

## ABOUT THE ROLE AND PLACE OF SCIENCE IN SOLUTION OF COAL ASH HANDLING PROBLEM

**KEYWORDS:** by-products, ash handling, ash use, system researches

### ABSTRACT

In connection with increase in the man-made impact on environment, a problem of coal ash handling being both regional and global, becomes more and more actual. At many Thermal Power Plants (TPPs) of Russia ash disposal sites are close to their design filling that forces power engineers to search for the new ways of dealing with these matters. Without involving the profile scientific organizations, engaged in solution of the coal ash handling problem, a personnel from TPPs and power companies won't cope with this. Such organizations should be involved in the activity under the projects on reconstruction of the operating and creation of the new ash and slag removal systems at TPPs at a design stage for the purpose of working out of the general schemes of ash and slag removal systems and preparing the recommendations on introduction of the best available technologies in the field of ash handling issues. Thus, information, consulting and expert services should be rendered without any competitions. System work and researches in this field, financed from the state budget and supported by the interested power companies, should be conducted constantly. It is necessary to consider the coal ash handling issues in programs of base education, and also additional education of the personnel from power companies, to develop educational materials, hold conferences and workshops and create the open access portals relating to this subject. The mentioned questions are lightened in the paper in detail.

### INTRODUCTION

A question on coal ash handling becomes more and more sharp, since ash disposal sites at a number of TPPs, constructed 30...40 years ago, are very close to their design filling. Building of the new ash disposals is not only a very expensive action, but also makes the irreparable harm to environment. In connection with the filling of ash disposal sites, there are several options of solving the problem:

- building of the new ash disposals that costs some hundred millions US \$ leading to devastation of hundred hectares of the ground;
- raising the protecting dams at the existing ash disposals being even more expensive;
- ash and slag processing and their use in different applications.

Thus, for solution of the mentioned problem owners of TPPs have to choose one of three options on the basis of technical and economic estimation of possible altern a-

tives. For that purpose it is necessary to involve experts from the profile scientific organizations dealing with coal ash handling issues to work out the general schemes of ash and slag removal systems and recommendations on introduction of the best available technologies on ash and slag problem. By this, experts from scientific organizations rendering information, consulting and expert services should be constantly involved without any competitions. The following technical requirements should be met in the process of development of ash and slag removal projects:

- separate ash and slag removal;
- maximum mechanization and automation of all technological processes;
- development and introduction of technologies providing the minimum negative impact of power objects on environment;
- an option to discharge up to 100 % of ash and slag of their current output for processing;
- landfilling of the unclaimed part of ash and slag at disposal sites using ecologically acceptable ways with maximum preservation of their consumer properties.

For an effective solution of ash and slag problem the following is required:

- continuous conducting of system researches,
- qualified experts,
- development of legal documents and standards,
- development of textbooks and educational materials,
- information support of activity on coal ash handling issues (holding scientific conferences, practical workshops, creation of sites of the open access relating to these subjects).

**On conducting of system researches.** As for conducting R&D on ash problem, it should be financed by the corresponding state Ministries, Departments, and also the interested power companies. Unfortunately, it is not happening.

### QUALIFICATION OF EXPERTS IN ASH AND SLAG HANDLING

*Education in high schools.* Till now there are no higher educational institutions in Russia and other countries all over the world, where experts in ash and slag handling are prepared. A paradoxical situation appears, when the problem exists, but there are no dedicated experts in educational institutions. People become experts in this field as a result of any casual events occurring in their life. As a rule, such experts have fragmentary, non-

systemic knowledge which is insufficient for effective solution of ash and slag handling problem. It is necessary to address the issue of a target preparation of the diplomaed experts in specialized secondary educational establishments and higher educational institutions. This situation is worsening due to reformation of the Russian educational system. After December 31, 2010 bachelor and master qualifications will become the basic ones for the students entering the Russian high schools, no engineers will be graduated.

In addition to the target preparation of graduates in high schools, a system of professional skill improvement and professional retraining of experts could and should be organized.

