impact on the population and environment.

Researches have proved that significant success can be achieved partially on discrete stages of the SDW handling process (collection, transportation, neutralization, utilization, processing, composting, disposal, etc.), but in this

case all technologies and measures being used should be developed in complex, supplementing each other. This complex of technologies can solve the problem completely just when it is not only based on the latest scientific and technical achievements, but also used in combination with economic and social tools, as well as is based on the strategic, long-term and system planning.

Monitoring and assessment of waste handling results should be accompanied continuously with the development and application of programmes aimed at the efficient SDW handling at every stage of the process. A system approach should come first during the selection of scientific and methodical means to be used in the sphere of waste handling.

Annually, on our planet 50 tons/man of various raw materials are produced and transported, of which about 1-2 tons of short- and medium-lived products are manufactured that in the course of time also turn into waste. About 20% of materials are used for construction, i.e. they become long-lived wastes. According to different scientists, just 2% of raw materials are tuned into final products, which in the course of time become wastes as well (Karlovich, 2005).

Under close consideration the waste handling problem is more complex than just the scarcity of sites for new landfills. There is always a deficit of space for new landfills. Anyhow, landfills actually occupy not so much space, at least in a geographical scale: for example, for all domestic wastes produced at a modern rate in Russia during 500 years a site with dimensions 20x30 km<sup>2</sup> and a waste layer just 25 m thick would be required.

Thus, there exist interconnected environmental problems of solid domestic wastes (Table 1).

Table 1. Main aspects of SDW ecological problem

Aspect	Description
SDW volume	Continuously grows not only in absolute values, but also per capita
SDW composition	Sharply becoming more complex with increasing number of ecologically dangerous components
Population's attitude	Becoming distinctly negative to the traditional methods of waste dumping
Laws	Tougher waste handling regulations are issued on all governmental levels
New technologies	Waste utilization, including modern systems of separation, incinerator plants and landfills are used more widely
Economy	Waste management becomes more complicated. Waste utilization costs grow sharply

### **Features of problem of waste management at the present stage.**

The problem of wastes became urgent at the turn of the centuries due to:

- firstly, the increased volume of industrial wastes caused by the intensive growth of production;
- secondly, the appearance of a large number of new kinds of wastes (multiring hydrocarbons, dioxins, chlorinated hydrocarbons, etc.) during the scientific and technical revolution;
- thirdly, the increased mass of the solid domestic wastes, mainly packing materials, due to the improvement of the people's welfare.

Ecological problems connected with solid wastes and sewage sludge can be divided into two parts:

- negative impact of wastes on the environment and man's health;
- necessity to recycle and use wastes as secondary material and energy resources.

It should be noted that solid domestic wastes and sewage sludge present a rich source of recycled resources. They include carbonaceous components that can be used as fuel in power engineering. For instance, by burning 1000 kg of SDW or sewage sludge one may produce the same quantity of thermal energy as by burning 250 kg of fuel oil. But the real savings will be even higher, if we take into consideration the saved raw material, absence of production and transportation costs as well as pollution of the environment accompanying this process.

Anyhow, the problem of solid domestic wastes and sewage sludge handling is primarily an ecological problem. It is highly important to make processes of SDW storage, processing and utilization environmentally safe. To solve this task, it is necessary:

- to classify wastes by the method of occurrence and hazard classes with respect to the environment;
- to develop State norms and laws regulating waste handling;
- to develop methods of waste processing and utilization.

The following five vital and fundamental rules should be mentioned that have to be introduced on the territory of the Russian Federation for solid waste and sewage sludge handling:

- Absolute and universal prohibition to dump any wastes affecting the biosphere on landfills and other storages.

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- Absolute and universal prohibition for landfill disposal of wastes comprising paper, cardboard, polymeric and other materials that can be subjected to recycling.
- Limitation of disposed waste quantities strictly controlled by the State, and public inspection of the landfill practical functioning.
- Disposal of biodegradable wastes on the basis of special authorization and on specially arranged landfills under strict State and public control.
- Taxation of landfill disposal of solid wastes.

