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SYSTEM SOLUTION FOR THE BACKFILLING OF EMPTY VOIDS

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ABSTRACT
The most used methods for stabilization of mine working area in order to create the conditions for normal production and safe working environment is backfilling of empty voids left in the mine once the outdoor ore is extracted. During uncontrolled exploitation of lead at Stan Tërg Mine before the war in Kosova, most of the voids were left unfilled due to the shortage of suitable backfill material.
It is estimated that the requirements for the backfilling material for the stabilization of mine was 200.000 m^3/a. Considering that during the period from 1989 until 1999 when the mine was operational, backfilling was not done adequately, the needs for backfill material was increased and currently about half million cubic meters are necessary.
Stan Terg mine can produce not more than 130.000 m^3/a of the tailing remains from the annual exploitation of 650.000 m^3/a of ore at the mine and which can be used for backfilling.
Considering the above mentioned, it is initiated the detailed study of the existing circumstances and conditions focusing on proposals of technically acceptable and economically reasonable for compensation of 70.000 m^3/a backfill material. As a result, study has identified power plant "Kosova B" at Kastriot (20 km far from mine) as the most appropriate source due to the fact that properties of the fly ash produced there are similar to the once produced at the Stan Terg mine.
This paper describe the system solution for backfilling of empty voids which consists of construction of heavy facilities for fly ash transport and load out at power plant together with mixing, unloading and pumping facilities at Stan Terg mine with the specifics identified during erection and commissioning of system.
Keywords: Backfilling, fly ash, load out, mixing

1. GENERALLY
This project was supported by European Agency for Reconstruction, built by Rudis-Slovenia and supervised by author, while complete design, supply and assembly of equipment for taking out, transport and mixing of fly ash with water is realized, as is mentioned above, is realized in two separate locations:

- **Kosova B-KEK power plant in Kastriot**
- **Trepca Mine in Stan Tërg**

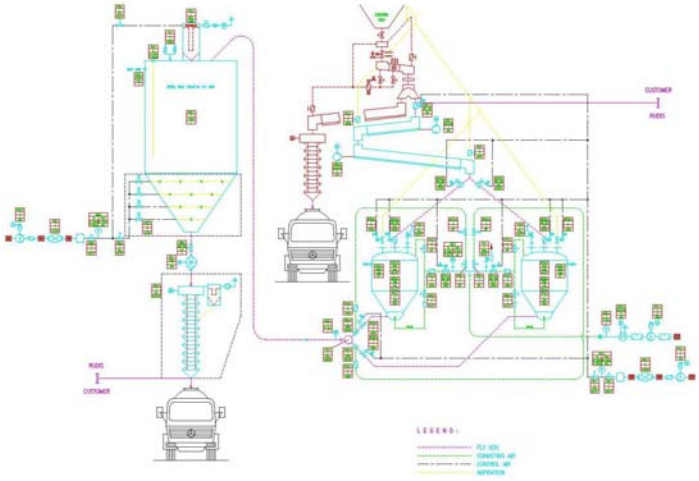
In Kosova B power plant in Kastriot the fly ash from existing bunkers is taken out, transported and stored in the silo specially constructed for this purpose. It is the first part of the project and second one is at Stan Tërg location where a new silo is constructed as well. This silo receives the fly ash transported by semi-trailers from the fly ash silo constructed in Kosova B. Fly ash from silo will be filled in the mixing pump and then mixed with process water will be transported to the vertical shaft of the lead and zinc mine Trepça in Stan Tërg. This mixture is used as an additive to other waste materials for backfilling of empty voids.

2. TECHNICAL DESCRIPTION

Taking out, transport and storage of fly ash in Kosova B-KEK power plant in Kastriot are carried out in the southern and western side of the building of fly ash bunkers. Fly Ash Load out facility at KEK Kosovo B Power Plant at Kastriot is situated some 130 m distance from the ash storage bunker at the existing pipe and Conveyor Bridge at the location.

This part of project comprises the following technological units:

- Shed for pressure vessels and compressors
- Pneumatic conveying of fly ash in front of pressure vessels
- Pneumatic conveying of fly ash behind pressure vessels
- Steel structure under fly ash silo
- Fly ash silo