For the practical solution of a problem on target preparation of graduates it is necessary to complete the following primary tasks:

- define a need of various economy branches of the state in such experts;
- develop a Curricula of training of bachelors and masters;
- select the interested basic educational institutions having to the maximum extent ready training facilities and methodological framework meeting the above-stated Curricula, where it is possible to arrange such a preparation of experts with minimum expenses;
- make the required changes in educational standards;
- create teaching materials for preparation of experts in the basic educational institutions selected in a corresponding order;
- start preparation of experts.

If to estimate a real time required to become the first experts, it is possible to assume, that it will occur in 8-10 years or even more after they start to make practical solutions on all the complex of problems. But time presses, though target preparation needs to be organized all the same.

Creation of the system of professional skill improvement and professional retraining of experts does not require so much time. There are two possible alternatives here: improvement of professional skill and professional retraining.

**Improvement of professional skill.** Development of educational materials for improving of experts' skill, in our opinion, will take no more than a year. Improvement of professional skill of experts in Russia could be arranged in the Center of training and retraining of experts «Ecology in Power Engineering» of the Moscow Power Engineering Institute (CPPEE MPEI) involving authoritative Russian and foreign experts. We believe, that in other countries there are also educational institutions which could improve professional skill of experts. Duration of professional skill improvement program can be different, but by experience of training of experts according to different programs for continuing professional education in order to achieve a desirable efficiency, it should be not less than 160 hours. In such a program execution and de-

fense of the final work, considering practical solution of any problem being sensitive for the organization in which the listener of the professional skill improvement program works, should be provided.

**Professional retraining of experts.** This is the most effective direction of dedicated expert preparation. According to the Russian educational standard three basic modes are possible here:

- graduate courses;
- postgraduate study;
- professional retraining.

It should be noted that CPPEE MPEI has a practical experience in all three modes of study.

**Graduate courses.** A training process under this form begins at the last (fourth) year of the bachelor's study on a speciality "Thermal Power Plants". A bachelor conducts the final work connected with ash and slag removal systems. Thus, professional retraining is combined with the basic education. During postgraduate studies there is a target preparation of the future expert in the field of ash and slag handling. At the same time along with studies a future master is involved in performance of works under contracts with power companies. During part of study time a student can also work for the power company which pays for his education. Total duration of preparation of such an expert makes three years (1 + 2 considering the last year of bachelor's study).

**Postgraduate study.** It is a form of preparation of highly skilled experts under system: "Bachelor's programme Master's programme Postgraduate studies". During postgraduate studies a future expert most of his time is involved in activity on performance of works under contracts with power companies. Total duration of professional retraining of such an expert makes six years (1 + 2 + 3 considering the last year of bachelor's studies).

**Professional retraining.** By experience of carrying out of programs on professional retraining of experts from power enterprises, it was found out that many engineers have no required profile power engineering education. Therefore, duration of effective professional retraining of experts on ash and slag handling should make not less than 1000 classroom hours that is possible at on-site and correspondence training during two years with the training program duration of about 2000 hours. Total duration of separation of the trainee from manufacture makes four months during two years.

## WORKING OUT OF EDUCATIONAL AND STUDY GUIDES

One of the tasks of educational and scientific organizations consists in working out of educational and study guides. So, in 2003 Publishing house of MPEI issued the manual "Ecology in Power Engineering", developed by the leading experts of Russia - teachers of CPPEE MPEI under general edition of V.Y. Putilov. It is intended for realization of programs on improvement of professional skill and professional retraining in the field of ecology in

power engineering of the personnel from enterprises and organizations of the Russian JSC “UES of Russia”, fuel and energy complex, housing and communal services and other branches and departments. A basis for the manual formed study guides of CPPEE developed in 1998-2003 for programs of improvement of professional skill and professional retraining of the personnel from power companies of the Russian JSC “UES of Russia” and other branches of economy on specialities: “Thermal Power Plants”, “Electric Power Systems and Networks” and “Electric stations”, and also for programs of professional skill improvement of engineers-inspectors on power equipment operation, labor safety and fire safety of power companies.

