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PROCEEDINGS

Edited by

Saša Stojadinović

and

Dejan Petrović

November 29th – 30th 2021

Bor, Serbia

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INCREASING THE CAPACITY OF THE COPPER SMELTING COMPANY IN THE COMPANY "SERBIA ZIJIN COPPER" - CHALLENGES AND CONSEQUENCES TO THE ENVIRONMENT

VelizarStanković[1], Miloš Janošević[2]

[1]Technical Faculty Bor, University of Belgrade, V.J. 12, 19210 Bor, Serbia

[2]Serbia Zijin Copper Co., ĐorđaVajferta 29, 19210 Bor, Serbia

Abstract

Through this paper a critical review will be given on the ENVIRONMENTAL IMPACT ASSESSMENT STUDY, presented to the public discussion, in the frame of Serbia Zijin Copper Co. intention of increasing a production capacity of copper in the existing Flash copper smelter and the auxiliary installations, from its nominal capacity of 80.000 tCu/year on a significantly enlarged one.

***Keywords**: environment, Flash copper smelter.*

1. INTRODUCTION

Serbia Zijin Copper Co., as a buyer of the RTB Bor Copper Co., has ordered a study of the environmental impact assessment (Study) [1,2], to increase a copper production capacity in the New Copper Smelter Plant. The Study was made by the TMF University of Belgrade, while the Ministry of Environmental Protection Serbia has offered it to the public discussion, according to the regulations. Remarks and comments, made through the public discussion, expressed some reserves about the Study in a view of the Smelter capacity enlargement and its effect on the environment while working. The further text is a critical analysis of the processes that would take place within the FSF with increased copper production, as well as the consequences that affect the environment in those circumstances.

2. INCREASING THE CAPACITY FOR COPPER PRODUCTION AND THE PROBLEMS THAT WOULD ARISE DUE TO THE RECONSTRUCTION OF THE SMELTER

Nominal production capacity of the New Copper Smelter has been designed and constructed based on the needs of the Serbian economy for copper, as well as the ore potential of copper mines and ore bodies that will be exploited in the future. To meet the nominal capacity, about 380.000 t/year of copper concentrate (21% Cu) should be produced, which is close to the copper concentrators capacity currently operating. Serbia Zijin Copper Co., as the new owner of all copper mines and other mining and metallurgical facilities bayed from the RTB Bor, driven by

profit, want to increase an annual copper production on 200.000 tones [1,2], meaning that more than 1·106 t/year of copper concentrate has to be processed in the same FSF changing or adjusting auxiliary facilities and installations, as sulphuric acid plants, concentrate drying and feeding installations, copper mate converters, off-gases purification, slag cooling and reflotation facilities, etc. So ambitious increase in production capacity of 2.5 times compared to the nominal one, requires a careful reconstruction of the installed FSF and all the installations coming before and after it in the technology chain of copper extraction from concentrate [2]. All these will cause a series of issues they have to concern the owner, and could interfere with the process itself, causing the threats to the environment and people living in Bor nearby the copper smelting plant. Among them, the most important one is how so big step towards production increase would reflect the environmental pollution and the people community living next to the Smelter.

The first issue that will arise is the shortage of concentrate from domestic sources, by almost two-thirds of the required annual amount. Domestic copper concentrates have a well-defined chemical and mineralogical composition ensuring stable process parameters. The missing amount of concentrate must be imported from the world market. Some of these concentrates are known as „dirty“ ones. Imported concentrates might differ from the domestic ones, containing some hazardous metals („dirty“ concentrates) that could affect the melting process polluting the melt and, what is more important, affecting the composition of off-gases especially if they are more volatile than copper. In that case, an increased amount of dust will be produced, in which hazardous metals will be presented either as metal oxides or fine metallic powder. Off-gases need to be purified from to eliminate fully the finest particles from the gas phase. Even that to reach a very high purification degree of FSF gases, an unknown amount of hazardous metallic compounds will go out, polluting the atmosphere around the smelter.

As is given through the conceptual solutions [2] and the Study [1], increasing capacity for 2.5 times, in relation to the existing copper production, should be carried out in the existing FSF reacting volume. The only changes relate to the installation of an adequate doser able to fulfil the new feeding capacity request and to a burner that will decrease problems at the uptakes lagging [1]. The reaction chamber height will only be increased by 40 cm, while the other dimensions of the FSF will remain the same. Increasing the production capacity of copper 2.5 times in the same FSF slightly adjusted for the new conditions will negatively be reflected on the copper smelting process in several ways. Even in the current work of the FSF, off-gases velocity in the settler gas space causes an elevated entrainment of melt droplets forming agglomerates at the end of up-take and on tubes in the boiler, causing breaks in the production, in order to remove the slag deposits from the up-take walls [1].

Increase in the concentrate charging, which would correspond to 2.5 times higher mass flux of the dispersed phase in the reaction chambre will cause the change in several working parameters of the process in the FSF:

- The residence time of the concentrate particles will be shortened, making questionable the completion of chemical reactions occurring in it;
- The flow rate of waste gases through the FSF will increase almost 3 times, due to an increased input of concentrate that will be burned, increasing the volume of chemically generated gases. Chemical reaction heat will raise the temperature inside the FSF;

- Linear gas velocity through the settler gas chamber will be increased, reaching > 21 m/s, leading to elevated entrainment of particles and droplets with the gas phase;

- Increased concentration of dispersed particles in the gas phase will contribute to significant slagging at the up-take end, as well as at the boiler, changing its heat transfer regime. Moreover, the planned burner at the end of the up-take to reduce the slagging effect could move the solidification front towards the boiler interior, while the problem with slagging deposits would remain and would be even enlarged;

- Increased mass flux of the dispersed phase will affect in worsening the melt phases settling leading to an increase of copper content in the slag and a higher concentration of iron oxides in the mate. In both cases, the work of the converters and the slag flotation will be disrupted;

- Increased flow-rate of the melt through the settler, besides bad separation of the phases, will disturb the regime of slag and mate discharging;

- Return of the dust to the FSF will additionally burden it and its work would deteriorate.

3. CONCLUSION

In conclusion, it would be more sustainable for the local environment, but also for the owner, to forget about the considered drastic increase in the production capacity of 200,000 t Cu /year and to give it up. Instead, one should validly and analytically reconsider whether and to what extent is possible to increase the capacity of the existing FSF and the accompanying facilities above the nominal one of 80,000 t Cu/year and to rely exclusively on domestic concentrates of defined quality, without buying any of dubious origin on the world market. In that way, any hazardous impact of the copper smelting plant on the environment will be minimized.

As for the environmental impact of the Smelter working with the enlarged production capacity, its footprint will be more expressive in the new circumstances than it currently is. Whether linearly with the new capacity, or following another functionallity, will depend not only on the concentrate origin, but also from many other facts. In any case, the city of Bor and its surrounding will remain a polluted area- a hot spot on the map of Eastern Serbia. Most probably the new spot will be bigger in size.

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