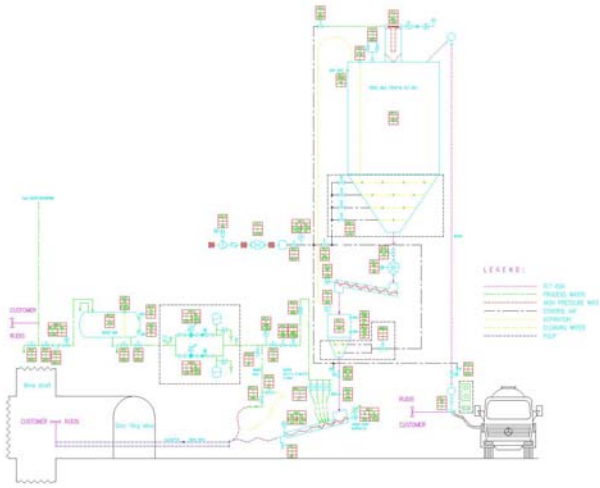
Air slides for fly ash transport, are a steel, self-supporting structures of rectangular transverse sections. Along their total length they are divided into two parts- upper somewhat higher channel represents the transport line through which the fly ash is transported and the lower channel is intended for air inlet. For pressure equalization in the system the upper part of the emptying funnel is equipped with a connection for air take out pipe, linked with the existing air take out pipes. In the vicinity of both slides are installed fans pos.VPT1.1 and VPT 2.1 connected by flexible PVC pipes. The fans take the air from the environment.

Pneumatic conveying of fly ash from pressure vessels to the fly ash silo starts with both pressure vessels and pneumatic valves installed close behind the outlet from both vessels. Behind them there are two nozzles installed each at its own line and above them non-return valves and even higher the electro-magnetic valves.

To perform pneumatic conveying it is manufactured pipe installation with dimensions ND 100 and ND 125. The pipes run from outlets of both pressure vessels. At both of these ways there are two pneumatic valves installed and behind them air nozzles. Along the complete line the pipe is fixed on the existing structure in the existing bridge and on the fly ash silo by means of fixed and mobile support.

The structure under fly ash silo is constructed in steel, closed and covered with façade sheet metal. On the upper edge of this structure fly ash silo with the volume of 100 m^3 fly ash is installed. Fly ash silo is constructed in steel and sheet metal with diameter 4.4m.It consists of cone and cylindrical part. Approximately 7m high cylindrical part is closed at the top with a walk able platform where the mechanical equipment, respectively the bag filter, equalization valve and level probes, are installed.

Next phase in process of backfilling of empty voids is represented by newly constructed structure and plant of the fly ash silo with the mixing station serves for preparation of the pulp of fly ash and process water, with which the exploited horizons or levels in the Lead and Zinc Mine in Stan Tërg are backfilled.



The Fly Ash backfill system at Stan Tërg Mine is envisioned to be an additional backfill system to existing hydraulic backfill system now in place. The Fly Ash system will independently provide additional backfill to compensate for the shortfall. It will also enhance the quality of the placed combined backfill by adding strength due to its cementations properties. The drainage of the backfill will be enhanced and the quality of mine water, in general, will be improved. In case of complete lack of hydraulic fill, the fly ash system will be able to run independently.
The existing hydraulic backfill system is located at the Tuneli i parë concentrator where mill tailings are produced, stored, and used as a hydraulic backfill. The fly ash plant is to be located at Stan Tërg mine at predetermined site close to the mine shaft, so that the fly ash slurry can be pumped directly underground.

General components of the system are: silo (100m^3), mixing pump assembly which is a simple combination of transport screw, mixer and screw pump, all mounted on one shaft and driven by only one motor. The pump shall have nominal capacity of 25 m^3/h.
Additional components are: water tank 30 m^3 , a water pumps CPV1 and CPV2vat min 6 bar pressure, and HDPE pipe line to the mine shaft where it is connected to the existing backfill piping.

The ash is blown from the truck in to silo by compressed air from the silo truck compressor or plant/mine compressors. From the silo, a screw conveyor system transports the dry ash to the feed bin of the pump assembly, from where it falls into the screw feeder part of the mixing pump.
In the screw pump the ash is mixed with high pressure water (6 bars) to a pulp and pumped through flexible hose in to heavy duty HDPE pipe (2, 00") up to the shaft. One kilogram of ash is mixed with 0.4 to 0 8 liters of water.

The mixture has a slurry density of 1.2 to1.7 kg/l, depending on the residual coal content and impurities in the ash. To keep the sedimentation rate in the piping low, a transportation velocity of 2.8 m/s is established by the determination of the pipe diameter.
Driven by the hydraulic pressure of the shaft and the pump pressure of 5 -10 bar the slurry will reach the voids that require backfill. From the silo to the voids the system creates a closed circuit. At the void, or at the backfill piping near the void, the fly ash pulp is mixed with the rest of the hydraulic backfill.

3. CONCLUSIONS

- Results from the preliminary tests matches excellent with investors requests from the project task
- The intensity of exploitation increase from 10 t/m^2 to 22,50 t/m^2 per year
- Manually measuring of the quantity and quality of the mixture and control of parameters is accepted from the point of view of experiences from similar mine in Germany.
- Discussed alternative of Corriolis meter is technically advanced solution which can be useful in other industrial conditions but in such heavy industry there is doubt for proper function.

4. REFERENCES

[1] ECLO-Kosova.: Fly Ash Load Facility, Prishtina, 2008.