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GEOMODEL OF MEDICAL WASTE MANAGEMENT
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Abstract:

The researchers developed a geomodel of medical waste management scheme for the Belgorod region territory which allows carrying out a comprehensive visualized spatial analysis, the evaluation and the forecasting of education, placement and movement of various types of medical waste within the region territory. This model is the component of waste treatment territorial scheme and the information basis for the management decision development to prevent and reduce the negative impact of waste on human health and environment.

Key words: Geomodel, database, electronic maps, geographic information systems, medical waste.

Introduction

One of the major sources of environmental pollution are the production and consumption waste in particular (Chemyaeva, 2013; Magomet and Mironenkova, 2015; Kurylenko *et al.*, 2012; Oribe-Garcia *et al.*, 2015). Of particular note is medical waste, which represent a toxicological, epidemiological and radiation risk. This has given rise to a need for effective control in the field of medical waste treatment to reduce the negative impact on the environment. (Pantini *et al.*, 2015; Sanjeevi *et al.*, 2015; Shmarinet *et al.*, 2012; Starostina *et al.*, 2014; Vadoudi *et al.*, 2015) In the framework of this task the authors have developed a geomodel for management of medical waste, which includes algorithms for the organization and implementation of activities in relation to the collection, transportation, processing, recycling, neutralization, and disposal of medical waste; a database (DB) and which provides the input, processing, analysis and reporting procedures; renders a comprehensive analysis, as well as the possibility of evaluating management scenarios of medical waste.

Main Part

The researchers set the task to develop a geomodel of medical waste management on the territory of the Belgorod region, providing an opportunity a current system assessment as well as the prediction of its development with the visualization of assessment and prediction results on the respective electronic maps.

A complex analysis was performed (Ivashchuket al., 2016) concerning the characteristics of medical waste sources (location, types of waste, hazard class, amount); collection, transportation, processing, recycling, disposal, medical waste placement facilities; medical waste traffic patterns; the balance of quantitative medical waste characteristics. On this basis the main problems of the existing waste management system are revealed, the databases were developed containing an accumulated array of statistical data.

Using the tools of spatial analysis the created databases allow to create the necessary electronic cartographic materials for the submission of the following analysis: the distribution of medical waste on the territory of the region; the placement of medical waste on the region territory; the distribution of gathering, processing, recycling and medical waste disposal places; the peculiarities of medical waste movement existing scheme through the territory of the region. The result of this analysis is the scientific substantiation and the formation of medical waste traffic prospective scheme within the considered territory; the development of recommendations on the effective development of a medical waste management system with the identification of possible targets. Figure 1 shows the algorithm for an electronic model creation concerning medical waste management.

The acquisition and the analysis of the raw data (the statistical data and vector data representing geographic objects), the selection of model objects, the determination of the essential attributes, the layers that describe these objects are performed at the initial stage. Then the decision on the data amount adequacy is developed; the structure of attribute tables is developed; the creation and the editing of the layers concerning created maps and its tables;; the input of tabular and textual data with the characteristics of objects; the development of a sign system (map layout elements); the overlapping of layers with the cartographic image development of thematic maps and its editing.

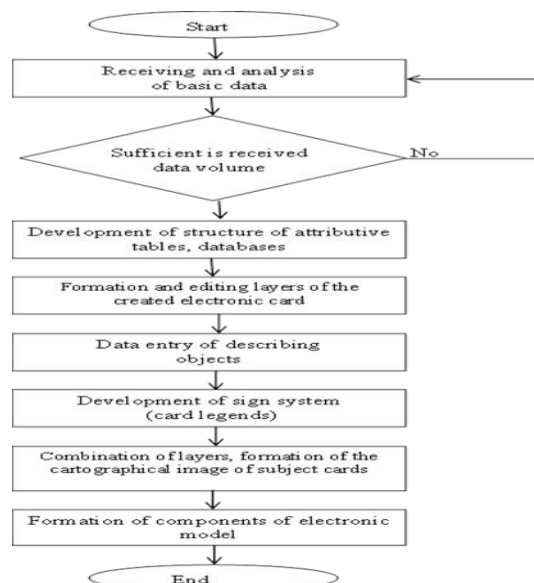


Fig.1: Electronic geomodel creation algorithm concerning medical waste management.