In 2007 Publishing house of MPEI issued the informational collection “State-of-the-art nature protection technologies in electric power industry” under the general edition of V.Y. Putilov. The informational collection was prepared and edited according to the Program of implementation of ecological policy of the Russian JSC “UES of Russia” for 2006-2007. It contains the data on domestic and foreign nature protection technologies which are applied or can be applicable in electric power industry of Russia to reduce the man-made impact of enterprises producing, transporting and distributing electric and thermal energy on environment.

Activity on creation and edition of similar printing works is continuing for a long enough period of time during which some materials can undergo essential changes or become outdated at all. This is a natural disadvantage of similar printing editions.

### **CREATION OF INFORMATIONAL SITES OF THE OPEN ACCESS**

In connection with that materials presented in educational and study guides, essentially change or become outdated, it is necessary to create online resources of the open access. The task of such constantly updated sites of the open access consists in reflection of results of the system researches of domestic and foreign experience on solution of a problem on environmental protection.

In May 2010 Moscow Power Engineering Institute (Technical University) received the status of the National Research University and got the financing from the budget. According to the program of MPEI development, proposal of the Informational and Analytic Centre “Ecology in Power Engineering” of MPEI (IACEE MPEI) on creation of the Informational Electronic Constantly Updated Open System “The Best Available and Perspective Nature Protection Technologies in the Russian Power Industry” (OIS BAT).

Informational base of the sites are informational collection “State-of-the-art nature protection technologies in electric power industry”; proceedings of international and Russian workshops and conferences on ecology in power engineering, Reference book on the best available and

technical methods in electric power industry; analytic materials; results of the system researches on various aspects of ecological problems in power engineering, represented by the authors to the Editorial Board of the system.

A main objective of the system creation is informational support for the following:

- implementation of economically effective and ecologically sound nature protection activity of companies and organizations of the Russian power sector;
- 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 environmental protection from the man-made impact of the power objects.

OIS BAT will contribute into the following:

- online acquaintance of any Russian or foreign user with 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 informational exchange on ecology in power engineering between the Russian and foreign experts;
- free access of students from 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 from organic fuel combustion replacing natural raw materials.

By the end of 2011 the web-site OIS BAT with all the contents will be translated into English.

### **HOLDING THE CONFERENCES AND WORKSHOPS**

Holding the conferences and workshops is one more possibility to inform the public about the situation on coal ash problem solution in Russia the world-wide. The purposes of conducting these events are the following:

- presentation and discussion of analytical materials on coal ash handling problem;
- building co-operation between the Russian and foreign experts on coal ash handling problem;
- youth attraction to scientific work on coal ash issues;
- forming the objective and favorable public opinion in different countries world-wide about the measures undertaken in Russia on creation of economically effective and ecologically comprehensible ash and slag removal systems at TPPs;

- contribution in increase of a level of coal ash processing into commodity output.

So, for example, from 2007 to 2010 IACEE MPEI organized three international scientific and practical workshops “Ashes and slags from TPPs – removal, transport, processing, landfilling”. In October, 2010 IACEE MPEI together with the Polish CCP Union held the I International workshop in Poland “A practice of implementing technologies for use of ash and slag from power generation” for familiarization with industrial technologies of large-capacity beneficial use of ashes from TPPs in the territory of Poland.

## CONCLUSION

For effective solution of the coal ash problem the primary goals of educational and scientific organizations are the following:

- rendering of information, consulting and expert services under the projects on reconstruction of the operating and creation of the new ash and slag removal systems at a design stage;

- conducting system researches in this field, financed from the state budget and supported by the interested power companies;
- consideration of coal ash handling issues in programs of base and additional education of the personnel from power enterprises;
- working out of educational materials;
- active interaction with national and international associations all over the world on coal combustion by-products handling;
- informing of all social classes about the best introduced technologies on coal ash handling all over the world and potential danger of landfilling the unclaimed ash part by ecologically unacceptable ways by means of holding the conferences and workshops, and also creation of the open access sites on the mentioned subjects.

**Putilov V.Y., Putilova I.V.** / About the role and place of science in solution of coal ash handling problem // Proceedings of the I International Workshop in Poland “A practice of implementing technologies for use of ash and slag from power generation”, Warsaw – Silesia, Poland, October 26 – 29, 2010.