System of Waste Management and Its Implementation in Samara Region of Russia

Andrey V. Vasilyev[1], Dmitry E. Bykov[2]
[1,2] *Samara State Technical University*

***Abstract* – Waste negative impact on the environment and man is becoming one of the most important problems in all industrial countries. Waste amount grows every year. Waste may cause a complex negative impact on the landscapes of territories, biosphere and human health. Therefore, the task of development of efficient waste management system is so important. Examples of waste negative impact are considered in the present paper. Methods and approaches of reduction of waste negative influence are analysed. Suggestions for improving the existing waste management system of Russia are made. Results of approbation of the proposed waste management system in Samara region of Russia are considered.**

***Keywords* – Impact, reduction, system, urban territory, waste management.**

I. Introduction

Waste negative impact in conditions of urban territories grows every year [1]–[10]. Now the problem of waste management is becoming one of the most important problems in all industrial countries. Waste amount grows every year. In the Russian Federation, annually more than 7 billion tons of different kinds of waste is formed, and only 7 billion tons of waste is used again after utilisation.

Waste may cause a complex negative impact on the landscapes of territories, biosphere and human health. Toxic waste is especially dangerous. Waste may cause negative influence on the human health in both industry and domestic conditions. Impact of waste with high toxicity is considered to be especially dangerous [1], [3], [6], [8]. For example, toxic waste of chemical nature may cause different negative impact on the humans leading to the damage of cardiovascular and respiratory systems, skin damage, toxicity poisoning and other negative consequences.

Thus, it is necessary to develop and to implement into practice an efficient system of waste management.

This paper is devoted to the problems of improvement and implementation of waste management system of urban territories and to its approbation in conditions of Samara Region of Russia.

II. Approaches to Organisation of Waste Management System in Russia

Generally, it is possible to subdivide the existing system of waste management in Russia into the different directions:

- waste collection, transportation, utilisation;
- waste temporal storage;
- waste displacement at special sites;
- monitoring of waste management at different stages;
- ecological education, organisation of the efficient system of teaching of specialists in the field of waste management;
- enlightenment and upbringing of population in the field of waste management;
- improvement of legal and normative documentation in the field of waste management;
- development and implementation of methods and technical solutions for reduction of waste negative impact;
- informational provision of waste management etc.

It is suggested to consider a waste management activity in Russia as a special cluster, the main purpose of which is provision of efficient interaction of various specialists that are deciding on particular issues.

General aims of a cluster are the following:

- Integration of subjects of waste management and of secondary resources among clusters and inside clusters;
- Development of markets of secondary resources;
- Promotion of economics of knowledge in the system "upbringing – education – science – production – consumption".

Detailed aims are the following:

- Initiation of fundamental research on different stages of increased waste vital cycle and on topical directions of resource saving;
- Creation of conditions of accelerated certification of waste with variation of status in the system "waste – secondary resource – product".
- Development of logistics of recycling;
- Determination of priorities of project implementation;
- Optimisation of regional normative-legal base for reaching the strategic aim "zero waste".

Advantages of cluster alliances in the field of waste management are evident, and it is possible to determine them as a priority direction of further development and increasing of efficiency of activity of enterprises operating in the industry of waste treatment:

- support in the creation and functioning of the system of secondary resource use;
- unification of resources on the basis of regional mechanisms for implementation of modern technologies of waste treatment;
- development and implementation of informational-technical systems and their use in the framework of common informational space;
- joint training of staff at all levels;

– collaboration with foreign enterprises on the exchange of advanced experience and new achievements.

It is necessary to point out that also waste monitoring is very important for efficient waste management. In Russia, there is a system of waste monitoring, including observation, control and collection of information at different levels:

– monitoring of impact on the environment;
– monitoring of waste displacement etc.

Monitoring of environmental impact assessment provides for control of the following parameters: object of control, methods of research, frequency of measurements, methods and equipment of control, periodicity of measurements, data processing and analysis, methods of estimation of environmental impact, methods of estimation of environmental damage. As a result, it is necessary to implement the measures allowing one to reduce the exceeding values of waste negative impact and to arrange control measurements.

Monitoring of all parameters of observation, control and analysis are carried out during the entire chain of waste treatment and disposal. Collected information is transmitted to the information-analytical centre and then to the forecasting centre, where possible events are modelled during negative impact on the environment.

