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DESCRIPTION OF TECHNOLOGICAL PROCESS OF HYDRAULIC TRANSPORT FROM THERMAL POWER PLANT

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Abstract: *Long experience at existing disposal area with hydraulic transport and fly ash disposal pointed on the environment pollution by spreading fly ash particles with wind. Present used transport and disposal of fly ash and water in ratio of 1:15 creates a large amount of water, which goes undergroung and mixed with underground waters, and pollute them. Mentioned environmental problems and disadvantages of the available water is the reason for the implementation of reconstruction of the existing system. New technology is based on dense slurry in the ratio (fly ash: water- 1:1). The basic characteristic of this technology is that the water mixes with fly ash and bottom ash in the ratio 1:1 and in the form of dense slurry.*

Key words: *Hydraulic transport, Pipeline, Fly ash, Bottom ash*

1. INTRODUCTION

Perennial experience from exploitation of the existing disposal area of hydraulic transport and fly ash shows environment pollution caused by spreading fly ash particles by wind. Using the most common transport and disposal of fly ash and water in ratio 1:15 creates water redundance. This water drains to underground, mix with ground waters and pollute them. This environmental problems and water shortage are reasons for reconstruction of existing system with new technology of dense slurry in ratio fly ash – water 1:1. Basic characteristic of this technology is mixing water with fly ash and bottom ash in ration 1:1, like dense slurry, and then, transport through pipeline to the disposal area with high pressure pumps (Hadziahmetovic, 2008). In this paper description of technological process of preparation and hydraulic transport of fly ash and bottom ash from thermal power plant Nikola Tesla B in Obrenovac (Energoinvest d.d.-Sarajevo, 2009).

2. PROCESS OF SLURRY PREPARATION

Two fly ash silos and one bottom ash silo are required for preparation of slurry for thermal power plant. A process of slurry preparation for transport and deposing starts from concrete silos for bottom ash of volume 800 m^3. Fly ash should be collected and pneumatic transported up to two fly ash silos of volume 4300 m^3. Bottom ash is to be transported by belt conveyors and deposited in the bottom ash silo with volume 800 m^3. It empties fly ash from the silo using pneumatic throughs, than via balance and pneumatic valve for silo emptying, it goes to premixer. From the premixer, the fly ash falls gravitationally into the conditioner. At the bottom of bottom ash silo there are two vibro dosers for emptying over which are placed barrer fasteners. Bottom ash, of upper limit coarse grain approximately 70-80 mm, empties through two openings for emptying towards crushers. The emptying is to be carried out via vibro dosers on movable conveyor belt which serves for emptying in case of breakdown into the empty basin or for truck transport of bottom ash. After that, the bottom ash goes to crushers. After getting out from the crusher, the bottom ash is of largeness approximately 25 mm. After that, the bottom ash is to be transported by ejectors into the premixers. Each ejector has its joined conditioner. Supply of each ejector with bottom ash is possible by mechanism placed in fork so that it is very easy to carry out bottom ash routing towards to the ejector.

In one or two operating conditioners, it carries out a preparation of slurry of fly ash and bottom ash with technological water in desired mass ratio (50-50%). Process of slurry mixing in the conditioner lasts few minutes. Conditioners are to be dedusted via wet scrubber by fan, and dust is to be separated by wet process in scrubbers using a water spray, than it is to be taken back to the conditioners as a rare slurry (Hadziahmetovic, 2008).

3. WATER SUPPLY OF THE PROCESS

3.1 Technological water supply

Technological water, in this system, is water used in this process for mixing with fly ash and bottom ash and in this way the slurry is made. This water does not have any technological requirements such as quality, contents of solid particles or temperature and this is actually waste water collected in existing bager pits from different sources such as: returning water from depot, water from plant washing etc. The existing bager pits of capacity of 1000 m^3 in new-designed system will be tanks of technological water (McGlinchey, 2008).

Plant for slurry preparation and transport operates with interruptions, depending on quantity of fly ash and bottom ash (50 or 240 t/h) and numbers of units operating and because of that, technological water supply of the hydraulic transport process is to be carried out discontinuously. Measuring devices for continuous measuring of water level are placed in the technological water tanks, and it displays signals of levels in the control room in the silo building (Wilson K.C. et al., 1997).

Besides possibility of inspection of water quantity condition in tanks, alarm signals in central control station warning on four levels as follows:

- high level (HL) or level of full tank,
- maximal level (HHL) or level of tank spillover,
- low level (LL) or level when 500m^3 of water is more left into the tank,
- the lowest level (LLL) or blockade level on which fail all pumps that take in the water from tank.

Technological water supply of mixing stations is to be carried out from two technological water tanks of 1000 m^3 in more ways:

- by ejector pumps (operational pumps),
- make up water pumps (operational pumps),
- pumps for washing (one is operational).

Pumps should provide water supply for normal work of two lines of plant for slurry preparation and transport, and as well as a flow for flushing of one line of slurry pipeline. Distribution of

technological water up to mixing stations (ejector water, make up water and water for washing) is to be carried out by pipelines. Flowmeters are installed on make up water pipelines, which function is explained in details in a chapter of automatic regulation of the process. Pipeline drainage is to be carried out using valves with manual operation in the existing drain pit.

