

REMOTE CONTROL OF MUNICIPAL SOLID WASTE**I.A. Taykina**Scientific advisors associate professor T.A. Arhangelskaya,
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A lot of municipal solid waste, which should be disposed, is generated every day around the world. All countries solve this problem with varying degrees of success in different ways. The most popular way to dispose municipal solid waste in Russia is landfills and dumps. The share of this method accounts 75-80% of waste generated volume. [2, 4, 5].

The increasing importance of this problem points at necessity of developing high-quality and efficient state and regional programs, the need for management decisions. The decisions and programs are necessary for minimizing the impact on the environment at all stages of collection, transportation, storage, full processing, and destruction of non-recyclable part of wastes [3]. Wherein, it is necessary to have high profile of information about the location, scale, and the volume occupied by the municipal solid waste. It is required for developing the programs of implementation. But now this information is absent completely. It makes difficult to conduct government ecologic monitoring in the area of waste and making effective management decisions.

Application of remote research methods may be a way out of this situation. In particular, it is the most popular technologies and satellite operational monitoring data [3]. Satellite images contain operational information about objects of waste disposal facilities and evidence of their impact on the environment. It allows observing and forecasting the dynamic of dump's development, conducting effective and operate ecologic monitoring, revealing the problems, and monitoring operation and landfill's reclamation compliance with the rules [2]. Satellite images make possible to decrease waste of money and time for mapping and researching territories occupied with the waste because of wide field of view and high-resolution.

Effective method of waste disposal should contain the following steps: selection of the most suitable space images which include necessary technical and time characteristics, image processing with special programs, interpretation of conditions at the dumps or landfills, loading of the results in database [1].

Image quality which permits interpreting objects with sufficient reliability, to measure the area, determining coordinates and types of dumps, monitoring the municipal solid waste. Therefore, satellite images of ultrahigh resolution (0.5-1 meter) are used for monitoring. This information can be obtained by satellites such as WorldView-1,2, GeoEye, Pleiades-1A, 1B, QuickBird, Iconos and others. Ultrahigh resolution of images allows determining and mapping a dump size from 10 m. with 90-95% probability.

The control of dumps and landfills, implementation of their reclamation is provided by using different time satellite images. Thereby, total accurate monitoring is available.

In addition to the measurement of area characteristics, remote control methods allow us to measure the height of objects (with accuracy of up to 1 m.), calculate the volume of wastes by means of the stereoscopic instruments.

Besides, a number of landfill's quality parameters such as composition, landfill's impact on the environment can be determined. The parameters mentioned above permit for development of ecological passport. Determination of landfill's chemical composition becomes possible through air drones equipped with spectrometers.

Consequently, results of interpretation can be used for waste monitoring, collection, disposal and utilization. Also, it is used for monitoring of design, exploitation, and reclamation of the lands occupied by the waste. Method of reclamation helps to conduct effective ecologic monitoring in time: track and predict the development of negative processes; detect formation and dynamics of damp's development.

To choose the most suitable place for new landfills is as important as control of existing ones. Remote methods of control are useful in this area too. Using by high-resolution satellite images allows observing large area in details and choosing the most suitable area for landfill. It is applied into practice in other countries. For example, landfill area in Kerbala (Iraq) is determined by using the integration of Geographic Information Systems (GIS) and multicriteria decision analysis (MCDA) [6]. These systems include high-resolution satellite images. Satellite images of Kerbala and its environment are gathered from WorldView-2 satellite. The satellite multispectral image of Kerbala city taken in year 2010 of 0.5 meter resolution is used. Images and maps input are processed by many GIS software according to landfill site selection criteria.

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ECOLOGICAL PROBLEMS RELATED TO COAL AND HYDROCARBON PRODUCTION

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The ecological issues related to coal and hydrocarbon production have been thoroughly discussed over the past decades. Particularly, the main concern of the global society is burning of such fossil fuels as coal, oil, and gas. The production of these natural resources may contribute to global environment pollution more than other human activities. To prove this fact, it is even enough to mention “greenhouse effect” that leads to