

Editorial

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As a result of the development of society, the issue of environmental degradation due to the man-made impact of various sectors of the economy and the communal sphere is becoming more urgent. This leads to the depletion of natural resources, the disruption of ecosystems and the biosphere of the planet due to pollution of the air and water basins, as well as an increase in the volumes of solid industrial and household wastes. Irrational nature management further worsens the ecological situation. This largely applies to energy facilities. Only implementation of the best available technologies of energy production with acceptable environmental and economic indicators can minimize the man-made impact of the energy sector on the environment. The need to find the best ways of handling industrial by-products and domestic wastes, including their co-utilization, stimulates the search for new integrated technological solutions in this area. An important role in the development and adoption of environmentally sound and economically viable solutions is played by informational support for the environmental activities of energy enterprises, which can be realized through appropriate conferences and seminars, programs for additional professional education, and the creation of open, public databases on environmental technologies in the energy sector. One of the most important issues to improve the environmental and economic efficiency of energy projects is co-utilization of coal combustion by-products with waste from other industries, as well as household wastes.

One of the examples of information resources in Internet, covering all the aspects of nature protection activities of power companies is the electronic information constantly updated system of the open access "The Best Available and Perspective Nature Protection Technologies in the Russian Power Industry" (OIS BAT, 2018). The system was created in 2011 according to the Programme of the Moscow Power Engineering Institute Development. The System was registered in the Rospatent of the RF as a database and has two identical versions: Russian and English. Constant work on updating both Russian and English versions of the System is in progress. The initiator and scientific supervisor of the project for the creation and development of the System is the Head of the Centre for Science and Education "Ecology of Power Engineering" of MPEI Putilov V.Y.

The main objective of the System creation is information support of nature protection activity in the power sector for the following:

- implementation of ecologically and economically effective nature protection policy;

- training, improvement of professional skill and professional retraining of experts from power companies in high schools and other educational institutions according to the state-of-the-art requirements in the field of protection of environment from the man-made impact of the power objects.

The System contributes into the following:

- online access of any Russian or foreign user to the constantly updated information on development, introduction and use of nature protection equipment and technologies in the Russian power sector and all over the world;
- open information exchange on ecology in power engineering among the Russian and foreign experts;
- free access of students of educational institutions, listeners of professional skill improvement and retraining programs, pupils and other groups of users interested in getting information on nature protection problems in power engineering and ways of their solution;
- formation of a favorable image of Russia in the field of environmental protection all over the world due to maximum open objective informing the world community on activity of the Russian power companies on solution of ecological problems on the basis of the best available nature protection technologies and use of by-products of organic fuel combustion replacing natural raw materials.

The information placed in the System is a result of systematic research of domestic and international experience in solving the ecological issues in power engineering.

The System presents the materials in the following areas:

- Air Protection.
- Water Protection.
- Ash Handling.
- Complex Technologies.
- Physical Impacts.
- Advanced Technologies.
- Energy Saving.
- Renewable Energy
- General Ecological Issues.

Information is intended, first of all, for the technical officers engaged in designing, adjustment, operation and supervision of power equipment operation at power utilities and companies of the fuel and

energy complex, housing and communal services and other branches of economy. The materials resulted in the System, are also intended for students of high schools as the handbook on nature protection technologies in power engineering. The site can be useful for experts from nature protection bodies and other interested persons.

Ash and slag handling section of the web-site is a part of the World-Wide Coal Combustion Products Network (WWCCPN, 2018).

Geography of foreign visitors of the System is very wide; visitors from all over the world use the presented materials without any restrictions. Therefore, the experts, dealing with nature protection technologies in general, and coal ash handling issues in particular, are welcome to share their analytical materials and papers demonstrating the benefits of the proposed technologies and the appropriate references.

The created information resources will be unclaimed without the appropriate level of training of specialists for whom, first of all, they are formed and develop. This involves the organization of advanced training and professional retraining in the field of environmental protection of specialists of energy enterprises and industries, taking into account the world experience in the introduction of new technologies, changes in environmental legislation, and new trends in the development of society. At the same time, it is necessary to develop and update textbooks, training aids and reference materials on the environmental aspects of the energy companies' activities.

Realizing the importance and necessity of this, since 1997 the Centre for Science and Education "Ecology of Power Engineering" has been training personnel of power enterprises and industries under various programs of professional development and professional retraining, including ecology of power engineering and environmental technologies at thermal power plants. During this period of time, more than 1400 students were trained (Putilov *et al.*, 2016). Hundreds of educational and methodological materials in the field of power engineering, manuals on various aspects of power engineering were prepared and published, in particular, the textbook "Ecology of Power Engineering" (Putilov, 2003) and the Information Handbook on the Best Available Nature Protection Technologies at Thermal Power Plants (Putilov, 2007).