III. Experience of Approbation of Improved Waste Management System in Samara Region of Russia

In Samara Region of Russia, there is a good experience of organisation of waste management system on the basis of a cluster approach. There is a special programme "Improvement of System of Industrial and Domestic Waste Management and Forming of Cluster of Using of Secondary Resources on the Territory of Samara Region". Main aims of the programme are the following:

– creation of joint system of industrial and domestic waste management on the principles of consolidation and unification of state structures with all the representatives of professional society;
– finding of investments into economics of Samara Region, creation of additional working places, provision of ecologically safe keeping, treatment and liquidation of waste.

In Samara Region of Russia, investments are directed mainly to the construction of sorting stations, logistics organisation, establishment of conditions for waste temporary storage and treatment. At a more high technological level, waste collection and temporary storage are arranged, new container sites are created. Main task is separation of waste and re-use of resources. It allows reducing negative impact on the environment, reducing a number of polygons of waste disposal and a volume of waste.

Regional and municipal legislative base of Samara Region in the field of waste management is continuously improving. In this case, much importance is attached to the development of system of waste management in the big towns of Samara Region: Samara, Togliatti, Syzran, and Zhigulevsk.

On the territory of city district, Togliatti system of industrial and domestic waste collection, transportation and utilisation is arranged in the following way. Utilisation of solid domestic waste and large size garbage formed as a result of vital activity of population of city district is financed by the city budget.

Scheme of industrial and domestic waste utilisation in Togliatti city is integrated into the cluster of secondary resources of Samara Region and includes such enterprises as POVTOR company, solid waste treatment plant, PLODAR company etc.

All the volume of solid domestic waste and large size garbage of Togliatti city is primarily delivered to POVTOR company, where the sorting of waste is provided. Organic waste is treated by a bio-thermal composting method in a solid waste treatment plant. The volumes of waste that it is not possible to utilise and to treat are disposed in special polygons.

Existing system of utilisation of solid domestic waste and large size garbage of Togliatti city allows providing efficient treatment of waste and reducing a total volume of waste disposed at polygons up to 25 % of the total value of waste.

Implementation of system of a separate collection of waste is an important and complex task requiring hard work on organisation of ecological enlightenment and upbringing, motivation of inhabitants to separate paper, glass, plastic in total waste volume.

It is also possible to point out one important and specific problem of oily waste management. Constant growth of volumes of oily waste as a result of industrial activity of oil production enterprises highlights the necessity for search of new technologies and optimisation of existing ones for efficient utilisation of such kind of waste. At present, it is one of the most urgent tasks in the field of environmental protection [1]–[3].

Oil-slimes are 3-phase systems, composition and properties of which vary in a wide range depending on the place and method of their generation. Variation of composition of such complex multi-component dispersion systems in time is significantly difficult for the development of universal methods of their utilisation [4].

At present, different technologies of utilisation of oily waste are being used. Mainly they are based on the processes of separation of water and organic phases like sedimentation, filtering, burning. For oil contaminated soils, the method of biological destruction of hydrocarbon component is more common.

Paper [6] informs about the possibility of using oil-slimes in road construction. With this possibility, waste was used without treatment for the purpose of fortification of earthen cloth, send underlayment and macadam base of road.

Thus, the analysis of world experience and patent research show that there is the necessity for the development of complex small-waste technology of treatment of HCO with maximum use of its resource potential by receiving valuable secondary oil products, such as hydrocarbons of diesel fraction and road bitumen.

From economical point of view, sulphur is especially important as a cheap additive to bitumen and filler for asphalt

concrete [8]. Pulverised sulphur is a carrier of surface-active characteristic of oil and oil products; therefore, it is used as an additive for creation of optimal structure of bitumen. Influence of sulphur during its inputting to bitumen during the temperature of 180–200 °C is the same as the action of oxygen during oxidation.

Influence of sulphur on the properties of oil bitumen is determined by the following factors: temperature and time of interaction, concentration of sulphur, type of bitumen structure and quality of primarily raw materials and technology of its generation.