The progress in preventing waste appearance means considerable changes in the methods of use of material and energy resources for production of various materials and products. Sooner or later all materials and products become waste. Therefore, the basic principles of waste handling should be radically changed. Technologies for manufacturing ecological products have to be developed, the manufacture, usage and consumption of which produce little waste. The low-waste resource-saving technologies should be used at all stages of production. It specifically concerns the chemical industry producing extremely harmful chemicals. A system of monitoring flows of materials and products that can affect the man's health and environment should be developed. For this purpose it is necessary:

- to assess safety of materials and products thereof during their entire life cycle, including occurrence of wastes, their processing and utilization;
- to replace hazardous matters by alternative ones, it is desirable by materials neutral for the environment;
- to develop a system of risk assessment for the entire product life cycle, including product production, transportation, packing, usage and utilization;
- to control ecologically hazardous matters, including those that close their life cycle as waste.

All wastes are to be utilized or disposed by means of technologies that inevitably affect the environment and cause expenditures for pollution abatement. Wastes serve also an indicator of ineffective consumption and production. Production materials not only produce wastes, but also have an influence upon the processes of their manufacture, use and final utilization. In connection with this, the regional concept of waste handling is aimed at the prevention of waste occurrence and recycling selective materials being part of it.

Application of the life cycle in resource management is based primarily on the issue of waste reduction. Prevention of waste appearance and recycling can reduce impact on the environment in two ways: elimination of the negative influence on the environment during the mining of the primary raw materials and during the processing of the primary raw materials in production processes.

Resources can have impact on the environment at all stages of their life cycle, including their mining and initial processing, production and usage of product products, and finally waste management. Measures on waste prevention and new introduction of wastes into an economical cycle (“close-loop material chain”), i.e. waste utilization is, therefore, an important element of a comprehensive approach to the management of resources.

### **The existing system of waste management in the Nizhny Novgorod region.**

The Nizhny Novgorod oblast is a large industrial region of Russia. Therefore, for the Nizhny Novgorod region, as for the entire Russia as a whole, the issues related to the occurrence, neutralization and processing of solid wastes today are ones of the most urgent. At present the development of a complex system of industrial and domestic waste management for the Nizhny Novgorod region is one of the most important tasks (The Ministry of ecology and natural resources of the Nizhny Novgorod region, 2010).

The sources of solid wastes on the territory of the Nizhny Novgorod region are industrial and agricultural enterprises, public institutions, as well as household activities of population.

Population of the Nizhny Novgorod region as on January 1, 2010 constituted 3 390 160 people. The standard quantity of SDW produced from the population activities reaches 873.15 thousand tons/year.

Norms of SDW accumulation by the infrastructure entities located on the territory of the Nizhny Novgorod region range between 30 and 50% of the SDW accumulation norms of the population household activities. For the calculation of the SDW quantities produced by the institutions and enterprises in the cities of the Nizhny Novgorod region the accumulation norm of 40% was accepted, in other settlements it was 30% of the SDW accumulation norms of the population household activities.

The standard quantity of SDW produced annually by the industrial enterprises and public institutions of the Nizhny Novgorod region is 326.27 thousand tons. Under present conditions there is no possibility to separate quantities of SDW

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produced by the population from those of SDW of the industrial enterprises and public institutions which do not report according to form “2ТП-Отходы”, because the wastes from both sources are collected together. The standard total quantity of SDW produced by the enterprises and institutions of the public infrastructure of the Nizhny Novgorod region and by the population constitutes 1199.42 thousand tons/year. The average quantity of SDW produced by the industrial enterprises and institutions of the region is 57.96 thousand tons.

Table 2. Mass of solid wastes on the territory of Nizhny Novgorod region

Source of waste	Mass of waste, t/year	Source share in SDW total mass
Standard quantity of SDW produced by population	873 148.7	69%
Standard quantity of SDW produced by infrastructure entities	326 272.1	26%
Quantity of SDW produced by enterprises and institutions	579628	5%
Total	12573835	100%

The total mass of SDW produced on the territory of the Nizhny Novgorod region including enterprises and institutions is presented in Table 2. It is equal to 1257.4 thousand tons/year.