3.2 Gland seal water supply

Gland seal water is water used for sealing of braid of slurry pumps, and it uses also for wet scrubbers of conditioners.

Quality of this water is clean water without ingredient of solid particles and without special requirements from the aspect of chemical composition. Gland seal water is to be sent by these pumps in compensation tank, which is located in the silo building, where from the gland seal water, is led by pumps up to some consumers. Only the one of all gland seal water pumps is in operation when a system of hydraulic transport of bottom ash and fly ash works. An operator will choose a pump and tank from which gland seal water will be sent before start in the control room.

Circulation pumps and pumps of first, second, third and fourth degree are to be supplied, depending on their work pressure and necessary quantity, by separate gland seal water pumps, and water supplying of scrubbers is to be carried out from pressure side of pump pipeline for sealing of circulation slurry pump.Scrubbers require water pressure of app. 5 bars on entrance.

4. TRANSPORT OF FLY ASH AND BOTTOM ASH SLURRY

Transport of fly ash and bottom ash slurry is to be carried out using three transport lines, two are operational and one is reserve. Long distance pipelines come out of fly ash silo and follow the existing route of hydraulic transport up to depot.

Each transport line starts from conditioner and consists of four composite centrifugal slurry pumps, long distance steel pipelines and pipeline distributions around the depot. All pumps in serial connection, work with variable number of rotations, regulated frequency regulator of number of motor rotation. Behind the last pump in a series, for the purpose of regulation and control of the process, a slurry flowmeters, slurry densitometer, atmometer in pipeline are to be installed.

5. INTERVENTION LINE FOR PIPELINE FLUSHING

For the cases of unforeseen failures of some of the slurry pumps because of which it is necessary to execute replacement of a group of the slurry pumps by a group of the pumps from the other available line, it has been foreseen an intervention flushing of complete group of the pumps and slurry pipeline.

The flushing is to be carried out like that water flows in direction from the pump of 4.degree up to the conditioner. This intervention is to be realized by opening (closing) of manual valves and this will be a subject of operational instructions.

6. DRAINAGE OF CONDITIONERS

Drainage of conditioners should be carried out in case of unforeseen work stopping of the transport line. Drainage, i.e. evacuation of remaining slurry from the chamber at the conditioner bottom, is to be carried out in drain pit. Drainage of conditioners is to be carried out by pipeline situated in drain channel, in a special basin with sloping bottom, where, at the lowest part, there is a basin for placing of slurry pump. In case of stopping of the transport line, when a need for drainage of conditioners appears (foreseen longer stoppage or for eventual repairs), a valve for drainage on conditioner is to be open. Slurry flows gravitationally into a drain basin. The drain basin has a volume enough for receiving of complete contents of two conditioners. Forcibly emptied material should be overinflated from the drain basin, using drain vertical pump and flexible pipe into the conditioner in operation (Wasp et al., 1977).

7. DRAINAGE OF PIPELINES

Drainage of pipelines should be carried out after flushing and work stoppage of the plant in winter season, as well as in emergency situations during whole year round. Long distance pipeline has sections with general descents and ascents along the route, and therefore the drainage should be executed in more drain basins that are located along the pipeline route (Sasic, 1990).

8. EMERGENCY BOTTOM ASH EMPTYING VIA BELT CONVEYORS

Bottom ash silo is equipped with a drive for exceptional emptying. Under two vibro dosers, and above distribution hopper, two movable belt conveyors will be installed. If it is necessary, for any reason, to empty very fast the bottom ash silo to the trucks, than, prepared movable belt conveyors can be easily placed under vibro dosers, and with operation of both vibro dosers, the bottom ash silo can be very fast emptied. With this app. 7 m long belt conveyor, the trucks can be easily loaded. In case of breakdown of any device for emptying, the silo should be emptied of complete bottom ash contents through the movable belt conveyor (capacity 150 t/h, length 7m) in the empty basin of capacity 1000 m^3.

9. CONCLUSION

Hydraulic transport and fly ash disposal in ratio fly ash – water 1:15 should be replaced with new technology of ''dense'' slurry in ratio fly ash – water 1:1 Basic characteristic of this technology is mixing water with fly ash and bottom ash in ratio 1:1 and like dense slurry, with high pressure pumps, transported by pipeline to the disposal area. This is hydraulic transport and disposal with afterwards self solidifaciton disposal material.

This technology completely used fly ash and bottom ash characteristic and all negative influence on mining production are eliminated (like instability of disposal material, redundance of water used like transport medium and pollute water and air).

Hydraulic transport of fly ash and bottom ash like dense slurry (in ratio 1:1) have next advantages: simple operation of facility, less of investments, minimum consumption of electricity required for transport, satisfy ecological standards, and simple service and minimum costs.

This is possible using certain technology in equipment, modern computer equipment and program solutions, control and process operating.

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