Another fairly effective way of informational interaction is the organization and holding of representative international conferences and seminars, which address the pressing problems and ways of their solution in the field of environmental protection of enterprises and organizations in the energy sector. For example, the employees of the Centre for Science and Education "Ecology of Power Engineering" organized and conducted nine international conferences and seminars in the field of ecology of power engineering and on the coal ash handling in Russia, as well as two international workshops on the coal ash handling in Poland.

In addition, for more than 20 years, the Center has been developing economical and environmentally friendly technical solutions in the

field of ecology of power engineering in general, and problems of coal ash handling in particular, taking into account the best available environmental technologies. The result of the Center's work is the development of five industry normative documents on coal ash handling, as well as a large number of R & D on this topic.

Environmentalists sound alarm and call upon humanity to reconsider their attitude to life and consumption of natural resources, because only protection against environmental pollution will improve the situation and prevent serious consequences. Environmental pollution by volatile organic compounds (VOCs) at oil and gas processing, wood-treating, and manufacturing of chemicals is one of these issues. In their paper Goreham and Lake (2018) perform the results of studying the diffusive and sorptive parameters of benzene, ethylbenzene and trichloroethylene through soil-cement materials. The peculiarity of their research is that scientific and technical sources contain little data on experimental investigations on the diffusion of VOCs through cement-based materials. Moreover, to decrease contaminant migration from soil-cement systems the additives such as fly ash or activated carbon could be used. We assume that the results of this study will provide new discussions and projects.

A principle of the heat pump operation was first formulated by William Thomson in 1852. In 1855 the Austrian Peter Ritter von Rittinger improved this design and was the first to design a heat pump. However, the real application began only a century later. Since then, heat pumps have been actively used for heating the houses in winter and air conditioning in summer. In this case, the soil is used as a natural heat source. Soil, like subsoil waters, has one advantage - a relatively stable temperature during the year. An evaluation of the efficiency of ground heat exchangers is impossible without modeling the boundary conditions in the surface layers. In their article, the authors Sedighi *et al.* (2018) formulate the surface boundary conditions, including coupled thermo-hydraulic behavior by considering a range of climatic variables and mechanisms. Undoubtedly, these boundary conditions will impact the performance of the ground source pump systems. It would be useful to continue research on how the boundary conditions influence the characteristics of heat pumps in order to increase the efficiency of their operation.

At present, the problem of storage of municipal solid waste is vital in all the big cities of the world. In connection with the tightening of environmental standards, the problem of landfilling by means of the ecologically sound ways will be even more urgent. Despite the introduction of a growing number of incineration plants, most of municipal solid waste must be taken to landfills and buried. Currently, the height of solid waste landfills can reach 60 m and even more. In this connection, it is important to ensure the stability of slopes under static and dynamic loads, for which it is necessary to calculate the strength characteristics. When designing landfills for various solid wastes, it is necessary to consider the failure criterion of the landfill. Fei and Zekkos (2018) have analyzed the U.S. standards and carried out an analytical review of a large

number of scientific materials on shear strength of waste, and also conducted a number of own studies of various waste samples on direct and simple shear at various vertical loads in which the strength characteristics have been refined in comparison with the results obtained by other authors.

To minimize leakages in groundwater from the surface of landfills storing various wastes, it is necessary to use protective barriers or screens. The latter can be made of natural materials (sand, gravel) or manufactured ones, such as geotextiles. The effectiveness of various natural and manufactured protective barriers is significantly different, as shown by the results of experiments performed by Lima *et al.* (2018). In the case of ash disposal site operation it is necessary to provide practically 100 percent efficiency of groundwater protection from solutions of toxic and radioactive compounds in connection with their permanent leaching. The same can be attributed to landfills storing wastes which contain toxic and/or radioactive materials. As a result of the experimental data obtained by Lima *et al.* (2018), it was found that the effectiveness of using geotextile capillary barriers is 14 ... 43% higher than that of gravel and sand barriers, respectively. Further research will improve the methods of designing barriers to protect groundwater from infiltration of harmful and hazardous compounds.

The problem of radioactive waste disposal is constantly arisen in countries where nuclear energy prevails over the other types of energy (France, Finland, Japan, etc.). Sometimes we hear that nuclear power plants produce environmentally clean energy; however, for this to happen it is necessary to solve the radioactive waste disposal problem. In this connection there are a lot of environmental problems and one of them is hydrogen production due to corrosion reactions

(Mahjoub and Rouabhi, 2018), which can lead to the increased pore pressure and eventually to mechanical damage of the host rock. Studying the hydrogen migration, the authors (Mahjoub and Rouabhi, 2018), used a hydromechanical model. For a deeper study of the effect of the pore pressure on the integrity of the host rock, a large number of numerical simulations and studies are required.

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