The development of electronic maps, visualizing tire processes for the collection, transportation, processing, recycling, disposal and medical waste placement was carried out using ArcGIS platform where additional tools may be created using Python module for specialized task solution. Preliminary data processing was carried out in Excel.

Figure 2 shows an example of display attribute data and vector objects. This figure shows the distribution of medical waste by types within the settlement boundaries using pie charts; their diameter indicates tire total amount of medical waste; the color of the settlements shows the total amount of medical waste produced on their territory. The opportunity of the necessary SQL-query creation for tire sampling from tire database, for example, tire following type: `SELECT*FROM Rovenki WHEREamount_of_Medical_waste">200`. Thus, for example, tire settlement sample was obtained with of their waste is >200 in.

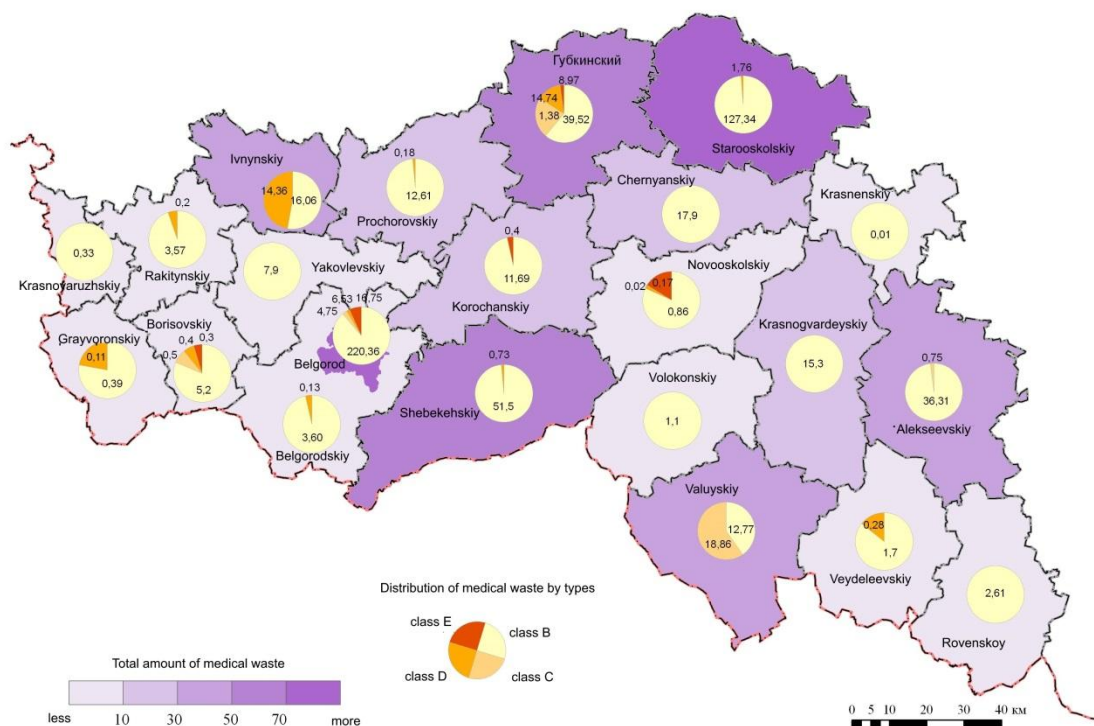


Fig.2: Attribute data and vector objects display fragment in ArcGIS (the development medical waste volumes on the territory of Belgorod region).

Conclusion

The developed electronic geomodel of medical waste management is an information system, including DB, electronic maps and the tools for data input, storage, update, processing, analysis, presentation and data visualization. The system allows an on-line analysis of a situation in real time to forecast the development processes changing various man-made and anthropogenic factors and create the optimal solution variants to improve the ecological situation of the region.

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