TABLE I

RESULTS OF PHYSICAL AND MECHANICAL TESTING OF SECONDARY BITUMEN

Value	Standard bitumen according to EN 12591-2010	Bitumen with the addition of sulphur in quality:				Method of testing
	250/330	5 %	10 %	15 %	20 %	
Depth of penetration spine during 25 °C, 0.1 mm	250–300	303	261	246	181	EN 1426
Depth of penetration spine during 15 °C, 0.1 mm	70–130	102	91	62	51	
Temperature of softening according to the method of “ring and sphere”, °C	30–38	43	36	41	44	EN 1427
Resistance to solidification:						EN 12607-1
-increase in the temperature of softening, °C	≤ 11	8	7	7	4	
- variation of mass (absolute value), %	≤ 1.0	0.9	0.8	0.8	0.7	
Temperature of flash, °C	≥ 180	240	238	235	233	EN ISO 2592
Solubility, %	≥ 99.0	99.0	99.0	99.0	99.0	EN 12592

From the data presented in Table I, it is evident that during adding of 5, 15 and 20 % of sulphur the samples do not correspond in total to the requirements of standards, which do not allow using it in road construction. However, during mixing with 10 % of sulphur the values meet the normative requirements and correspond to the requirement of standard EN 12591-2010. Consequently, it is possible to use secondary bitumen with addition of 10 % mass of sulphur as an analogue of bitumen of mark 250/330.

It is also an interesting experience of work of association of Samara Region “Waste Management” uniting as enterprises activity of which is connected with waste formation, disposal and utilisation, as educational institutions.

It is necessary to underline that in Samara Region of Russia much importance is attached to ecological education, enlightenment and upbringing, including also the field of waste management. Some universities of Samara Region teach the students to ecological specialisations. Mass measures, actions, exhibitions, competitions with active involvement of population of region are carried out. For example, in September 2013 within the framework of international ecological congress ELPIT-2013 in Samara there was an international round table devoted to waste management problems with active participation of heads and specialists of enterprises, as well as scientists and public organisations and citizens. The next ELPIT-2015 congress in Samara will include again the events devoted to discussion of waste management issues: international round tables, symposia, exhibition “Eco-leader” etc.

IV. Conclusion

Problem of waste management in urban territories is especially important in Russia due to the negative waste impact on the environment and human health and because of a large volume of waste that is not utilised. Toxic waste impact is especially dangerous.

Existing system of waste monitoring in Russia is described, including observation, control and collection of information at different levels. Suggestions for the improvement of the existing waste management system in Russia have been made. On the example of Samara Region of Russia, the experience of approbation of improved waste management system has been considered. Special attention has been devoted to the oily waste problem decision.

It is possible to conclude that the task of reduction of waste negative impact on the population and environment may be achieved efficiently only by implementation of a complex approach, including waste collection, transportation, disposal, treatment, utilisation, education, information of population etc.

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Andrey V. Vasilyev is a Doctor of Technical Sciences (2006), Professor (2006), Mechanical Engineer (1985), Head of the leading scientific school of Russia in the field of engineering ecology, ecological monitoring and of complex problems of machinery honoured by the grant of the President of the Russian Federation. Over 600 scientific papers and 7 books have been written as well as 12 inventions have been developed. The author's major field of study is engineering ecology, ecological monitoring, and environmental pollution reduction.

At present, he is the Head of the Department of Chemical Technology and Industrial Ecology of Samara State Technical University, Head of R&D Laboratory of Vibration, Acoustics, Ecology and Life Protection of Togliatti State University, Russia.

He is a grant holder of the German Academic Exchange Service (DAAD), Open World programme of the USA, field "Environment" (2004) etc.

Address: 244 Molodogvardeyskaya Str., Samara State Technical University, Samara, 443100, Russia.

Phone: +7(846)2421176.

Fax: +7(846)2784400.

Email: avassil62@mail.ru; ecology@samgtu.ru.

Dmitry E. Bykov is a Doctor of Technical Sciences (2004), Professor (2004), Engineer in Chemistry and Technology (1988). He has founded the scientific-analytical centre of industrial ecology and independent attestation-methodical centre at Samara State Technical University. Since 2001 till 2006 he was the Head of the Department of Chemical Technology and Industrial Ecology of Samara State Technical University, since 2006 till 2009 – the Dean of Oil-Technological Faculty. In 2009 he was elected to the position of Rector of Samara State Technical University. He has written over 200 scientific papers. The author's major field of study is engineering ecology, waste management, and environmental pollution reduction.

At present, he is the Rector of Samara State Technical University, Russia.

Address: 244 Molodogvardeyskaya Str., Samara State Technical University, Samara, 443100, Russia.

Phone: +7(846)2784311.

Fax: +7(846)2784400.

Email: rector@samgtu.ru