

Creation of electronic forms of statistical reporting on the treatment of industrial waste (hereinafter – EF) with web-tools can become a shining example of the use modern information technologies in environmental protection activities.

EF is a client-server application and has a number of advantages:

1) collection of information takes much less time, thus reducing labor costs by making data in the database table;

2) validation (compliance) of input data on the client side (a nature-user) includes a comparison of data for several years, and completely eliminates the possibility of erroneous data in the database;

3) the amount of stored information is not particularly limited;

4) the use of GIS-technology provides more visual and complete information in territorial aspect;

5) there is a possibility of interaction between different information resources in the field of waste management and EF (eg, for the purpose of environmental agencies coordination).

To date, it solved a number of issues related to the creation of the EF:

1) an assessment and analysis of the information technologies used in environmental statistics, taking into account international experience;

2) the structure of the EF, the algorithm of its work and possible links with existing information resources used by environmental protection activities;

3) developed the design of the user interface of the system with a view to minimizing the user effort;

4) identified enablers ESP project.

The investigations as well as design of the system are carried out in the Republic Unitary Enterprise “Belarus Research Centre “Ecology”. During the next a few years is planned to amend the regulations governing the issues of environment statistics, the implementation of the pilot version of the EF and its functional for the possibility of using EF as an alternative to existing technologies, the creation of new EF modules for a more visual representation of information using GIS-technology.

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THE CALCULATION MESH FOR HEAT TRANSFER COMPUTER SIMULATION IN PERMAFROST GROUND

Physical processes in soils are described by systems of nonlinear differential equations in partial derivatives, supplemented by the boundary conditions. In the models describing the physical processes in frozen soils should consider water-ice phase changes and dynamic phase transition boundaries. This is why the calculation

grids should satisfy the special requirements. On the one hand, it should provide a sufficient accuracy of calculations. So, the grids for the models with complicated boundaries are constructing using irregular spatial steps and mesh refinement in the featured areas. On the other hand, this increases the calculation time and requires more computational resources.

Today, the world leaders in the field of computer (mathematical) modeling are usually using the finite element mesh. Finite element mesh has several advantages:

1) Universality; the finite element method can be used to solve various problems: heat transfer simulation, mechanical problem, fluid dynamics, etc. This makes a comprehensive analysis possible;

2) Higher boundary approximation accuracy;

3) Deformability; in solving the mechanical problem (and some others) it is important to have the ability to change the calculation mesh considering results of the current iteration. Deformability helps to track the dynamic boundaries.

However, the approximation based on the finite difference method also has a number of advantages:

1) simplicity of software implementation;

2) high computational performance (per node);

3) easy parallel computing (including SIMD architectures).

In this paper we propose the finite-difference calculation mesh for simulation of heat transfer processes occurring in permafrost soils. The estimations showed that for qualitative sampling of soil reference sample area of 1 hectare and a depth of 10 m is required grid consisting of more than 1 million units. The prediction calculation of the thermal conductivity of the soil for 10 years on a grid takes about 10 minutes on a single CPU core.

For modeling of processes taking into account a filtration within the classical Darcy's law is offered the fixed settlement grid based on fictitious areas method. However, the counting duration even for a test example considerably increases.

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CONTROLLED THERMONUCLEAR FUSION

In our work achievements and perspectives aimed to producing controlled thermonuclear reactions of fusion are considered. We remind that fusion is the energy source of the Sun and stars. In the tremendous heat and gravity at the core of these stellar bodies, hydrogen nuclei collide, fuse into heavier helium atoms and release tremendous amounts of energy in the process. As a rule in terrestrial laboratories the following reactions

