

## ASH AND SLAG HANDLING

## 3.7. Analytics

## 3.7.14. Experience of Kashirskaya gres in ash and slag utilization

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## ABSTRACT

The main problem of the coal-fired power stations is the great volume of ash and slag. Currently stockpiling of slag becomes disadvantageous both from economic and ecological point of view. The problem of the ash and slag treatment is especially complicated in densely populated areas, for example, in the Moscow Region.

The Kashirskaya GRES has three 300 MW coal-fired units. As a result of power generation, annual ash and slag output is more than 120 000 tons, and the total ash and slag volume of ash and slag mixture in the stockpile is 7 million tons after the whole operating time of the station.

The article presents the practice of the Kashirskaya GRES co-operation work with the producers of building materials for the selling ash and slag materials.

The recycling and further use of the coal combustion products is the problem of today all over the world. Every day and every year the great volume of pollutions inflates the Earth. The responsible producers do everything in their power to secure industrial waste.

The Kashirskaya GRES (Kashira Thermal Power Station) has 3×300MW coal-fired generating units for the energy production. Ash and slag are the main solid coal combustion products. The annual stockpiled ash and slag volume is over than 120 000 tons. According to the report "The state of the hydraulic structures" the station's stockpiled volume of ash and slag is more than 7 million tons. The remained capacity of the ash storage will be covered in less than for 15 years.

The integrated approach of utilization has been worked out and approved by Technical Advice of JSC "OGK-1" as the solution of the station wastes storage problem:

- Selling of the ash and slag materials;



- Design and implementation of the projects for the processing ash and slag materials into the building materials.

The selling of the coal combustion products affords to decrease the volume of disposed ash mixtures. It also decreases the environmental impact in the power station area.

There are three marketable ready raw products for selling: ash and slag mixture (ASM) from stockpile, fly ash and silica-alumina microspheres.

ASM is a marketable product from the coal combustion process that is loaded from ash and slag stockpile. The ash and slag stockpile of the Kashirskaya GRES is the hydraulic structure that consists of five cells. This organization allows shutting down one cell for ASM loading process and not interfering in operation of others. The ASM of the Kashirskaya GRES is widely used by producers of Portland cement in the Moscow region. The ASM content in the final stock mass is from 3 (Portland cement) to 15 (other cements) %. 96 % of the power station ASM was consumed by Portland cement producers in 2009.

2 % of all consumed ASM volume is used for brick production. The ASM include not burnt corpuscles of carbon. It allows brick producers save the fuel at the firing process. During the firing in the bricks the pores are formed as a result of carbon content combustion that increases thermal conductivity. The brick production is one of the promising directions of use large volumes of ASM.

The pilot batch production of the aerated concrete blocks in Orel displayed successful application of ASM instead of sand. Such replacement of 30 % of sand mass allows to increase compressive strength, frost resistance and to make blocks more lightweight. The production of aerated concrete blocks consumed 2 % of ASM volume in 2009.

ASM is also applied as the land filling material for the power station embankment of ash and slag storage.

Fly ash from the precipitators represents the finely dispersed material with particles size from 500 micrometer to the 0.14 mm. The precipitators include 4 successive fields. Each of the fields catch different particle size of fly ash from the flue gases (the first one catch the large particle and the fourth catch the finest). Equipping of each separate field by pneumatic transport and storing systems will allow producing fly ash with a various particle size distribution, without additional fractioning. To improve the quality and for wide application of fly ash in the concrete production, the possibility of setting the integrated separation system is discussed. The carbon content that separated in this system



can be re-used in the boiler chambers of the Kashirskaya GRES.

The most valuable product for producers is microspheres – the specific light fraction of fly ash. It is solidified silica-alumina glass spherical drops with diameter from 5 to 250 microns. At high temperatures the silicate material of coal melts and then is crushed into fine drops in the flue gas stream of combustion. Gas content expands and blows the drops. It makes the microspheres lightweight and durable. The microspheres are gathered by the flotation method from the water surface of the cell №3. The microspheres find wide application in the production because of their properties. The main fields of application are production of blasting explosives, as lightweight and durable filler; production of lightweight plastic materials; production of airplanes external parts coverage and so on. The annual volume of gathered microspheres including alleviation in various cells and season of gathering is 250 tons. Such volumes don't allow processing of microsphere at the power station. The purchase contract includes gathering, drying and transportation to the site of microspheres processing.

In 2009 one can note the positive sale dynamics of the ash and slag in comparison with 2007 and 2008. Such dynamics shows also that the processing of ash and slag materials in the Moscow region and its neighborhoods was increased. The main target of Kashirskaya GRES to solve the ash and slag processing problem is selling all range of coal combustion products in volume of their annual production.

Within the limits of The Environmental Policy of JSC "OGK-1" and the integrated approach of utilization the design «The construction of the autoclave aerated concrete production factory with total replacement of sand by ASM» was developed. It became possible because of the application of multilayer carbon nanotubes. The content of nanotubes is only 0.0017 % of the aerated concrete blocks mass. The total designed cost of the first line construction is 260 million RUR. The factory annual ASM consumption is 38 000 tons, the factory output capacity is 150 000 m<sup>3</sup> of marketable and high-demanded product. The use of steam and ASM from the power station makes the cost price significantly lower. The factory design is advantageous both from the economic and social point of view. It will create jobs, support the government program “affordable housing» because of lower cost of building materials, and it will improve environment in the Kashirskaya GRES area. The design «The construction of the autoclave aerated concrete production factory with use of coal ash waste of the Kashirskaya GRES – branch of JSC “OGK-1» received the prize of the Ministry of natural resources and ecology of the Russian Federation as «The Best Ecological Design - 2008».

We should be care of our green-blue planet and prevent its transformation into the deathly-sulphar one. Each of us and no one else is responsible for modifications of water, air and soils. We should leave after us not only working iron, but also blossoming gardens.