Table 3. Morphological composition of SDW produced on the territory of the Nizhny Novgorod region

SDW fraction composition	Weight. %	Fraction mass, tons	Share of the secondary raw material	Mass of the secondary raw material, tons
Food waste	23.56	296239.55	0.300	88871.87
Paper, cardboard	30.24	380232.77	0.535	203424.53
Wood	2.27	28542.61	0.696	19865.65
Ferrous metal	1.36	17100.42	0.615	10516.76
Non-ferrous metal	0.91	11442.19	0.443	5068.89
Textile	1.1	14334.17	0.520	7453.77
Bones	0.57	7167.09	0.384	2752.16
Glass	9.68	121714.72	0.431	52459.05
Leather, rubber	0.54	6789.87	0.473	3211.61
Plastics	12.79	160819.35	0.570	91667.03
Other	10.55	132653.96	0.000	0.00
Unusable remains	6.39	80346.81	0.000	0.00
Total:	100.00	1257383.49		485291.31

Presently, all collected SDW are disposed on landfills. But SDW can serve sources of the secondary raw material. To evaluate SDW potential as the secondary raw material and justify the necessity of construction of waste segregation houses and separate collection, analysis of the waste morphological composition has to be done.

Table 3 presents the SDW morphological composition, as well as the mass of utility fractions, which can be collected and used as the secondary raw material.

The total mass of SDW utility fractions which can be sorted out and used as the secondary raw material constitutes 485.3 thousand tons; the remaining 772.1 thousand tons of SDW are subject to disposal on landfills.

### **New concept of organization system of solid waste management in the Nizhny Novgorod region**

The Government of the Nizhny Novgorod region has developed a programme that realizes a principally new approach in the sphere of waste management. The work on the modernization of the waste handling system is being carried out in collaboration with the European partners.

In cooperation with the western partners the Government of the Nizhny Novgorod region forwarded an application to the European Commission for financing the development of the “Conception of industrial and domestic waste handling in the Nizhny Novgorod region”, as well as organization of ecological monitoring of the operational landfills.

The regional programme is being implemented in two stages. The first stage envisaged transition of the region to a new system of waste collection and disposal during 2008-2010. It included certification of all the settlements of the region according to the waste production, inventory of container areas and identification of their locations, determination of tariffs, as well as analysis of waste flows and elaboration of route charts.

At present the work on the change of container stock and automobile fleet is under way. The demand of the Nizhny Novgorod region in eurocontainers is 18 thousand pieces, in modern garbage trucks – 150 pieces. Today 12 thousand eurocontainers are available in the cities of the Nizhny Novgorod region that covers about 65% of the required stock, 47 modern garbage trucks operate which is 32% of the demand. About 50% of the population of the region, living in 8 large cities (including Nizhny Novgorod), are involved in a new system of SDW collection and removal. At the end of 2009 the modernization of the automobile

fleet and container stock was completed. The total amount of expenditures related to the fulfillment of this stage constituted more than 1 milliard roubles without financing from the regional budget.

The second stage of the programme will include the closing-down of the existing landfills; but doing this we must have an alternative, i.e. build 9 state-of-the-art regional SDW landfills (to replace 250 existing dumps), 7 waste processing complexes and 16 trans-shipping stations, which will permit to optimize traffic logistics. The cost of the second stage is 16 milliard roubles, out of which 95% is contribution of investors. The period of implementation of this stage is 4 to 5 years. By now 2 of 9 planned regional SDW landfills have been built.

The construction of the intermunicipal landfills is carried out in compliance with the requirements of the Russian laws and EU norms, on the basis of which the regional regulations determining the unified requirements for construction, reconstruction and exploitation of the areas of industrial and domestic waste disposal have been developed.

The regional programme envisages also a complex of measures for handling medical, construction and industrial wastes.

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